

Aug. 18, 1925.

G. A. YANOCHOWSKI

1,550,300

TELEPHONE SYSTEM

Filed May 15, 1919

3 Sheets-Sheet 1

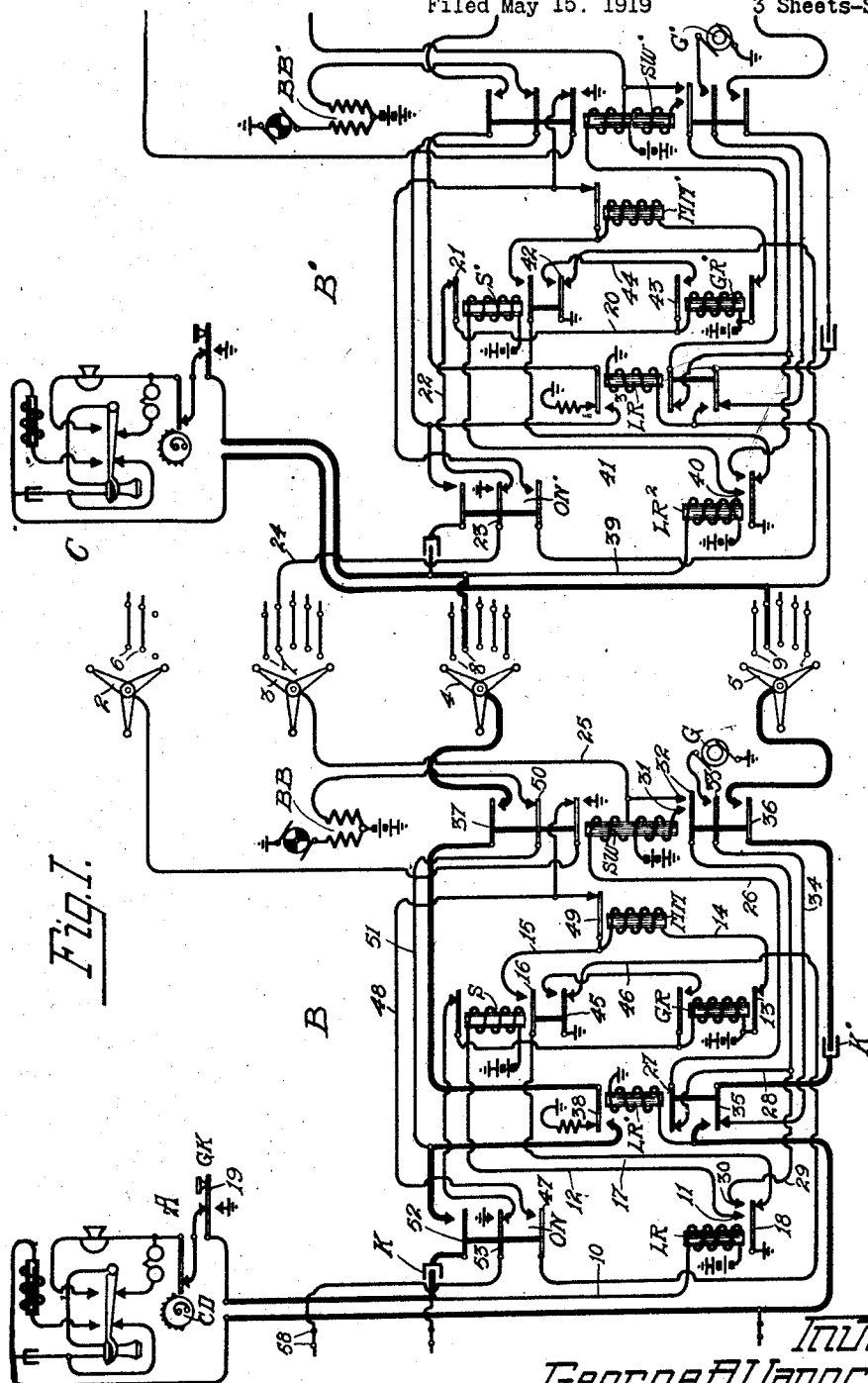


Fig. 1.

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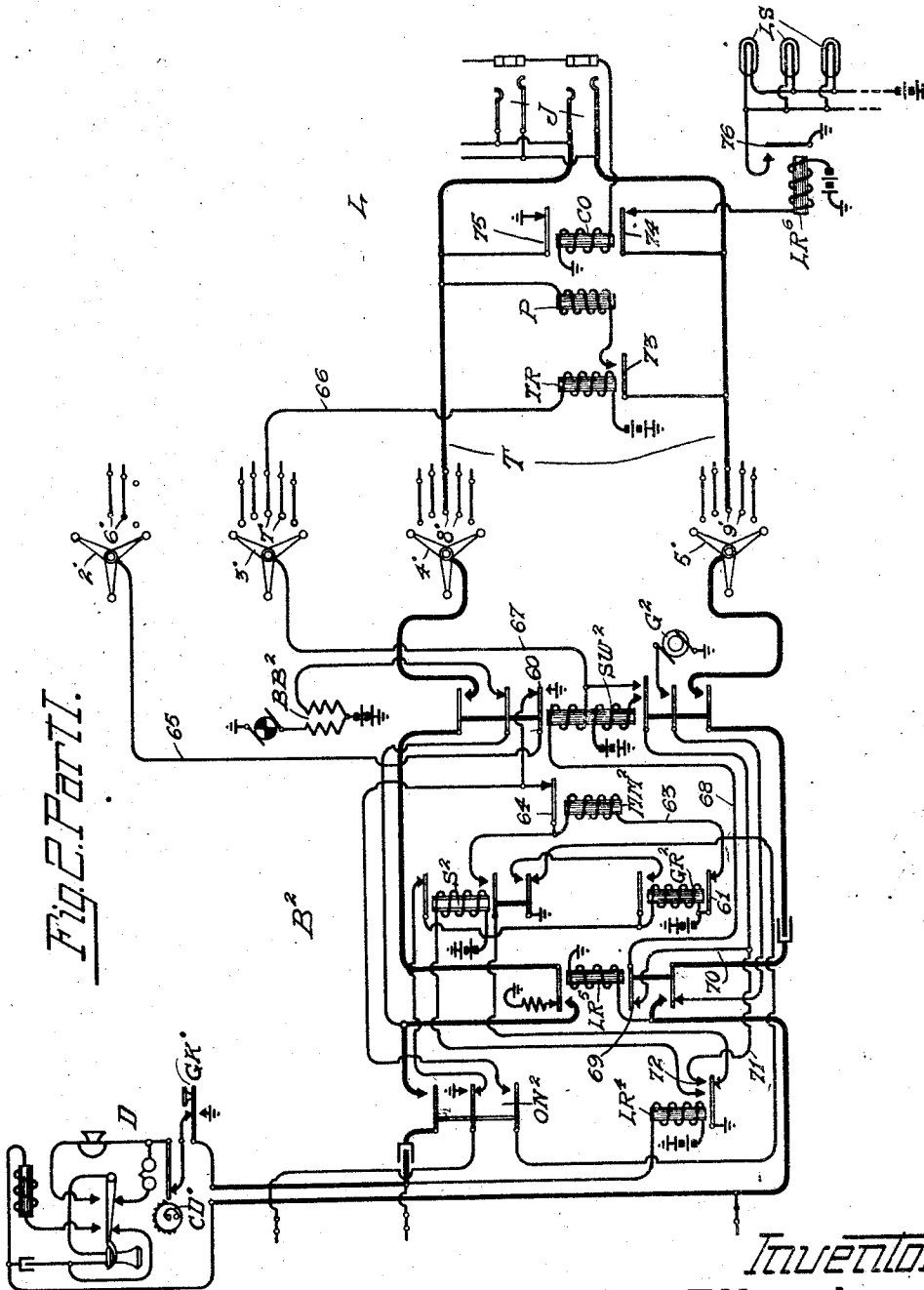
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3 Sheets-Sheet 2



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TELEPHONE SYSTEM

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3 Sheets-Sheet 3

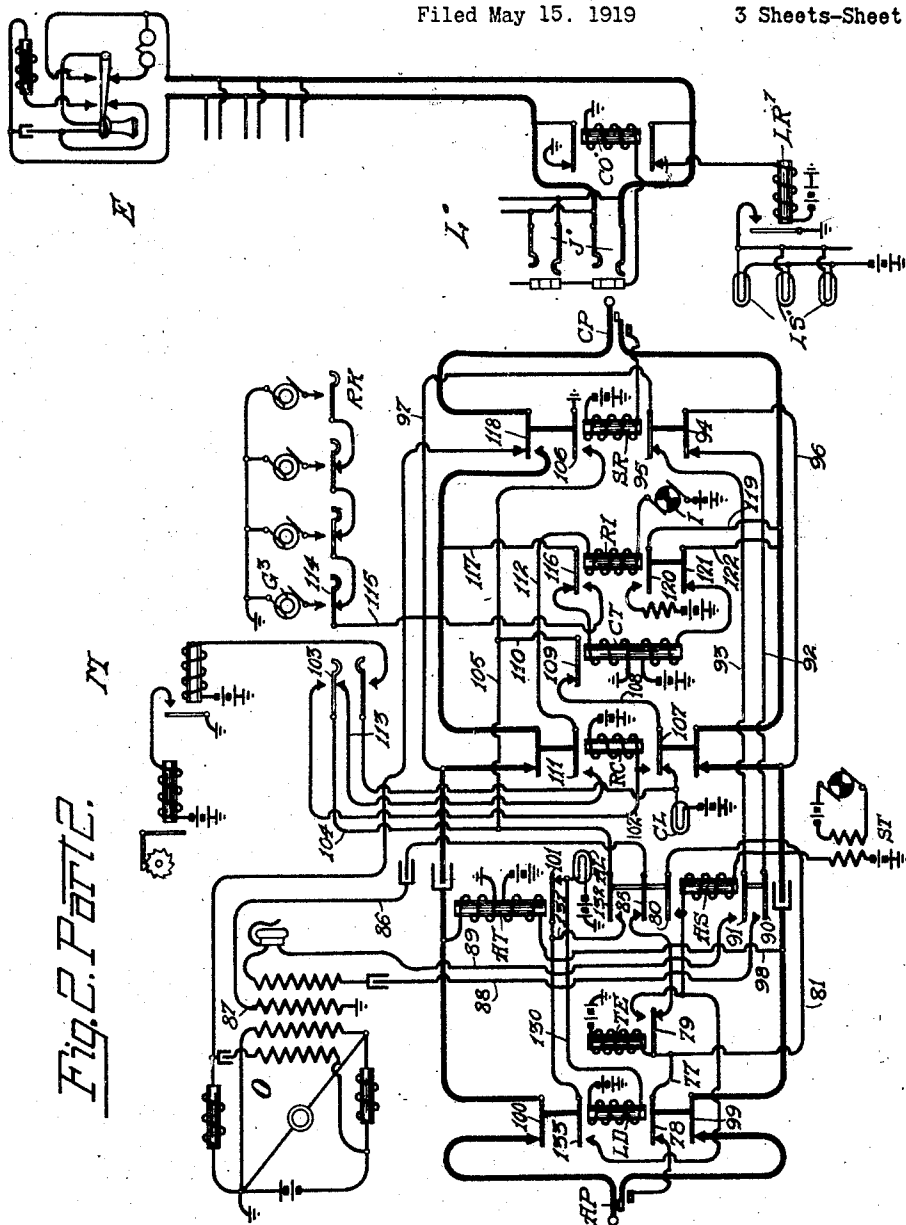


Fig. 2. Part C.

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UNITED STATES PATENT OFFICE.

GEORGE A. YANOCHOWSKI, OF CHICAGO, ILLINOIS, ASSIGNOR TO KELLOGG SWITCHBOARD AND SUPPLY COMPANY, OF CHICAGO, ILLINOIS, A CORPORATION OF ILLINOIS.

TELEPHONE SYSTEM.

Application filed May 15, 1919. Serial No. 297,247.

To all whom it may concern:

Be it known that I, GEORGE A. YANOCHOWSKI, a citizen of the United States of America, residing at Chicago, in the county of Cook and State of Illinois, have invented certain new and useful Improvements in Telephone Systems, of which the following is a specification.

My invention relates to telephone systems and has to do more particularly with systems of the so-called switching type in which impulses transmitted from a calling line by a subscriber thereat, actuate switches to seek the contacts of a line which is being called. The system which is herein disclosed is applicable to private automatic exchange systems and is commonly known in the art as a P. A. X. system. A system of this kind is adapted to serve a plurality of stations, say twenty-two in number, each station of the system being supplied with a single motion rotary switch such as is disclosed in a patent to Harry H. Ide, issued Oct. 21, 1924, No. 1,512,101. An object of my invention is the provision of an improved circuit arrangement which embodies desirable features and advantages all in an efficient, simple and economical manner.

A feature of my invention is the provision of means whereby trunk connections with a main exchange may be allotted to certain stations to the exclusion of others, and means whereby an idle trunk is automatically seized. The above features as well as others will be more fully hereinafter described.

The novel features of the invention through the provision of which the above mentioned and other advantageous results are attained will be explained by referring to the accompanying drawings in which like reference characters in the several views denote like parts, and in which—

Fig. 1 illustrates diagrammatically a private automatic exchange including the circuit of my invention;

Fig. 2, which includes parts 1 and 2, illustrates the circuit of my invention operating in connection with a trunk arrangement whereby connection may be obtained with a main exchange.

Referring now in general to Figure 1, I show a calling substation A connected to an individual switch circuit B. The calling

substation A comprises the usual substation apparatus, and in addition, a calling device CD and a grounding key GK for purposes as will presently be described. The individual switch B comprises line relays LR and LR', a switching relay SW and a motor magnet MM. Off-normal contacts ON are also provided and assume their alternate position upon the first step of the switch off normal. A guard relay GR and a slow-acting relay S are also provided for purposes as will be more particularly pointed out in the following specification. The switch B may be similar to the switch illustrated and described in connection with a patent to Harry H. Ide, No. 1,512,101, issued Oct. 21, 1924.

The switch is also provided with wipers 2, 3, 4 and 5, which are adapted to engage contacts 6, 7, 8 and 9. The wipers 3, 4, and 5 are the private and line wipers operatively associated with the private and line contacts 7, 8 and 9. The auxiliary wiper 2 and contact 6 are used for trunking purposes, as will be more fully hereinafter described. To the right of the drawing, I show a called substation C (similar to the calling substation A) terminating in a line switch B', similar to the line switch B.

Having described in general the apparatus of Figure 1, I will now describe in detail the circuit connections which may be established between the calling subscriber at substation A and the called subscriber at substation C. The subscriber at the substation A in initiating a call, removes his receiver from the switch hook to close an energizing circuit for the line relays LR and LR', traced from battery through the winding of the relay LR, conductor 10, through the now closed contacts of the substation switch hook back through the winding of the line relay LR' to ground, the two relays LR and LR' operating in series. The closing of alternate contact 11 of line relay LR establishes an energizing circuit for the relay S from battery, through the winding of the said relay S, over conductor 12 to ground at alternate contact 11 of line relay LR.

Assuming further that the called number of the called subscriber is 15, the subscriber at the substation A now actuates his calling device to send fifteen impulses of current, the subscriber actuating the dial CD by pull-

ing the naught digit and then by pulling the digit five, which will transmit fifteen impulses of current to the switch B. These impulses of current bring about fifteen de-energizations and energizations of the line relays LR and LR' and upon the first de-energization of the line relay LR, a circuit is established for the motor magnet MM, traced from battery at normal contact 13 of the guard relay GR, conductor 14, through the winding of the motor magnet MM, conductor 15, alternate contact 16 of relay S, conductor 17 to ground at normal contact 18 of relay LR. The magnet MM is thus energized and de-energized 15 times, the motor magnet stepping the wipers 2, 3, 4 and 5 into engagement with the contacts 6, 7, 8 and 9, which contacts lead to the called subscriber of substation C. The energization and de-energization of line relay LR' is only incidental at this time. The relay S does not de-energize during the rapid interruptions of alternate contact 11 of line relay LR, due to its slow-release construction. Upon the first step of the switch wipers off normal, the off-normal contacts ON assume their alternate position and the closing of alternate contacts 53 of off-normal contacts ON places a ground on the private normals 58 of the calling substation A, thus preventing any other subscriber from seizing the contacts of the calling line. The subscriber A having selected the contacts of the wanted called line, depresses the key GK to impress ringing current upon the called line to signal substation C. Assuming that substation C is idle, key GK opens the series energizing circuit of the line relays LR and LR', and LR' restores, but the relay LR remains energized over a circuit traced from battery, through the relay, conductor 10, to ground at alternate contact 19 of the key GK. The private contact 7 being idle and relay LR' having restored while the key GK is depressed, a series circuit is established for the guard relay GR' of the switch circuit B', and the switching relay SW of the switch B, traced from battery through the winding of the guard relay GR', conductor 20, normal contact 21, conductor 22, normal contact 23, conductor 24, contact 7, wiper arm 3, conductor 25, the upper winding of the switch relay SW, conductor 26, normal contact 27 of line relay LR', conductors 28 and 29, to ground at alternate contact 30 of line relay LR. The switching relay SW upon energization closes its alternate contact 31, establishing a locking circuit for itself, traced from battery through the lower winding of the said relay, alternate contact 31, conductor 29, to ground at alternate contact 30 of relay LR. The closing of alternate contact 32 of switching relay SW extends the ground from alternate contact 30 of line relay LR over conductor 29 to alternate contact 32, and then over conductor 25 to the wiper arm 3 and private contact 7, placing a ground or busy potential upon the contact 7, preventing any other calling subscriber from engaging the contacts of the called substation C, and the ground placed upon the private contact 7 also maintains relay GR' energized over conductor 24, normal contact 23, conductor 22, normal contact 21, conductor 20, through the winding of relay GR' to battery. The closing of alternate contact 33 of the switching relay SW connects the ringing generator G and ringing current is impressed upon the called line, said ringing current being traced from the ungrounded pole of generator G, through alternate contact 33, conductor 34, normal contact 35 of relay LR', alternate contact 36 of relay SW, wiper arm 5, contact 9, through condenser and call bell to the called substation C, back through contact 8, wiper arm 4, alternate contact 37 to ground at normal contact 38 of relay LR'. Each time the key GK is depressed, ringing current is connected to the called line. The subscriber at the substation C in response to the signal, removes his receiver from the substation switch hook, closing an energizing circuit for the line relays LR² and LR³ of the switch B' from battery, through the winding of relay LR², conductor 39, through the now closed contact of the substation switch hook, back through the winding of relay LR³ to ground. The closing of alternate contact 40 of line relay LR² establishes an energizing circuit for the relay S' from battery through the winding of relay S', conductor 41, to ground at alternate contact 40 of relay LR². The closing of alternate contact 42 of the relay S' establishes a locking circuit for the guard relay GR', traced from battery, through the winding of relay GR', alternate contact 43, conductor 44 to ground at alternate contact 42 of relay S'. The subscriber at the calling substation A and the called substation C are now in conversational circuit, said circuit being traced over the heavily marked conductors, said conductors having the condensers K and K' interposed.

Assuming now that the subscribers have finished conversation, they replace their receivers upon their respective switch hooks. The replacing of the receiver at the calling substation A opens the series energizing circuit of the line relay LR and line relay LR', and the opening of alternate contact 11 of line relay LR opens the energizing circuit of the relay S. The closing of normal contact 45 of relay S upon its de-energization establishes an energizing circuit for the motor magnet MM traced from ground at the now normal contact 45, conductor 46, alternate contact 47 of the off-normal spring contacts ON which assume

their alternate position upon the first step of the wipers off normal, conductor 48, normal contact 49 of motor magnet MM, conductor 14, to battery and ground at normal contact 13 of relay GR. The motor magnet MM is thus energized and de-energized due to the opening and closing of its normal contact 49, and upon the last step of the wipers back to their normal position, the off-normal contacts ON are again engaged to be moved back to their normal position, and the opening of alternate contact 47 opens the circuit of motor magnet MM preventing its further actuation. The replacing of the receiver of the called substation C opens the energizing circuit for the line relays LR² and LR³, and the opening of alternate contact 40 of line relay LR² opens the energizing circuit of the relay S'. The relay S' upon restoring to normal opens its alternate contact 42 to open the locking circuit for the guard relay GR'. The apparatus used for establishing connection between the calling substation A and the called substation C are now at normal and available for establishing other connections.

Assuming now that the subscriber at the called substation C is busy, the operation of the circuit is the same up to and including the time that the calling subscriber at the substation A depresses the key GK. The subscriber C being busy, its private contact 7 will have a ground or busy potential upon it from its grounded contact of its off-normal contact, if it is a calling line, or from the ground through the alternate contact of a switching relay SW, if it is a called line. Upon the depression of the key GK at the calling substation A no current flow is established through the switching relay SW as the circuit through the upper winding of the said relay SW will extend from ground at alternate contact 30 of relay LR, conductors 29 and 28, normal contact 27 of relay LR', which relay de-energizes upon the actuation of the key GK, conductor 26 through the winding of the relay SW, conductor 25, wiper arm 3 to ground at the busy contact 7. The relay SW failing to energize, a busy back signal is transmitted to the calling substation A, traced from the busy back apparatus BB, normal contact 50 of relay SW, conductor 51, alternate contact 52 of the off-normal contacts ON, through the substation back through the line relay LR' to ground. The subscriber is thus notified that the called line is busy and replaces his receiver upon the switch hook, thus bringing about the de-energization of the line relays LR and LR' and of the relay S. The closing of normal contact 45 of relay S again establishes a circuit for the motor magnet MM, as previously described, stepping the wipers 2, 3, 4 and 5 back to their normal position, and upon the last step

of the wipers, the off-normal contacts ON assume their normal position and the apparatus is now at normal and available for establishing other connections.

Referring now to Fig. 2, parts 1 and 2, I illustrate a calling subscriber as D terminating at the private automatic exchange into an individual switch B² similar to that of B. The subscriber at D may establish local calls between subscribers at the private branch exchange, and may also be provided with trunk service. The switch B² associated with the calling substation D has its last three contacts connected with trunk lines leading to the main exchange. These contacts are not necessarily multiplied through all the other switches, but are engaged by the wiper 2' which engages successive contacts 6' to seek an idle trunk leading to the main exchange.

Referring to Fig. 2, part 1, the substation D contains the usual substation apparatus, and in addition is also supplied with a calling device CD' and key GK'. The switch B² is similar to B. I show one of the trunk lines T terminating at the main exchange in a line circuit L, which comprises the line relay LR⁶, the cut-off relay CO, multiple line signals LS and multiple jacks J. In addition I show a trunk relay TR and a coil P for purposes as will be more fully hereinafter described.

The line circuit L as illustrated is known as a multiple line lamp circuit in which a line lamp as LS is provided for each line jack J so that when a trunk is seized by a calling station at the private automatic exchange, a lighted line lamp LS appears before each of a plurality of operators at the main exchange, any one of whom may seize the call to the exclusion of the others.

Fig. 2, part 2, illustrates an operator's cord circuit M at the main exchange and comprises an answering plug AP and a calling plug CP. The answering end of the cord circuit M comprises an answering tip supervisory relay AT and an answering sleeve supervisory relay AS. The answering sleeve supervisory relay AS upon energization connects the operator's set O to the cord conductors. A high resistance test relay TE is also provided which prevents more than one operator seizing the same call. A link disconnect relay LD is also provided which actuates upon the termination of conversation to disassociate the connected line circuit L from the cord circuit M, as will be more fully hereinafter described. The link circuit M is adapted to be used to interconnect ordinary manual lines such as line E. The special tone feature is of particular use when such connections are established.

The calling end of the cord circuit M is provided with a sleeve relay SR which relay

actuates when the calling plug CP is inserted into the jack of a called line. A ringing control relay RC and a ringing interrupter relay RI are also provided, the ringing relay RI periodically interrupting the ringing current and the ringing control relay RC controlling the application of ringing current. A party line ringing key RK is also provided for connecting ringing current to the called line. A calling supervisory relay CT is also provided which actuates upon the response of the called subscriber. The line circuit L' associated with the called line E comprises the usual line relay LR', multiple line lamps LS', multiple jacks J', and the cut-off relay CO'.

Assuming now that the subscriber at the substation D of the private automatic exchange initiates a call and wishes to be connected to one of the trunks leading to the main exchange. The switch B², which is a twenty-five point switch, will have the last three contacts arranged for trunking purposes. The first two contacts of the last three lead to the main exchange and terminate in line circuits as L. The last contact of the three is on open circuit, for purposes as will be more fully hereinafter described. Assuming that the trunk line is designated by the numeral 23, the subscriber at substation D wishing a trunk connection, removes his receiver to bring about the operation of line relays LR⁴ and LR⁵ and relay S² as previously described, and now actuates his calling device to send twenty-three impulses of current, and the wipers are stepped into engagement with contacts 6', 7', 8' and 9' which are the twenty-third set. These contacts are connected to the first trunk leading to the main exchange. Should the said trunk be busy, there will be a ground or busy potential upon the auxiliary contact 6' from ground at alternate contact 60 of a switching relay SW to the other switch that is already engaging the contacts 6', 7', 8' and 9'. This ground upon the auxiliary contact 6' closes an energizing circuit for the motor magnet MM² traced from battery, through normal contact 61 of relay GR², conductor 63, through the winding of the motor magnet MM², its normal contact 64, normal contact 60 of the relay SW², conductor 65, wiper arm 2' to the grounded contact 6'. The magnet MM² upon energization steps the wipers 2', 3', 4' and 5' into engagement with the next set of contacts, and assuming that it is idle, no ground or busy potential will be on it and therefore no energizing circuit for motor magnet MM² is established. The said wipers remain in engagement with the said engaged contacts 6', 7', 8' and 9'.

The subscriber at the substation B now actuates key GK' to bring about the de-energization of the line relay LR⁵, thus clos-

ing an energizing circuit for relay TR of the line circuit L traced from battery, through the winding of said relay TR, conductor 66, contact 7', wiper arm 3', conductor 67, through the upper winding of the switching relay SW², conductor 68, normal contact 69 of relay LR⁵, conductors 70 and 71 to ground at alternate contact 72 of relay LR⁴. The switching relay SW² closes a locking circuit for itself, as previously described, and places a busy potential upon auxiliary contacts 6' to prevent any other subscriber from seizing the trunk now occupied by the subscriber D. Relay SW² also places a busy potential upon the private contact 7' through its alternate contact, the said ground also holding relay TR energized, as previously described. The relay TR upon energization closes its alternate contact 73, establishing an energizing circuit for the line relay LR⁶ of line circuit L traced from battery, through the winding of the said relay LR⁶, normal contact 74 of relay CO, alternate contact 73 of relay TR, through the winding of the coil P to ground at normal contact 75 of relay CO. The line relay LR⁶ energizing closes its alternate contact 76 to light the multiple line lamp signals LS which appear before different operators' positions. One of a plurality of operators seizes the call by inserting the answering plug AP into the multiple jack J' of the trunk T, closing an energizing circuit for the high resistance test circuit TE, traced from battery, through the winding of the said relay TE, conductor 77, normal contact 78, sleeve contacts of the connected plug AP and jack J through the winding of relay CO to ground. Relay CO at this time does not energize due to the high resistance of relay TE. The closing of alternate contact 79 of the test relay TE establishes an energizing circuit for the answering sleeve supervisory relay AS, traced from battery through the winding of said relay AS, alternate contact 79, conductor 77, normal contact 78, sleeve contacts of the connected plug AP and jack J, through the winding of relay CO to ground. Relay CO now energizes to open its normal contact 74, allowing the said line relay LR⁶ to de-energize and open the circuit of the multiple line lamps LS. The relay AS upon energization closes its alternate contact 80, which establishes a locking circuit for itself, traced from battery, through the winding of said relay AS, its alternate contact 80, conductor 81, and thence over conductor 77, normal contact 78, sleeve contacts of the plug AP and jack J to ground through the winding of the cut-off relay CO. The relay AS is thus held energized independent of the contact 79 of the high resistance test relay TE. Should a second operator attempt to answer the

call, the low resistance relay AS of the first cord prevents the high resistance test relay TE from operating due to the shunting effect of relay AS of the first cord, and this being the case, the second operator will receive a special tone notifying her that the call has been seized by another operator, and she therefore removes the answering plug from the multiple jack of the seized line upon receiving the tone.

The special tone is traced from the special tone apparatus ST, through the winding of relay AS of the cord circuit M which we have assumed has seized the call which is to be extended from the private exchange, alternate contact 80 of the answering supervisory relay AS, conductors 81 and 77, normal contact 78 of relay LD, sleeve contacts of the connected plug AP of cord circuit M, and jack J of line circuit L, the circuit then extends from the said sleeve of the jack J to the sleeve of the multiple jack as J into which the second operator has inserted a plug AP, the sleeve contacts of the answering plug AP of the second cord, normal contact 78 of the relay LD of the second cord, conductor 77, normal contact 79 of the high resistance test relay TE of the second cord, which relay TE fails to energize as already described, normal contact 85 of relay AS of the second cord, conductor 83 through the winding 87 of the operator's set associated with the second connected cord to ground. The operator of the cord circuit M having seized the call, her operator's set O is connected to the conductors of cord circuit M, traced over conductors 88 and 89, alternate contacts 90 and 91 of the answering supervisory relay AS, conductors 92 and 93, normal contacts 94 and 95 of relay SR and over conductors 96 and 97 to the tip and sleeve cord conductors. The supervisory relay AT is also energized upon the insertion of the answering plug AP into the jack J, the circuit being traced from battery, through the lower winding of answering tip supervisory relay AT, conductor 98, normal contact 99 of link disconnect relay LD, ring contacts of the connected plug AP and jack J, alternate contact 73 of relay TR, through the winding of coil P, tip contacts of the connected plug AP and jack J, normal contact 100 of relay LD, and through the upper winding of the supervisory relay AT to ground. The opening of normal contact 101 of relay AT prevents the premature glowing of the answering supervisory lamp AL.

The operator being thus connected, now inquires the wants of the calling substation D at the private exchange, and assuming that it is the subscriber at the substation E that is wanted, the operator of the cord circuit E tests the multiple jack J' of the called line as to its idle or busy condition in the

usual manner and if it is busy, she receives the customary busy click in her head receiver. Assuming that the called subscriber at substation E is idle, the operator now inserts the calling plug CP into the multiple jack J' of the called line, thus closing a circuit for the sleeve relay SR of the cord circuit M and the cut-off relay CO' of the line circuit L' into which the called line E terminates, from battery, through the winding of the sleeve relay SR, sleeve contacts of the connected plug CP and jack J' to ground, through the winding of the relay CO'. The supervisory relay SR upon energization opens its normal contacts 94 and 95 to disconnect the operator's set O from the cord conductors and the closing of alternate contact 106 of the said relay SR closes a circuit for the calling supervisory lamp CL, traced from battery, through the lamp CL, normal contact 107 of the ringing control relay RC, conductor 108, normal contact 109 of relay CT, conductors 110 and 105 to ground at alternate contact 106 of relay SR. The calling supervisory lamp CL thus remains lighted until the ringing key is depressed to signal the called for subscriber at substation E. To signal the called for subscriber at the substation E, one of the plurality of ringing key plungers of ringing key RK is depressed to connect the proper frequency of ringing current upon the called line to actuate the call signal at the substation E of the called subscriber. The depression of one of the ringing key plungers of the ringing key RK also brings about the momentary actuation of a set of end springs of the said ringing key RK. The closure of alternate contact 103 of the end springs closes an energizing circuit for the ringing control relay RC, traced from battery, through the winding of the said ringing control relay RC, conductor 102, through the momentarily closed contact 103 of the end springs of the ringing key RK, conductor 104, conductor 105 to ground at alternate contact 106 of the sleeve relay SR. The opening of normal contact 107 of ringing control relay RC opens the circuit for the calling supervisory lamp CL the effacement of which lamp signifies to the operator that the called party wanted is being signaled. The closing of the alternate contact 107 of the ringing control relay RC also establishes a locking circuit for itself, traced from battery, through the winding of the said ringing control relay RC, its alternate contact 107, conductor 108, normal contact 109 of the calling supervisory relay CT, conductor 110, conductor 105 to ground at alternate contact 106 of the sleeve relay SR. The closing of alternate contact 111 of ringing control relay RC establishes an energizing circuit for the ringing interrupter relay RI, traced from battery, through the constantly

rotating interrupter I, through the winding of the ringing interrupter relay RI, conductor 112, through alternate contact 111 of ringing control relay RC, conductor 113, normal contact 103 of the end springs of ringing key RK, which springs restore when the ringing key plunger assumes its ringing or indicating position, conductors 104 and 105 to ground at alternate contact 106 of sleeve relay SR. Due to the constantly rotating interrupter I, the relay RI is thus intermittently energized and de-energized and ringing current is thus applied intermittently to the call bell at the called substation E. The ringing current is traced from the ungrounded pole of the ringing generator G³ which we will assume is the proper generator frequency, alternate contact 114 of the depressed ringing key plunger of the ringing key RK, ringing conductor 115, alternate contact 116 of ringing interrupter relay RI, when in one of its energized positions, conductor 117, alternate contact 118 of sleeve relay SR, tip contacts of the connected calling plug CP and jack J', through the call bell and condenser of the called substation E and back through the ring contacts of the connected plug CP and jack J', conductor 119 to battery and ground at alternate contact 120 of the ringing interrupter relay RI. The call bell of the subscriber at the called substation E is thus intermittently rung, due to the intermittent energization and de-energization of the ringing interrupter relay RI.

The removal of the receiver at the called substation E in response to the call signal, closes an energizing circuit for the calling supervisory relay CT, traced from battery, through the lower winding of the said calling supervisory relay, normal contact 121 of the ringing interrupter relay RI, when the said relay is in one of its de-energized positions, conductor 122, ring contacts of the plug CP and jack J', through the now closed switch hook contacts at the substation E, back through the tip contacts of the connected plug CP and jack J', alternate contact 118 of sleeve relay SR, conductor 117, normal contact 116 of the ringing interrupter relay RI and through the upper winding of the supervisory relay CT to ground. The relay CT, upon energization, opens the locking circuit of ringing control relay RC, at its normal contact 109 and the relay RC opens the energizing circuit of ringing interrupter relay RI at its alternate contact 111 and the relay RI upon restoring to normal opens its alternate contact 116, preventing further application of ringing current. The subscriber at the private exchange station D and the subscriber at the main exchange called substation E are now in conversational circuit, the said talking circuit being traced over the heavily marked

conductors. Assuming that conversation has terminated, the subscribers at the stations D and E replace their receivers upon their respective switch hooks and the replacing of the receiver at the called substation E interrupts the circuit at the calling supervisory relay CT at the switch hook contacts and the closing of normal contact 109 of relay CT closes an energizing circuit for the calling supervisory lamp CL, traced from battery, through the lamp CL, normal contact 107 of relay RC, conductor 108, normal contact 109 of relay CT, conductors 110 and 105 to ground at alternate contact 106 of relay SR. The calling supervisory lamp CL is thus lighted and notifies the operator that the called subscriber has replaced his receiver. The subscriber at the branch exchange substation D replacing his receiver upon its switch hook opens the energizing circuit for the line relays LR⁴ and LR⁵, and the line relay LR⁴ restoring opens the energizing circuit of the slow-acting relay S². The opening of alternate contact of relay LR⁴ opens the energizing circuit for switching relay SW² and the said relay restoring, removes the ground or busy potential on the private contacts 7', and the closing of normal contact of relay S² closes an energizing circuit for the motor magnet MM², and the motor magnet MM² then steps the wipers 2', 3', 4' and 5' to their normal position, and when the wipers reach normal, off-normal contacts ON² are restored, opening the circuit of motor magnet MM². This restoration of switch B² is the same as described in connection with Fig. 1 and a detailed description is not deemed necessary. The ground having been removed from private contact 7' upon the restoration of relay SW², the energizing circuit for the relay TR of the trunk T is interrupted and the relay TR restoring, its contact 73 assumes its normal position which opens the energizing circuit of answering supervisory relay AT, which relay restores, and the closing of its normal contact 101 establishes an energizing circuit for the link disconnect relay LD, traced from battery, through the winding of the relay LD, conductor 130, normal contact 101 of relay AT, conductor 131, alternate contact 132 of relay AS, conductors 104 and 105 to ground at alternate contact 106 of relay SR. The closing of normal contact 101 also establishes a circuit for the answering supervisory lamp AL from battery, through the said lamp, normal contact 101, conductor 131, alternate contact 132, conductors 104 and 105 to ground at alternate contact 106, the said lamp lighting and notifying the operator that the subscriber at the branch exchange has replaced his receiver. The relay LD upon energization opens its normal contacts 99 and 100, disassociating the line circuit L

from the cord conductors, and the opening of normal contact 78 of relay LD opens the circuit for relay AS and the relay CO, but relay AS remains energized through alternate contact 133 of relay LD, normal contact 101 of relay AT, its alternate contact 132 to ground at alternate contact 106. The relay CO of circuit L now restores and should the operator at the main exchange leave the plug in the jack after the subscribers have finished conversation, the trunk used in establishing the connection just described is not rendered useless for as soon as the subscriber at the private exchange replaces his receiver, the trunk is cleared, due to the energization of relay LD of the cord circuit and the trunk is thus immediately available and should the trunk last used be again seized, the line relay LR^o will again energize, due to the restoration of relay CO and the energization of relay LR^o will again light the multiple line signals LS so that the call may be again seized by the same operator or another operator. The same operator seizing the call, removes the calling plug CP from the jack, allowing relay SR to restore, and the relay SR restoring, connects the operator's set O to the cord conductors. When the operator notes the two lights, supervisory signals AL and CL and knows that conversation has terminated, she removes the plugs AP and CP from their respective jacks J and J'. This removal of the plug CP allows relay SR to restore, and the relay SR restoring opens the circuits of relays LD and AS and signals AL and CL. The apparatus which was used in establishing a connection is now at normal and available for establishing other connections.

To prevent certain stations at the private exchange from connecting with contacts which will connect them with the main exchange, the last three contacts, which we assumed are for trunking purposes of their associated switches, are not connected as illustrated, but are left open. Now, when a subscriber, who is not allotted trunk service, tries to seize a trunk contact by calling the trunk number, the wiper 3' of his switch engages the trunk contact but as it is in open circuit, the switching relay SW of the said switch remains at normal and thus receives a busy signal from the busy back apparatus BB, and hearing it, he replaces his receiver, thus allowing the switch to restore to normal, as previously described.

Connectors that operate as do those herein described to add together all the digits transmitted that operatively affect the connector, may be concisely referred to as adding-type connectors.

While I have illustrated my invention operating in connection with a preferred circuit arrangement, I do not wish to be

limited to the same as it is applicable with other arrangements, and changes and modifications will also suggest themselves to those skilled and I, therefore, aim to cover all such changes and modifications as come within the spirit and scope of the appended claims.

What I claim as new and desire to secure by United States Letters Patent, is:

1. A telephone system including an automatic switch having a driving magnet for advancing and restoring the same, a line terminating in multiple jacks via said switch, multiple line lamps for said line adapted to glow responsive to the removal of the receiver at the substation on said line, common battery cord circuits for connection to said line, means whereby the first cord circuit to connect to a jack operatively connects to the line and prevents a second cord circuit from operatively connecting to said line, a tone for apprising the operator of the second cord circuit of the fact that the first cord circuit has been connected to the line, and disconnect means for disassociating said first cord circuit and said line.

2. A telephone system including a subscriber's line, a switch individual thereto, a trunk terminating in the bank of said switch and in multiple jacks, said switch being under the control of the subscriber for connecting the subscriber's line to said trunk, a cord circuit provided with a plug for connection to said trunk, and means controlled by the disconnection of said subscriber's line from said trunk to cause said cord circuit to be operatively disconnected from said trunk, said switch being also adapted to operate to connect the subscriber thereat to another subscriber's line exclusively of said trunk circuit and said cord circuit.

3. A telephone system including subscribers' telephone lines, an adding-type connector switch individual thereto provided with a single level of bank contacts, other subscribers' lines terminating in said bank contacts, and trunk lines leading to a main exchange terminating in said bank contacts, subscriber-controlled means for electing the first one of said trunk lines, automatic means for thereafter selecting an idle one of said trunk lines, and operator's cord circuits for extending calls from said trunk lines to called subscribers' lines.

4. A telephone system including a subscriber's telephone line, a switch individual thereto, other subscribers' telephone lines terminating in the bank of said switch, an automatic switch for one of said other lines, a cut-off relay for said last switch, means controlled by the said first subscriber for energizing said cut-off relay, means controlled by the response of the other of said subscribers for removing the control of said cut-off relay from said first subscriber and

placing it entirely under the control of said second subscriber, the releasing of said switch remaining under the control of said first subscriber.

- 5 5. A telephone system including a subscriber's line, an automatic switch individual thereto provided with a level of bank contacts, part of said bank contacts terminating in other subscribers' lines, and the rest of
10 the bank contacts terminating in trunk circuits, automatic means individual to said switch for selecting an idle one of said trunk circuits and operable to cause the wipers of said switch to rotate to the bank contacts of
15 the last trunk line if the preceding trunk lines are busy, means whereby said switch operates to thereafter test the idle or busy condition of said last trunk line, and operators' cord circuits for connecting to said
20 idle trunk lines to extend a call therefrom to a called subscriber's line.

6. A telephone system including trunks, subscribers' lines, selectors individual to said lines for automatically picking out idle
25 ones of said trunks, other trunks adapted for connection with the first to extend calls toward called lines, and means for operating the selectors to free the first trunks for use in other connections while said first trunks
30 still remain connected with terminals of the said other trunks, said selectors also adapted to operate to interconnect said subscriber's lines exclusively of said first and said other trunks.

- 35 7. In combination with adding-type connectors, said connectors operable in a single plane and adapted to automatically restore to normal after termination of conversation, telephone circuits adapted to be automatically
40 selected by said connectors, said adding-type connectors also adapted to connect to each other in conversational circuit exclusively of said telephone circuits, only a pair of said connectors being required to effect
45 a conversational circuit between two subscribers, and audible busy-back means for indicating when a called for subscriber is busy.

- 50 8. In combination with adding-type connectors, said connectors operable in a single plane and adapted to automatically restore to normal after termination of conversation, means for operating them to select idle
55 trunks, other manually operated trunks adapted to be linked with those first mentioned, terminals therefor adapted to be connected to subscribers' lines, automatic means in said other trunks controlled by the calling subscribers for freeing said adding-type
60 connectors from said other trunks, and audible busy-back means for indicating when a called for subscriber is busy.

9. A telephone system including manually
65 equipped lines and automatically equipped lines, adding-type connectors for operation

over the two sides of the automatically equipped lines in series, trunks provided with manually operated terminals associated with the manually equipped lines, said connectors having also automatic devices for
70 selecting idle trunks.

10. A telephone system including telephone lines, adding-type connectors controlled over the two sides of the said lines
75 in series for operation to establish connections with some of said lines, automatic selecting circuits for the connectors and busy and idle trunks to be selected, and connective means for applying the latter to others of said lines.

- 80 11. A telephone system including a telephone line, a pair of electromagnets in series therewith, means for simultaneously vibrating them by digit impulses, a relay controlled by the one maintaining its armature in operated position while said magnets
85 vibrate, circuit connections for holding the first magnet in operated position while the second retracts its armature, a test relay switched into circuit responsive to said magnets, a source of ringing current connected in when said relay is in one operative position, a source of busy current connected in when said relay is in another operative condition.

- 90 12. In combination a telephone line, a pair of electromagnets in series therewith, means for vibrating them by digit impulses, while a third magnet maintains its armature in operated position, circuit connections for holding the first in operated position while
95 the second retracts its armature, a test relay switched responsive to said magnets, a called line, a test relay for said line in circuit with said first relay, a source of current connected to said circuit and energizing both
100 said relays when the called line is idle.

- 105 13. A telephone system including a calling and a called telephone line, a connector for each line operable over the two sides of the line in series, said connectors having each a test relay in temporary circuit with each other, calling line means comprising a pair of quick release relays in series with said
110 line for connecting a current source to said circuit, ringing means for said connector and means controlled by the calling subscriber for operating said quick release relays for applying ringing current to said
115 called line.

- 120 14. A connector having a pair of relays simultaneously vibrated by digit impulses, substation means to energize one while de-energizing the other, travel controlling means sensitive to the simultaneous vibrations, and test controlling means sensitive to the second relation.

- 125 15. In combination a calling and a called line, each having a connector operable in a single plane over the two sides of the line
130

in series, said connectors operable in a single plane temporarily switched together, a double wound test relay for one connector adapted to energize in series with a relay of the other when the called line is idle, an off-normal contact of one connector only in said energizing circuit, and a pair of simultaneously vibrating digit impulse relays controlled over the two sides of the line in series to establish the connections, and to establish said energizing circuit.

16. A telephone system including a calling and a called line, each having a connector operable in a single plane and provided with operating control means controlled over the two sides of the line in series, said connectors temporarily switched together, a relay for each connector, said relays adapted to operate in series with one another when the called line is idle, an off-normal contact of one connector only in said circuit, and ringing and busy back means controlled by said circuit, the application of ringing current to said called line being controlled manually by the calling subscriber.

17. A telephone system including telephone lines, a connector, a contact serving to place a busy potential on the private normal of said connector, a digit impulse vibrated relay having an armature contact to connect with a wiper of said connector to test the called line, a test relay with a winding in series between said contact and said wiper, and operating in a manner dependent on the electrical condition of an engaged called line contact for switching a connection to said wiper to render the called line busy.

18. An automatic exchange including a pair of relays adapted to be simultaneously vibrated in series with the two limbs of a line, a called line, and a test relay for said connector to test the called line having a test winding controlled jointly by said relays and a locking winding for said test relay.

19. An automatic exchange including a relay adapted to be operated over the two limbs of the line in series to advance a single level connector switch and over one limb at the will of the subscriber for another purpose, a test relay for said connector, circuit means controlled by said first relay for controlling said test relay, there being no off-normal contact in the circuit of said test relay.

20. A connector for automatic exchanges including a relay adapted to be operated over the two limbs of the line in series to advance a single level connector switch and over one limb at the will of the subscriber for another purpose, another relay operated over said line, a test relay for said connector, and circuit means solely controlled by said

relays for connecting said test relay to one side of battery.

21. A connector for automatic exchanges including a relay adapted to be operated over the two limbs of the line or over one limb at the will of the subscriber, a second relay operating in series with the first, a test relay for said connector, an armature contact of said first relay for controlling said test relay, armature means controlled by the second for switching said test relay, said contact and said means solely controlling the connection from one side of battery through said test relay to the test wiper.

22. A connector for automatic exchanges including a pair of relays adapted to be simultaneously digitally vibrated over the two limbs of the line, a test relay for said connector, and a circuit therefor including contacts of both said relays.

23. A connector for automatic exchanges including a pair of relays adapted to be simultaneously digitally vibrated over the line, a test relay for said connector, and a circuit therefor effective for testing purposes when closed through a back contact of one of said first-mentioned relays, and a front contact of the other.

24. A telephone system including a test relay, an energizing circuit and a holding circuit for said relay, a pair of relays in series with the line and simultaneously vibrating their armatures in response to digit impulses, contacts of both relays of said pair in one of said circuits, and a contact of one relay of said pair only in the other of said circuits.

25. A telephone system including an automatic switch having a driving magnet for advancing and restoring the same, a subscriber's line terminating in multiple line lamps via said automatic switch, means for causing said multiple line lamps to glow responsive to the removal of the receiver at the substation, common battery cord circuits for answering calls from the subscriber's substation, means for preventing the effective connection of more than one of said cord circuits to said subscriber's line when attempting to answer a call, audible means for apprising an operator of one cord circuit when the operator of another cord circuit has effectively connected to the subscriber's line, and automatic disconnect means for disassociating the cord circuit effectively connected to said calling line from said calling line.

26. A telephone system including an automatic switch having a driving magnet for advancing and restoring the same, a subscriber's line terminating in multiple line lamps, via said automatic switch, means for causing said multiple line lamps to glow responsive to the removal of the receiver at

the substation, common battery cord circuits provided with automatic listening for answering calls from the subscriber's substation, means for preventing the effective connection of more than one of said cord circuits to said subscriber's line when attempting to answer a call, audible means for apprising an operator of one cord circuit when the operator of another cord circuit has effectively connected to the subscriber's line, and automatic disconnect means for disassociating the cord circuit effectively connected to said calling line from said calling line.

27. A telephone system including an automatic switch having a driving magnet for advancing and restoring the same, a subscriber's line terminating in multiple line lamps, via said automatic switch, means for causing said multiple line lamps to glow responsive to the removal of the receiver at the substation, common battery cord circuits for answering calls from the subscriber's substation, means for preventing the effective connection of more than one of said cord circuits to said subscriber's line when attempting to answer a call, audible means for apprising an operator of one cord circuit when the operator of another cord circuit has effectively connected to the subscriber's line, and automatic disconnect means for said cord circuit for disassociating said cord circuit effectively connected to said subscriber's line from said subscriber's line.

28. A telephone system including an automatic switch having a driving magnet for advancing and restoring the same, a subscriber's line terminating in multiple line lamps via said automatic switch, means for causing said multiple line lamps to glow responsive to the removal of the receiver at the substation, common battery cord circuits for answering calls from the subscriber's substation, means for preventing the effective connection of more than one of said cord circuits to said subscriber's line when attempting to answer a call, audible means for apprising an operator of one cord circuit when the operator of another cord circuit has effectively connected to the subscriber's line, and automatic intermittent ringing means for said cord circuits for signaling called subscribers.

29. A telephone system including an automatic line switch having a driving magnet for advancing and restoring the same, a subscriber's line terminating in multiple line lamps via said automatic line switch, means for causing said multiple line lamps to glow responsive to the removal of the receiver at the substation, common battery cord circuits for answering calls from the subscriber's substation, said cord circuits being provided with automatic listening, automatic disconnect and automatic ringing,

means for preventing the effective connection of more than one of said cord circuits to said subscriber's line when attempting to answer a call, and audible means for apprising an operator of one cord circuit when the operator of another cord circuit has effectively connected to the subscriber's line.

30. A telephone system including an automatic line switch having a driving magnet for advancing and restoring the same, a subscriber's line terminating in multiple line lamps via said automatic line switch, means for causing said multiple line lamps to glow responsive to the removal of the receiver at the substation, common battery cord circuits for answering calls from the subscriber's substation, means for preventing the effective connection of more than one of said cord circuits to said subscriber's line when attempting to answer a call, audible means for apprising an operator of one cord circuit when the operator of another cord circuit has effectively connected to the subscriber's line, and means whereby when the calling subscriber replaces his receiver may again immediately remove the same and re-light multiple lamps to make a recall prior to the disconnection of the plug of the cord circuit from a called line.

31. A telephone system including a subscriber's line, a switch individual thereto and provided with a driving magnet for advancing and restoring said switch, a trunk terminating in multiple jacks and multiple line lamps before a plurality of operators, subscriber-controlled means for operating said switch to connect said subscriber's line to said multiple jacks, thereby causing the glowing of the multiple line lamps, a plurality of operators' cord circuits for answering the call, means for preventing the effective connection of more than one of said cord circuits to said subscriber's line in answering the call, and audible means for notifying operators connecting to said subscriber's line subsequently to said effective connection that the call has been seized by another operator.

32. A telephone system including a subscriber's line, a switch individual thereto and provided with a driving magnet for advancing and restoring said switch, a trunk terminating in multiple jacks and multiple line lamps before a plurality of operators, subscriber-controlled means for operating said switch to connect said subscriber's line to said multiple jacks, thereby causing the glowing of the multiple line lamps, a plurality of operators' cord circuits for answering the call, means for preventing the effective connection of more than one of said cord circuits to said subscriber's line in answering the call, automatic audible means for notifying the operators connecting to said subscriber's line subsequently to the

effective connection of said first operator and said line that the call has been seized by another operator, and automatic disconnect means under the control of the subscriber for freeing the cord circuit from the trunk circuit.

33. A telephone system including a subscriber's line, a switch individual thereto and provided with a driving magnet for advancing and restoring said switch, a trunk terminating in multiple jacks and multiple line lamps before a plurality of operators, subscriber-controlled means for operating said switch to connect said subscriber's line to said multiple jacks, thereby causing the glowing of the multiple line lamps, a plurality of operators' cord circuits for answering the call, means for preventing the effective connection of more than one of said cord circuits to said subscriber's line in answering the call, automatic audible means for notifying the operators connecting to said subscriber's line subsequently to the effective connection of said first operator and said line that the call has been seized by another operator, and automatic disconnect means under the control of the subscriber for freeing the cord circuit from the trunk circuit and for disconnecting the subscriber's lines from the trunk circuits.

34. A telephone system including a subscriber's line, a switch individual thereto and provided with a driving magnet for advancing and restoring said switch, a trunk terminating in multiple jacks and multiple line lamps before a plurality of operators, subscriber-controlled means for operating said switch to connect said subscriber's line to said multiple jacks, thereby causing the glowing of the multiple line lamps, a plurality of operator's cord circuits for answering the call, means for preventing the effective connection of more than one of said cord circuits to said subscriber's line in answering the call, automatic audible means for notifying the operators connecting to said subscriber's line subsequently to the effective connection of said first operator and said line that the call has been seized by another operator, and automatic listening means for said cord circuits.

35. A telephone system including a subscriber's line, a switch individual thereto and provided with a driving magnet for advancing and restoring said switch, a trunk terminating in multiple jacks and multiple line lamps before a plurality of operators, subscriber-controlled means for operating said switch to connect said subscriber's line to said multiple jacks, thereby causing the glowing of the multiple line lamps, a plurality of operators' cord circuits for answering the call, means for preventing the effective connection of more than one of said cord circuits to said subscriber's line

in answering the call, automatic audible means for notifying the operators connecting to said subscriber's line subsequently to the effective connection of said first operator and said line that the call has been seized by another operator, and automatic ringing for said cord circuits.

36. A telephone system including a subscriber's line, a switch individual thereto and provided with a driving magnet for advancing and restoring said switch, a trunk terminating in multiple jacks and multiple line lamps before a plurality of operators, subscriber-controlled means for operating said switch to connect said subscriber's line to said multiple jacks, thereby causing the glowing of the multiple line lamps, a plurality of operators' cord circuits for answering the call, means for preventing the effective connection of more than one of said cord circuits to said subscriber's line in answering the call, and means including an audible tone device for apprising one operator when the other operator has effectively connected to the subscriber's line.

37. A telephone system including a subscriber's line, a switch individual thereto and provided with a driving magnet for advancing and restoring said switch, a trunk terminating in multiple jacks and multiple line lamps before a plurality of operators, subscriber-controlled means for operating said switch to connect said subscriber's line to said multiple jacks, thereby causing the glowing of the multiple line lamps, a plurality of operators' cord circuits for answering the call, means for preventing the effective connection of more than one of said cord circuits to said subscriber's line in answering the call, whereby said subscriber may recall prior to the disconnection of the cord circuit from the trunk circuit, and automatic audible means for notifying the operator at the second cord circuit connected to said line that another cord circuit has been connected to said line prior to said second cord circuit.

38. A telephone system including a subscriber's line, a switch individual thereto and provided with a driving magnet for advancing and restoring said switch, a trunk terminating in multiple jacks and multiple line lamps before a plurality of operators, subscriber-controlled means for operating said switch to connect said subscriber's line to said multiple jacks, thereby causing the glowing of the multiple line lamps, a plurality of operators' cord circuits for answering the call, means for preventing the effective connection of more than one of said cord circuits to said subscriber's line in answering the call, whereby the trunk circuit may again be used prior to the removal of the plug of the cord circuit from the jack of the trunk circuit, and

automatic audible means for notifying the operator at the second cord circuit connected to said line that another cord circuit has been connected to said line prior to said second cord circuit.

39. A semi-automatic telephone system including an automatic switch provided with means for progressively advancing and restoring the same, a subscriber's line terminating in multiple line lamps via said automatic switch, means for causing said multiple line lamps to glow responsive to the removal of the receiver at the substation, common battery cord circuits for answering calls from the subscriber's substation, means for preventing the effective connection of more than one of said cord circuits to said subscriber's line when attempting to answer a call, a signal for apprising an operator of one cord circuit if the operator at another cord circuit has effectively connected to the subscriber's line, and automatic disconnect means whereby the subscriber may operatively disconnect his line from the cord circuit connected thereto.

40. A semi-automatic telephone system including an automatic switch provided with means for progressively advancing and restoring the same, a subscriber's line terminating in multiple line lamps via said automatic switch, means for causing said multiple line lamps to glow responsive to the removal of the receiver at the substation, common battery cord circuits provided with automatic listening for answering calls from the subscriber's substation, means for preventing the effective connection of more than one of said cord circuits to said subscriber's line when attempting to answer a call, a signal for apprising an operator of one cord circuit if the operator at another cord circuit has effectively connected to the subscriber's line, and automatic disconnect means whereby the subscriber may operatively disconnect his line from the cord circuit connected thereto.

41. A semi-automatic telephone system including an automatic switch provided with means for progressively advancing and restoring the same, a subscriber's line terminating in multiple line lamps via said automatic switch, means for causing said multiple line lamps to glow responsive to the removal of the receiver at the substation, common battery cord circuits for answering calls from the subscriber's substation, means for preventing the effective connection of more than one of said cord circuits to said subscriber's line when attempting to answer a call, a signal for apprising an operator of one cord circuit if the operator at another cord circuit has effectively connected to the subscriber's line, and automatic disconnect means whereby the subscriber may oper-

atively disconnect his line from the cord circuit connected thereto.

42. A semi-automatic telephone system including an automatic switch provided with means for progressively advancing and restoring the same, a subscriber's line terminating in multiple line lamps via said automatic switch, means for causing said multiple line lamps to glow responsive to the removal of the receiver at the substation, common battery cord circuits for answering calls from the subscriber's substation, means for preventing the effective connection of more than one of said cord circuits to said subscriber's line when attempting to answer a call, a signal for apprising an operator at one cord circuit whether or not the operator at another cord circuit has effectively connected to the subscriber's line, means controllable by the operator for automatically intermittently ringing said called subscriber, and automatic means controllable by the calling subscriber for operatively disconnecting his line from the cord circuit operatively connected to his line.

43. A semi-automatic telephone system including an automatic switch provided with means for progressively advancing and restoring the same, a subscriber's line terminating in multiple line lamps via said automatic switch, means for causing said multiple line lamps to glow responsive to the removal of the receiver at the substation, common battery cord circuits provided with automatic listening for answering calls from the subscriber's substation, means for preventing the effective connection of more than one of said cord circuits to said subscriber's line when attempting to answer a call, a signal for apprising an operator at one cord circuit whether or not the operator at another cord circuit has effectively connected to the subscriber's line, means controllable by the operator for automatically intermittently ringing said called subscriber, and automatic means controllable by the calling subscriber for operatively disconnecting his line from the cord circuit operatively connected to his line.

44. A semi-automatic telephone system including an automatic switch provided with means for progressively advancing and restoring the same, a subscriber's line terminating in multiple line lamps via said automatic switch, means for causing said multiple line lamps to glow responsive to the removal of the receiver at the substation, common battery cord circuits for answering calls from the subscriber's substation, means for preventing the effective connection of more than one of said cord circuits to said subscriber's line when attempting to answer a call, a signal for apprising an operator at one cord circuit whether or not the op-

erator at another cord circuit has effectively connected to the subscriber's line, means controllable by the operator for automatically intermittently ringing said called subscriber, and automatic means controllable by the calling subscriber for operatively disconnecting his line from the cord circuit operatively connected to his line.

45. A semi-automatic telephone system including a subscriber's line terminating in multiple line lamps, means for causing said multiple line lamps to glow responsive to the removal of the receiver at the substation, common battery cord circuits for answering calls from the subscriber's substation, means for preventing the effective connection of more than one of said cord circuits to said subscriber's line when attempting to answer a call, a signal for apprising an operator at one cord circuit when the operator at another cord circuit has effectively connected to the calling subscriber's line, a calling supervisory signal for the cord circuit effectively connected to the calling line, automatic means for intermittently signaling the subscriber on said called line, operator controlled means for effecting an operation of said signaling means and for actuating said supervisory signal, means controlled by the called subscriber for disconnecting the signaling means from said called line, and automatic disconnect means controllable by the calling subscriber for operatively disconnecting his line from said cord circuit whereby he may initiate a recall prior to a disconnection of the answering plug of the cord circuit from the calling subscriber's line.

46. A semi-automatic telephone system including a subscriber's line terminating in multiple line lamps, means for causing said multiple line lamps to glow responsive to the removal of the receiver at the substation, common battery cord circuits provided with automatic listening for answering calls from the subscriber's substation, means for preventing the effective connection of more than one of said cord circuits to said subscriber's line when attempting to answer a call, a signal for apprising an operator at one cord circuit when the operator at another cord circuit has effectively connected to the calling subscriber's line, a calling supervisory signal for the cord circuit effectively connected to the calling line, automatic means for intermittently signaling the subscriber on said called line, operator controlled means for effecting an operation of said signaling means and for actuating said supervisory signal, means controlled by the called subscriber for disconnecting the signaling means from said called line, and automatic disconnect means controllable by the calling subscriber for operatively disconnecting his line from said cord circuit

whereby he may initiate a recall prior to a disconnection of the answering plug of the cord circuit from the calling subscriber's line.

47. A semi-automatic telephone system including a subscriber's line terminating in multiple line lamps, means for causing said multiple line lamps to glow responsive to the removal of the receiver at the substation, common battery cord circuits for answering calls from the subscriber's substation, means for preventing the effective connection of more than one of said cord circuits to said subscriber's line when attempting to answer a call, a signal for apprising an operator at one cord circuit when the operator at another cord circuit has effectively connected to the calling subscriber's line, a calling supervisory signal for the cord circuit effectively connected to the calling line, automatic means for intermittently signaling the subscriber on said called line, operator controlled means for effecting an operation of said signaling means and for actuating said supervisory signal, means controlled by the called subscriber for disconnecting the signaling means from said called line, and automatic disconnect means controllable by the calling subscriber for operatively disconnecting his line from said cord circuit whereby he may initiate a recall prior to a disconnection of the answering plug of the cord circuit from the calling subscriber's line.

48. A semi-automatic telephone system including a subscriber's line terminating in multiple line lamps, means for causing said multiple line lamps to glow responsive to the removal of the receiver at the substation, common battery cord circuits for answering calls from the subscriber's substation, means for preventing the effective connection of more than one of said cord circuits to said subscriber's line when attempting to answer a call, an operator's telephone, automatic means for connecting and disconnecting said operator's telephone and one of said cord circuits, a signal for apprising an operator of one cord circuit if the operator of another cord circuit has effectively connected to the calling subscriber's line, a called subscriber's line, a signal for the cord circuit effectively connected to the calling subscriber's line operable when the cord circuit is connected to the called subscriber's line, automatic ringing means, operator controlled means for connecting said automatic ringing means to said called subscriber's line and for effacing said supervisory signal, and automatic disconnect means controllable by one of said subscribers for freeing said subscriber's line from said cord circuit prior to the removal of a plug of said cord circuit from a jack of said line.

49. A semi-automatic telephone system including a subscriber's line terminating in multiple line lamps, means for causing said multiple line lamps to glow responsive to the removal of the receiver at the substation, common battery cord circuits for answering calls from the subscriber's substation, means for preventing the effective connection of more than one of said cord circuits to said subscriber's line when attempting to answer a call, an operator's telephone, automatic means for connecting and disconnecting said operator's telephone and one of said cord circuits, a signal for apprising an operator of one cord circuit if the operator of another cord circuit has effectively connected to the calling subscriber's line, a called subscriber's line, a

signal for the cord circuit effectively connected to the calling subscriber's line operable when the cord circuit is connected to the called subscriber's line, automatic ringing means, operator controlled means for connecting said automatic ringing means to said called subscriber's line and for effacing said supervisory signal, and automatic disconnect means controllable by one of said subscribers for freeing said subscriber's line from said cord circuit prior to the removal of a plug of said cord circuit from a jack of said line.

Signed by me at Chicago, county of Cook and State of Illinois, this 13 day of May, 1919.

GEORGE A. YANOCHOWSKI.