

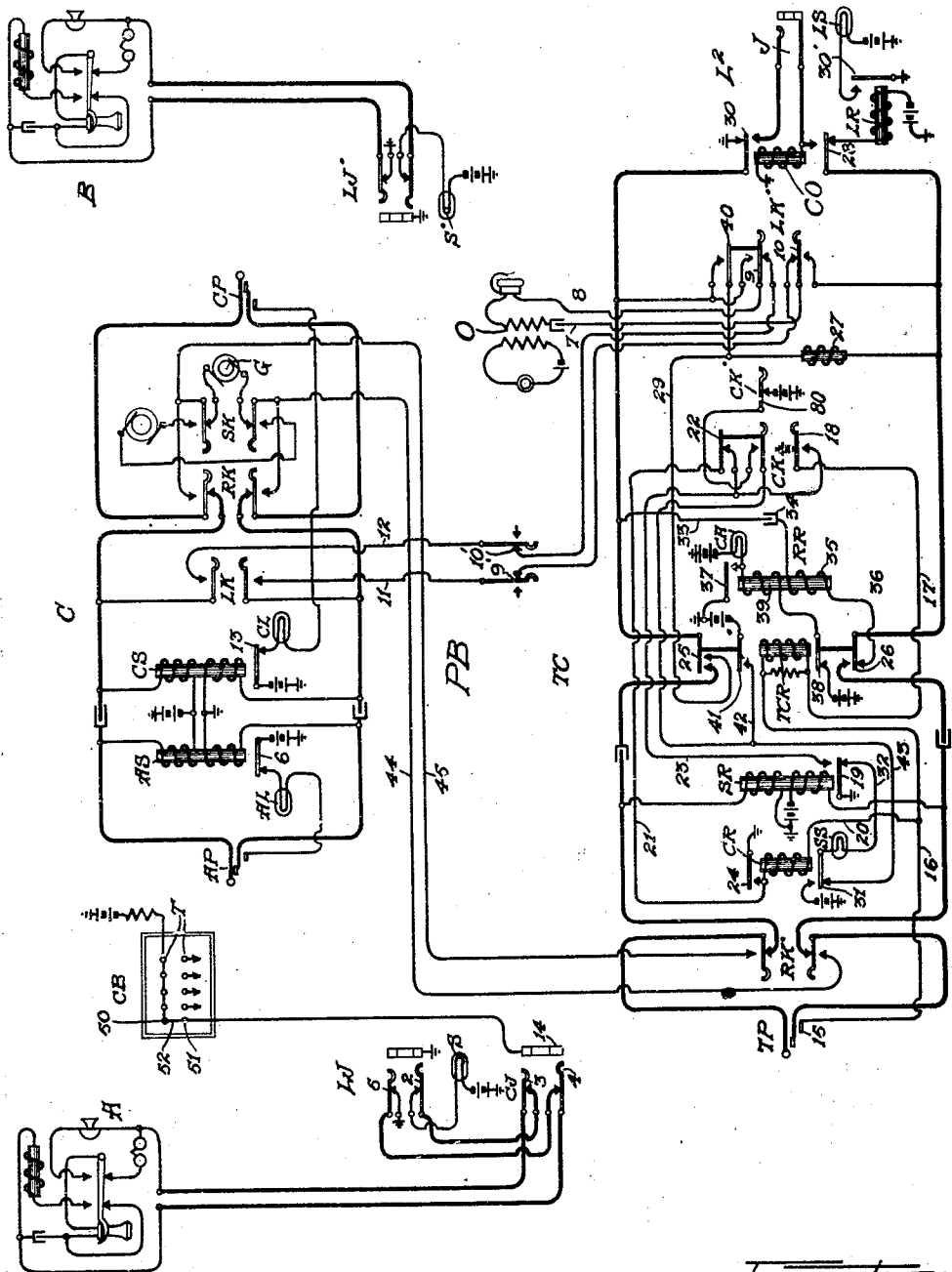
June 2, 1925.

1,539,866

A. E. REINKE

TELEPHONE SYSTEM

Filed Nov. 26, 1920



Inventor:
Arthur E. Reinke
By Arthur E. Reinke
Attorney

UNITED STATES PATENT OFFICE.

ARTHUR E. REINKE, OF THE HAGUE, NETHERLANDS, ASSIGNOR TO KELLOGG SWITCHBOARD AND SUPPLY COMPANY, OF CHICAGO, ILLINOIS, A CORPORATION OF ILLINOIS.

TELEPHONE SYSTEM.

Application filed November 26, 1920. Serial No. 426,366.

To all whom it may concern:

Be it known that I, ARTHUR E. REINKE, a citizen of the United States, and residing at The Hague, Netherlands, have invented certain new and useful Improvements in Telephone Systems, of which the following is a description.

My invention relates to telephone systems and has to do more particularly with private branch exchange systems, such as are used for interconnecting local subscribers terminating at a branch exchange board, and for also connecting local subscribers and main exchange subscribers, and an object of my invention is the provision of an improved circuit arrangement which has desirable features of operation, all in a simple, efficient and economical manner.

In private branch exchange systems of the above type, it is desired to connect the branch exchange subscribers with main exchange subscribers, and in a board of this type it is often desirable to allow only certain ones of the substation lines terminating at the branch board to connect with the main exchange. One of the objects of restricting the service, of course, is to limit the use of the trunk lines strictly to business purposes, and so reduce the number of trunk lines required.

A feature of my invention is the provision of a plurality of jacks, which I term city service jacks, which are allotted to the lines at the branch exchange in addition to the usual local jacks for local connections. The sleeve of the city service jacks of the lines allowed city service are connected to one pole of a battery. To the sleeve contact of each of the city service jacks I connect a conductor which leads to a sealed glass cabinet, which may preferably be placed where the person who has the authority for allotting the city service privileges to the subscribers can connect battery to the sleeves of any of the jacks that he desires. This feature of giving service to certain subscribers only may be called discriminating service.

Another feature of my invention is the provision of a trunk circuit, used in connecting a private exchange subscriber allowed city service to a main exchange subscriber, provided with means, responsive

when connection is made with a city service jack, to extend the trunk conductors to the main exchange. When a connection is made with a jack of a subscriber's line not allowed city service in an attempt to extend a connection to the main exchange, the said means remains unoperated or normal, and leaves the trunk conductors open to the main exchange so that a connection is not extended to the main exchange.

The features as above outlined, as well as others, will be more fully hereinafter described in the ensuing specification.

Referring now in general to my invention as illustrated in the accompanying drawing, at A I illustrate a substation terminating at the private branch exchange switchboard in a local cut-off jack LJ and a line signal S. At C I illustrate one of a plurality of branch exchange cord circuits with which the board is equipped for interconnecting the branch exchange subscribers, and which comprises an answering plug AP and a calling plug CP, the plugs being connected by the heavily marked conductors. The cord circuit C is provided with an answering supervisory relay AS and a calling supervisory relay CS, the two relays controlling, respectively, the answering supervisory and calling supervisory signals AL and CL. A listening key LK is provided for connecting the operator's set O to the cord conductors, and a ringing key RK is also provided, which when actuated connects ringing current to the called line. I also show a key SK which when actuated connects the ringing key RK with a different source of ringing current. To the right of the drawing I show a substation B similar to A and terminating at the private branch exchange board in a local cut-off jack LJ' and a line signal S'.

The private branch exchange stations may be interconnected for conversational purposes by means of the cords C, and in addition certain of the local stations are allotted city service, whereby they may be extended to the main exchange and be connected to substations terminating thereat. For this purpose, I provide jacks which I will term city service jacks CJ, and the substations at the branch exchange that are allowed city service are connected to the jacks CJ. Each

of the subscribers' lines may be connected to a city service jack CJ. In addition, I provide a terminal or connection box provided with a plurality of pairs of screw terminals 5 T; the screw terminals 50 of each pair T being connected to battery. The connection box is provided with a suitable cover, which is sealed and can only be opened by an authorized person. The other terminals 51 of the pairs T are connected to the sleeves of the city service jacks CJ. Now, when a local substation is to be provided with a city service extension, a jack CJ is connected to the said local substation (if not already provided with a jack CJ), in addition to his regular local jack LJ and a jumper wire 52 used to connect the screw terminals 50 and 51, thus extending the battery to the sleeve of the city service jack CJ. The local jack LJ of the substation is connected to ground and the jack CJ is connected to battery for purposes as will be more fully hereinafter described.

Two-way trunk circuits TC are also provided in addition to the local cords for connecting the substations provided with city service to the main exchange. The trunk circuit as illustrated in the drawing terminates at the private branch exchange in a trunk plug TP, and at the main exchange in a line circuit L², comprising the usual line relay LR, cut-off relay CO and line signal LS. The trunk circuit TC is provided with a trunk cord conductor control relay TCR, which operates when the plug TP is inserted into a city service jack CJ to extend the trunk cord conductors through to the main exchange, but remains at normal when the said plug TP is inserted into a local jack LJ or into a jack CJ not connected to battery, as will be more fully hereinafter described. I also provide a supervisory relay SR and a supervisory signal control relay CR for controlling the supervisory signal SS. A ringing relay RR is provided which operates when a call is extended to the private branch exchange to light a call lamp CA to inform the branch exchange operator that a call is awaiting her attention from the main exchange. A listening key LK' and a ringing key RK' are provided for connecting, respectively, the operator's set O and ringing current from generator G. A switching key CK is also provided for night service, as will be more fully hereinafter described.

The private branch exchange board is provided with a plurality of local cords C, and local jacks LJ into which the local substations at the branch exchange terminate. In addition, the branch exchange board is provided with city service jacks CJ which are allotted to the local substations for city extension service. A plurality of trunk circuits TC are provided and are arranged in

the plug shelf of the board for use in extending connections to and from the main exchange.

Having described in general the apparatus of the system of my invention, I will now describe in detail the operation.

Assuming now that the substation A at the private branch exchange PB initiates a call, the removal of the receiver at the substation closes a circuit through line signal S, traced from battery through the lamp S, normal contact 2 of the jack LJ, normal contact 3 of the city service jack CJ, through the closed contacts at the substation switchhook, back through normal contact 4 of jack CJ to ground at normal contact 5 of the jack LJ. The lamp is lighted over said circuit, and the operator noting the lighted signal inserts the answering plug AP of one of the private branch exchange cords C into the jack LJ of the calling substation, and this insertion opens the contacts 2 and 5 of the jack LJ to efface the line signal S, and establishes an energizing circuit for the answering supervisory relay AS, traced from battery through the upper winding of relay AS, the tip contacts of the connected plug AP and jack LJ, through the substation, back through the ring contacts of the connected plug AP and jack LJ to ground through the lower winding of relay AS. The relay AS upon energization opens its normal contact 6 to prevent the lighting of the supervisory lamp AL at this time. The operator now actuates her listening key LK to connect her operator's set O to the cord conductors of cord C, the said set O being connected thereto over conductors 7 and 8, normal contacts 9 and 10, of the listening keys LK' of the trunk circuit TC, and normal contacts 9' and 10' of a listening key of another trunk circuit, conductors 11 and 12, the now closed contacts of the listening key LK of the cord C to the cord conductors.

The operator now inquires the wants of the calling substation, and assuming that it is the substation B that is wanted, the operator inserts the calling plug CP into the jack LJ' of the wanted substation B, and actuates the ringing key RK to operate the call signal at the called station. The insertion of the plug CP into the jack LJ' closes a circuit through the calling supervisory lamp CL from battery at normal contact 13 of the calling supervisory relay CS, through the lamp CL, the sleeve contact of the plug CP to ground at sleeve of the jack LJ', and the lamp CL remains lighted until the subscriber at the called substation B answers. The subscriber at the substation B, in response to his call signal, removes his receiver, thus closing a circuit through the calling supervisory relay CS at the now closed switchhook contacts at the substation B, and the relay CS, upon energization,

opens its normal contact 13, thus effacing the supervisory lamp CL, thus indicating to the operator that the subscriber at substation B has answered. The subscribers at the substations A and B are now in conversational circuit, which may be traced over the heavily marked conductors.

Upon termination of conversation, the subscriber at the calling substation A replaces his receiver upon the switchhook to open the energizing circuit of the relay AS, and the relay restoring again closes its normal contact 6 to close a circuit through the supervisory lamp AL to ground at the sleeve of the jack LJ. The replacing of the receiver at the substation B opens the energizing circuit of the supervisory relay CS and the relay restoring again closes its normal contact 13 to close a circuit through the supervisory lamp CL to ground at the sleeve of the jack LJ'. The two lighted signals AL and CL indicate to the operator that conversation has terminated, and she now withdraws the plugs AP and CP from their respective jacks LJ and LJ', thus effacing the said lamps, and the apparatus used in establishing the above described connection is now at normal and available for establishing other connections.

Assuming again that the subscriber at the substation A initiates a call, the said call is answered in the manner as above described, and the operator now inquires the wants of the calling subscriber, and having received a request from the said calling subscriber for a connection to the main exchange, she will remove the plug AP from the local jack LJ. The subscriber at the substation A, as before mentioned, is provided with city service and the substation A, in addition to its local jack LJ at the branch exchange board, is provided with a second jack, which I will term a city service jack CJ, the sleeve of the said local jack LJ being connected to ground and the sleeve of the said city service jack CJ being connected to battery, and the purpose of the ground and battery connection for the respective jacks LJ and CJ will be more fully hereinafter described. The operator, after removing the answering plug AP of the local cord C from the jack LJ, now inserts the trunk plug TP of the trunk circuit TC into the city service jack CJ of the calling substation A. The insertion of the plug TP into the jack CJ closes an energizing circuit for the trunk control relay TCR, traced from battery at the sleeve 14 of the jack CJ, sleeve contact 15 of the trunk plug TP, conductor 16, through the winding of the relay TCR, conductor 17 to ground at normal contact 18 of the control key CK. The insertion of the plug TP into the jack CJ also closes an energizing circuit for the supervisory relay SR, traced from battery

through the lower winding of the relay SR, normal contacts of the ringing key RK', ring contacts of the plug TP and jack CJ, through the substation, back through the tip contacts of the jack CJ and plug TP to ground through the upper winding of the relay SR. The relay SR upon energization closes its alternate contact 19, establishing an energizing circuit for the supervisory control relay CR, traced from battery at the sleeve 14 of the jack CJ, through sleeve 15 of the plug TP, normal contacts of the ringing key RK', over conductors 16 and 20, through the winding of relay CR, conductor 21, normal contact 22 of the key CK and conductor 23 to ground at alternate contact 19 of relay SR. The relay CR upon energization closes its alternate contact 24, establishing a locking circuit for itself traced from battery at the sleeve 14 of jack CJ, sleeve 15 of plug TP, conductors 16 and 20, through the winding of relay CR to ground at its alternate contact 24. The relay CR and supervisory relay SR control the lighting of the supervisory lamp SS. The relay TCR upon energization closes its alternate contacts 25 and 26, closing the continuity of the trunk circuit conductors and thus extending the line of the subscriber A to the main exchange. The said trunk TC terminates at the main exchange in the line circuit L². The closure of alternate contact 25 of the relay TCR bridges the resistance 27 across the trunk conductors to establish an energizing circuit for the line relay LR of the line circuit L² at the main exchange, traced from battery through the winding of relay LR, normal contact 28 of relay CO, resistance 27, conductor 29, alternate contact 25 of the relay TCR, to ground at normal contact 30 of relay CO. The relay LR upon energization closes its alternate contact 30' to close a circuit through the line signal LS, which lamp LS is lighted to signal the main exchange operator. The main exchange operator noting the lighted signal LS inserts the answering plug of a cord pair into the jack J and inquires the wants of the calling branch exchange subscriber at substation A and extends the call to the called line in the usual manner. The resistance which is bridged across the trunk conductors upon the energization of relay TCR places the supervisory signal of the answering end of the main exchange cord under the control of the branch exchange operator. The called subscriber at the main exchange having answered in response to his call signal, is now in conversational circuit with the calling branch exchange subscriber A, and upon the termination of conversation the subscribers place their receivers on their respective switchhooks.

The replacing of the receiver at the called substation gives the main exchange operator

the usual disconnect signal. The replacing of the receiver by the subscriber at the branch exchange substation A opens the energizing circuit of the supervisory relay SR at the switchhook contacts, and the relay SR upon restoration closes its normal contact 19, establishing an energizing circuit for the supervisory lamp SS, traced from battery at alternate contact 31 of the relay CR, through the lamp SS, conductor 32 to ground at normal contact 19 of the supervisory relay SR. The lighting of the supervisory signal SS indicates to the branch exchange operator that the subscriber at substation A has replaced his receiver upon the switchhook, and she now withdraws the plug TP from the jack CJ opening the energizing circuits of the relays TCR and CR. The relay CR in restoring opens its alternate contact 31, effacing the supervisory signal SS, and the relay TCR in restoring opens alternate contact 25, interrupting the bridge of 27 across the trunk cord conductors, and this interruption of the bridge allows the tip supervisory relay of the main exchange cord to restore to close the circuit through the supervisory lamp of the cord, thus giving the main exchange operator a disconnect signal and she now withdraws the plug from the jack J and the apparatus used in establishing the connection is now at normal and available for establishing other connections.

Assuming that the subscriber A to whom city service is allotted receives a call from the main exchange, the operator at the said main exchange inserts the calling plug of a cord pair in the jack J which is associated with the trunk cord TC and projects ringing current to the branch exchange. The current extends from the tip of the jack J through alternate contact 30 of relay CO, condenser 34, through the lower winding 35 of relay RR, over conductor 36, normal contact 26 of relay TCR, alternate contact 28 of relay CO to the sleeve of the jack J. The ringing current passing through the winding 35 of relay RR causes the energization of the relay RR, and the closure of its alternate contact 37 establishes a locking circuit for itself through its locking winding, traced from battery at normal contact 38 of relay TCR, through winding 39 of relay RR to ground at alternate contact 37 of relay RR. The closing of alternate contact 37 of relay RR also establishes a circuit for the call lamp CA, traced from battery through the said lamp CA and through alternate contact 37 to ground. The lamp CA is lighted and notifies the operator that a call from the main exchange is awaiting her attention. The private branch exchange operator noting the lighted signal actuates the listening key LK' of the trunk cord TC and receives the number or name of the subscriber wanted at the branch exchange. The closing of alternate contact 40 of the listening key LK' bridges the resistance 27 across the trunk cord conductors to operate the supervisory signal at the main exchange so as to notify the main exchange operator that the call has been answered by the branch exchange operator. Assuming that it is the subscriber A that is wanted, the branch exchange operator inserts the trunk plug TP into the jack CJ of the wanted line to close an energizing circuit for the relay TCR, traced from battery at the sleeve 14 of the jack CJ, over sleeve 15 of the plug TP, conductor 16, through the winding of relay TCR, conductor 17, to ground at normal contact 18 of key CK. The relay TCR, upon energization, closes its alternate contact 41, establishing an energizing circuit for the supervisory lamps SS, traced from battery at alternate contact 41, over conductors 42 and 43, normal contact 31 of relay CR, through the lamp SS and over conductor 32 to ground at normal contact 19 of supervisory relay SR, the said lamp remaining lighted until the subscriber A answers.

The relay TCR upon energization opens its normal contact 38 to open the locking circuit of the winding 39 of the relay RR, and the relay RR now restores and opens its alternate contact 37 to efface the signal CA. The closing of alternate contacts 25 and 26 of relay TCR extends the trunk conductors through to the substation A and the closing of alternate contact 25 maintains the resistance 27 across the trunk conductors for controlling the supervisory signal at the main exchange, after the operator of the branch exchange has restored her listening key LK'. The private branch exchange operator now actuates the ringing key RK' of the trunk cord TC to connect ringing current over a path extending from one pole of the generator G over conductor 44, through alternate contact of the ringing key RK', ring contacts of the plug TP, and jack CJ, through the call bell and condenser at the called station A, back through the tip contacts of the connected jack CJ and plug TP, the other alternate contact of the ringing key RK' and conductor 45 to the other pole of the generator. The subscriber in response to his call signal removes his receiver from the switchhook and closes an energizing circuit for the supervisory relay SR. The said relay SR, upon energization, closes its alternate contact 19 to close an energizing circuit for the relay CR, traced from ground at alternate contact 19 of relay SR, over conductor 23, normal contact 22 of key CK, conductor 21, the winding of relay CR, conductors 20 and 16, sleeve 15 of plug TP, to battery at sleeve 14 of jack CJ. The relay CR upon energization closes a locking circuit for itself, traced from bat-

tery at sleeve 14 of jack CJ, over conductors 16 and 20, through relay CR to ground at its alternate contact 24. The opening of normal contact 19 of the relay SR effaces the supervisory signal SS, thus notifying the branch exchange operator that the subscriber at A has answered. The subscribers are now connected in conversational circuit, and the talking circuit may be traced over the heavily marked conductors.

The subscribers having finished conversation, they replace their receivers upon their respective switchhooks, and the replacing of the receiver at the calling substation in the main exchange gives the main exchange operator the usual disconnect signal, as is well understood. The replacing of the receiver at the called station A at the private branch exchange opens the energizing circuit of the supervisory relay SR at the switchhook contacts, and the closing of normal contact 19 of relay SR closes a circuit through the supervisory lamp SS, traced from battery at alternate contact 31 of the relay CR, through the lamp SS, and conductor 32 to ground at normal contact 19 of the supervisory relay SR. The lamp SS is lighted over this circuit and indicates to the branch exchange operator that the subscriber A thereat has replaced his receiver and conversation has terminated. The operator then withdraws the trunk plug TP from the jack CJ of the called line A. The withdrawal of the plug TP from the jack CJ opens the energizing circuit of the relays CR and TCR. The relay CR upon restoration opens the circuit of the signal SS, and the de-energization of relay TCR opens the bridge including the resistance 27 across the trunk conductors. The opening of this bridge brings about the lighting of the supervisory signal at the main exchange, and the operator noting the lighted signals withdraws the plug from the jack J. The apparatus used in establishing the above described connection is now at normal and available for establishing other connections.

Should the subscriber at the substation A, who is provided with a city service jack CJ, desire to remain in direct connection with the main exchange for the purpose of establishing several city connections, the operator of the branch exchange after having inserted the plug TP into the jack CJ, actuates the control key CK, and this opens the initial energizing circuit of the relay TCR at the normal contact 18 of the key CK, but a substitute circuit is established for the relay TCR, traced from battery at the sleeve 14 of the jack CJ, through sleeve contact 15 of the plug TP, conductor 16, through the winding of relay TCR, conductor 17, alternate contact 18 of key CK, conductor 23 to ground at alternate contact 19 of the supervisory relay SR. The resistance 27 is

bridged across the trunk cord conductor, and now should the subscriber at the branch exchange substation wish to attract the attention of the main exchange operator, the winking of the switchhook at the substation A opens and closes the circuit of the supervisory relay SR of the trunk TC, and the opening and closing of contact 19 of relay SR brings about the de-energization and energization of relay TCR, which relay TCR opens and closes the bridge 27 across the trunk conductors and causes the flashing of the supervisory signal at the main exchange.

Should the private branch exchange operator by chance, or intentionally, insert the plug TP of the trunk TC into a local jack LJ of the line, no energizing circuit for the relay TCR of the trunk circuit TC is established, as the sleeve of the jack of the local jack LJ is connected to ground and the other terminal of the relay TCR is connected to ground. Should the branch exchange operator insert the plug TP into a local jack LJ, and then actuate the key CK, and should the subscriber at the substation that terminates in the jack LJ into which the plug TP has been inserted, have his receiver off the hook, no energizing circuit for relay TCR is established, as the circuit through relay TCR under these conditions extends from ground at the sleeve of the jack LJ to ground at alternate contact 19 of the relay SR, through the alternate contact 18 of the key CK, and the relay TCR failing to energize, the connection is not extended to the main exchange.

Should the operator of the branch exchange insert the plug TP into a local jack LJ from which the ground has been maliciously removed, and then place the sleeve of either plug AP or CP to the sleeve of the inserted trunk plug TP, no operative energizing circuit is established for the relay TCR, of the trunk circuit TC, as the said relay TCR is adjusted to operate from 24 volts direct, but will not operate in series with a supervisory lamp as AL or CL.

Should the operator at the branch exchange insert an answering plug AP of a local cord into the local jack of a line and actuate the listening key LK of the cord C and the listening keys LK' of two trunk circuits TC, no connection will be established as the circuit over conductors 11 and 12 leading from the alternate contacts of the listening key LK will be disconnected at the normal contacts 9 and 10 of the listening key LK' and at normal contacts 9' and 10' of one of the listening keys of another trunk circuit TC, which was actuated. From the above it may be seen that the blocking of an illegal connection is positive, and to receive city service the local substation, in addition to the local jack for local connections, must be provided with a city service jack at CJ

connected to battery. Should the operator plug into a jack CJ not connected to battery, the relay TCR cannot be operated.

For night service so that a private branch exchange subscriber can make outgoing calls, the plug TP is placed in a jack CJ and keys CK and CK' operated. The operation of CK' prevents the lighting of lamp SS when the receiver at the calling substation is on the switchhook. No current is used by any of the relays at the branch exchange when the trunk circuit is connected to a subscriber's line for night service, the keys CK and CK' operated, and the receiver at the substation on its switchhook.

While I have described a specific form of my invention, I do not, however, wish to be limited to the exact circuit arrangement as illustrated and described, as changes and modifications will readily suggest themselves by those skilled in the art, 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 manually operated telephone system including a number of telephone lines of different classes extending from substations to terminals at an exchange switchboard, a common battery terminal block for supplying potential to the terminals of one of said classes, a connecting circuit for use in extending calls from lines of one of said classes to a distant exchange, terminals for said connecting circuit, normally opened contacts between said terminals in the conductors of said circuit, and mechanism rendered operative when connecting said circuit with a line of said class having said terminal block associated therewith to close said normally opened contacts to extend a connection to the distant exchange.

2. A telephone exchange system including telephone lines extending from substations to an exchange switchboard, terminals for said telephone lines, conductors extending from the terminals to a terminal block, connecting circuits for extending connections from said telephone lines to a distant exchange, means for applying potential to certain of the conductors extending to said terminal block; and means in said connecting circuit operative when the said connecting circuit is connected to one of said lines to which a potential is connected to extend the said line through to the distant exchange, said last means being inoperative when said connecting circuit is connected to one of said lines to which no potential has been connected.

3. A telephone system including subscribers' lines extending from substations and terminating in connection terminals at an exchange switchboard, said connection

terminals being provided with test contacts some of which have battery potential connected thereto, while others have ground potential connected thereto, a connecting circuit for extending connections from said lines to a distant exchange, via certain of said connection terminals, discriminating means in said connecting circuit operative when connected to one of said lines through one of said terminals having a battery potential connected to the test contact for connecting the line through to the distant exchange, said discriminating means not being operable when the connecting circuit is connected to one of said lines through a terminal having a ground potential connected to the test contact, thereby preventing the connection of said last line to the distant exchange, and means for placing said discriminating means under the control of the connected subscriber when the connecting circuit is connected to a terminal having battery potential on its test contact.

4. A manually operated telephone exchange system having lines of different characters extending from substations to an exchange switchboard, a link circuit for use in extending connections from said lines to a distant exchange, normally open contacts in the conductors of said link circuit, battery bridged across said link circuit at the distant exchange, signaling means included in said bridge, discriminating means in said link circuit whereby, when said link circuit is connected to a line of one character said discriminating means operates to place a bridge across the link circuit to operate said signaling means at the distant exchange and to close said normally open contacts, while when said link circuit is connected to a line of a different character said discriminating means does not operate to close a bridge across the link circuit to operate the signaling means at the distant exchange and means for placing said discriminating means under the control of the connected subscriber when said link circuit is connected to a line of said one character.

5. A telephone exchange system having lines of different characters extending from substations to an exchange switchboard, an operator's manually controlled link circuit for use in extending connections from said lines to a distant exchange, normally open contacts in the conductors of said link circuit, a battery bridged across said link circuit at the distant exchange, signaling means included in said bridge, discriminating means in said link circuit whereby when said link circuit is connected to a line of one character said discriminating means operates to place a bridge across the link circuit to operate said signaling means at the distant exchange and to close said normally open contacts, while when said link circuit

is connected to a line of a different character said discriminating means does not operate to close a bridge across the link circuit to operate the signaling means at the distant exchange, said discriminating means being operable when a call is extended from the distant exchange to a subscriber at the exchange switchboard of the first of said classes for connecting the said subscriber with the distant exchange and being inoperative when extending a call to a subscriber of the other of said classes for connecting the said subscriber to the distant exchange, a supervisory signal at the distant exchange controlled by said discriminating means, and means for placing said discriminating means under the control of the connected subscriber when said link circuit is connected to a line of said one character whereby the operator at the distant exchange may be signalled from the connected subscriber's substation.

6. A telephone system including subscribers' telephone lines extending from substations to an exchange switchboard, a link circuit for extending connections from said substations to a distant exchange, a normally open contacts in the conductors of said link circuit, a supervisory signal for said link circuit operable by a subscriber when the link circuit is connected to one of said subscribers' lines, responsive to the opening and closing of the bridge across the subscriber's lines, a signal for said link circuit at the distant exchange and means in said link circuit for closing said normally open contacts and also for rendering the signal in the link circuit at the exchange switchboard inoperative responsive to the opening and closing of the said bridge across the subscriber's line and for rendering said signal at the distant exchange operable by the opening and closing of the bridge across the subscriber's line.

7. A telephone system including subscribers' lines extending from substations to an exchange switchboard, a connecting circuit having its talking strands normally in open circuit, means for closing said talking strands to extend calls from said subscribers' lines to a distant exchange, a signal for said connecting circuit at the exchange switchboard and a second signal at the distant exchange, means controlled over a connected subscribers' line for operating the signal at the exchange switchboard but not the signal at the distant exchange, and means for preventing the operation of the signal at the exchange switchboard and for rendering operative the signal at the distant exchange.

8. A telephone system including subscribers' lines of different characters extending from substations to an exchange switchboard, a connecting circuit having its talk-

ing conductors normally in open circuit for extending calls from said subscribers' lines of one character to a distant exchange, discriminating means for said connecting circuit for preventing the subscribers' lines of another character from being extended to a distant exchange, a signal for said connecting circuit at the exchange switchboard, a second signal at the distant exchange under the control of said discriminating means, means controlled over a connected subscriber's line for operating the signal at the exchange switchboard but not the signal at the distant exchange, means for said link circuit including a switchboard operator's manually operated key for placing said discriminating means under the control of the connected subscriber for rendering the signal at the distant exchange responsive to the substation control and the said first signal at the exchange non-responsive to the substation control, and a third signal for said connecting circuit at the exchange switchboard controlled from said distant exchange for indicating a call from said distant exchange.

9. A telephone system including subscribers' lines extending from substations to an exchange switchboard, a connecting circuit for extending calls from said subscribers' lines to a distant exchange, normally open contacts in the talking conductors of said connecting circuit, automatic means for closing said normally open contacts, a signal for said connecting circuit at the exchange switchboard and a second signal at the distant exchange, means controlled over a connected subscriber's line for operating the signal at the exchange switchboard but not the signal at the distant exchange, and means for rendering the signal at the exchange switchboard non-responsive to the substation control and for rendering the signal at the distant exchange responsive to the subscriber control.

10. A telephone system including subscribers' telephone lines extending from substations to an exchange switchboard, a link circuit for use in extending connections from said substations to a distant exchange, means in said link circuit for opening and closing the talking strands of said link circuit, means responsive to the connection of said link circuit to one of said subscribers' lines for operating said means to close the conductors of said link circuit, and locking means for preventing the connected subscriber from opening the conductors of said link circuit.

11. A telephone system including subscribers' telephone lines extending from substations to an exchange switchboard, a link circuit for use in extending connections from said substations to a distant exchange, means in said link circuit for opening and closing the talking strands of said link circuit,

means responsive to the connection of said link circuit to one of said subscribers' lines for operating said means to close the conductors of said link circuit, locking means for
5 preventing the connected subscriber from opening the conductors of said link circuit, and means in said link circuit for rendering

said locking means inoperative and for permitting the subscriber to open and close the conductors of said link circuit to operate
10 signaling means at the distant exchange.

Signed by me at The Hague, the Netherlands, this 5th day of November, 1920.

ARTHUR E. REINKE.