

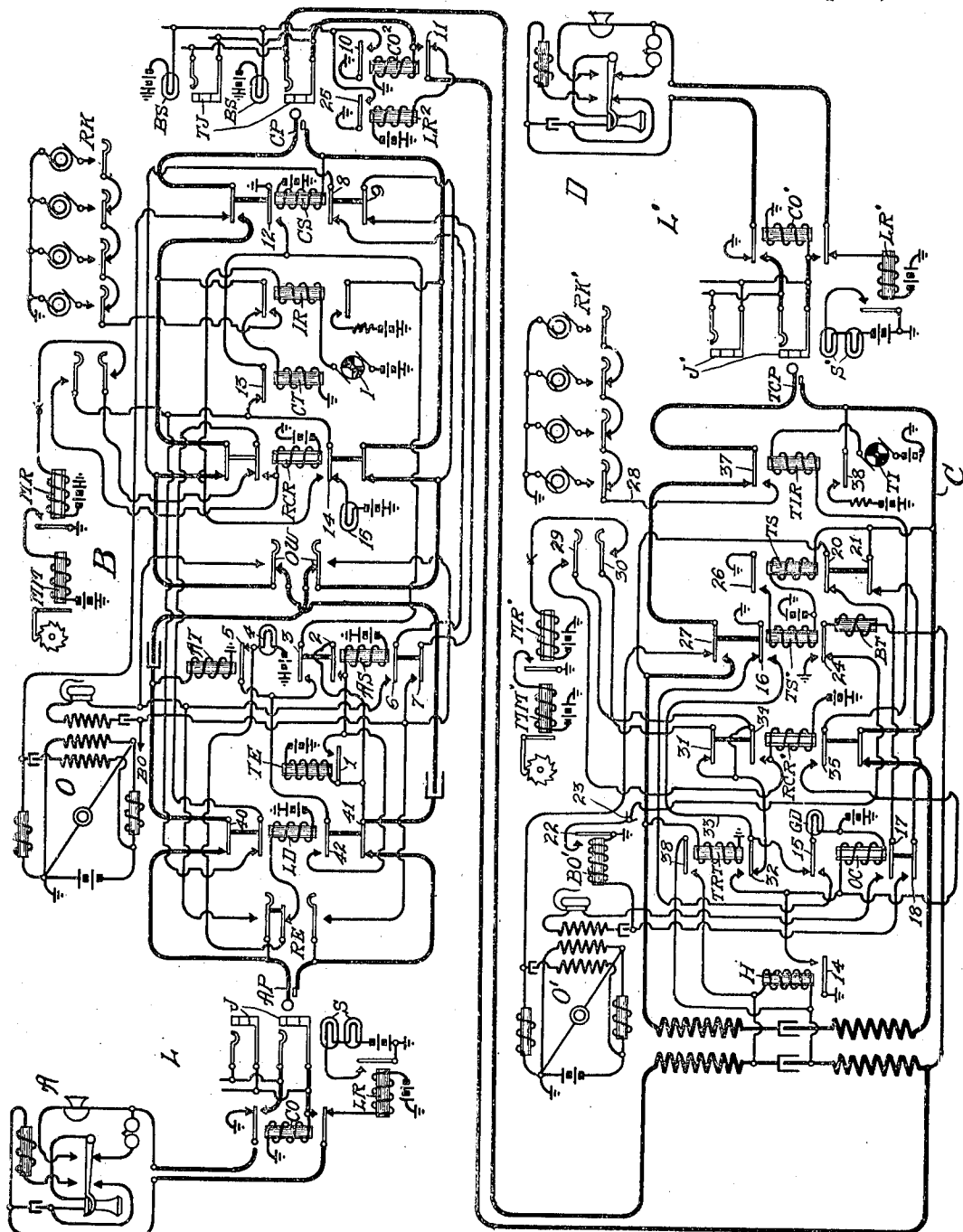
H. D. CURRIER, R. I. UTTER & M. B. STAZAK.

TELEPHONE SYSTEM.

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Witnesses:

George E. Mueller
Wm. Berghahn

Inventors:
Hiram D. Currier
Richard I. Utter
Michael B. Stazak
By Curtis B. Camp
Attorney

UNITED STATES PATENT OFFICE.

HIRAM D. CURRIER, RICHARD I. UTTER, AND MICHAEL B. STAZAK, OF CHICAGO, ILLINOIS, ASSIGNORS TO KELLOGG SWITCHBOARD & SUPPLY COMPANY, OF CHICAGO, ILLINOIS, A CORPORATION OF ILLINOIS.

TELEPHONE SYSTEM.

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To all whom it may concern:

Be it known that we, HIRAM D. CURRIER, RICHARD I. UTTER, and MICHAEL B. STAZAK, citizens of the United States of America, residing in Chicago, county of Cook, and State of Illinois, have invented certain new and useful Improvements in Telephone Systems, of which the following is a specification.

Our invention relates to telephone systems, having to do more particularly with trunking systems, that is, systems wherein calls are extended through operators' cord circuits and trunk circuits from calling to called substations, an object of our invention being to provide an improved system of the above character.

Heretofore the general practice in multi-exchange systems for handling trunk calls has been for the A operator to answer the incoming call by the use of an operator's cord circuit and then communicating with a trunk or B operator in the desired exchange by means of order-wires independent of the trunk circuits, the A operator then connecting to a trunk leading to the desired exchange which has been assigned by the B or trunking operator, whereupon the trunk operator extends the assigned trunk circuit to the called line. With this method of handling the connections special trunking operators and special trunking positions at a multiple switchboard are required and one of the main objects of our invention is to eliminate the trunk operators and to have each A or subscriber operator receive trunk calls while she is idle. To this end each A operator in addition to the usual answering and multiple jacks, has trunk jacks accessible from her position extending to the different exchanges and terminating at plugs before A operators in such exchanges, so that each operator has both outgoing and incoming trunks. Each trunk is preferably multiply connected to a number of such trunk jacks which are distributed among different operators' positions, and we also provide busy indicating means in connection with each trunk jack preferably in the form of a visual signal which indicates when such trunk is in use. Another feature of our invention is the provision of a control circuit whereby when an operator is busy put-

ting up a connection either in the nature of a local connection or a trunking connection, all trunks which terminate at her position indicate busy at their outgoing or jack ends. To this end we preferably provide an operator's busy relay common to each operator's telephone and which is effective to light the busy lamps whenever the operator's telephone is in use. There are other features and these will be more particularly referred to in the ensuing specification and appended claims.

For a better understanding of our invention, reference will be had to the accompanying drawing in which a calling substation A and called substation D are shown terminating in line circuits L and L' respectively, at different exchanges, together with an operator's cord circuit B and a trunk circuit C. The substations A and D are of a well-known common battery type and chosen for the purpose of illustration, said substations terminating in line circuits L including line and cut-off relays LR and CO respectively. Multiply connected jacks J are provided and in the present embodiment of our invention a line signal S is provided for each jack, the jacks being distributed among different operators. That is, when a call is initiated over any line, the line signals S are lighted and any one of a plurality of operators can seize the call.

The operator's cord circuit B comprises the usual answering plug AP and calling plug CP, the circuit shown being of the two-conductor type and said plugs being connected by tip and sleeve conductors. At the answering end of the cord circuit we provide a comparatively high resistance test relay TE which is connected to the sleeve strand and energized when the answering plug is inserted whereby the answering sleeve relay AS is connected to the sleeve conductor. With this arrangement the first operator to answer a call seizes it to the exclusion of any subsequent operator. That is, when the first plug AP is connected to a calling line, the sleeve relay AS associated therewith is connected to the sleeve strand and should a second operator attempt to seize this call the high resistance relay TE of the second cord circuit cannot operate

and this prevents the second operator from connecting to this line. An answering tip relay AT is also associated with the answering end of the cord being connected with the tip strand. We have also provided an instantaneous recall arrangement including a link disconnect relay LD. Should a calling subscriber desire to recall as soon as his receiver has been replaced and prior to his removal of the operator's cord B from his line the replacing of his receiver energizes the link disconnect relay LD thereby disconnecting relays AT and AS so that the subsequent removal of his receiver will again light his line lamp so that the recall may be seized by the same or a different operator.

In connection with the calling end of circuit B, we provide a calling sleeve relay CS and a calling tip relay CT which are operated in a well-known manner. Automatic party line ringing is also provided and to this end we have provided a party line key RK together with a ringing control relay RCR which is energized when the ringing key is actuated together with an interrupter relay IR which alternately connects ringing generator and calling tip relay CT of the called line. A call register is also provided comprising a meter relay MR and meter magnet MM which are controlled through common contacts of the ringing key.

We also provide automatic listening and disconnecting, the operator's cord circuit O being connected to the cord circuit through the sleeve relay AS when connection is made to a calling line and again disconnected by the operation of sleeve relay CS when connection is extended to another line or a trunk jack.

In order to handle the recalls and trunking connections we preferably provide a two-way key including the recall contacts RE and the orderwire contacts OW. This key when thrown one way being adapted to operate contacts RE to connect the operator's telephone set O with the cord circuit and at the same time restore the link disconnect relay LD, and when the key is thrown in the other direction the orderwire contacts OW are actuated to first sever the talking conductors of the cord circuit and then connect the operator's telephone O to the calling end of the cord whereby the operator may converse with the operator to whom the trunk connection is being extended and at the same time prevent the calling subscriber from hearing her pass a call to the distant operator.

Now as to the trunk circuit C, we preferably provide a number of multiply connected trunk jacks TJ for each trunk and distribute these jacks among different operator's positions and above each such jack we provide a busy signal BS which is lighted while the

trunk C is in use so that no other operator will attempt to connect therewith. Two relays are provided at the outgoing end of the trunk for controlling the signals BS, said relays being in the nature of line and cut-off relays LR^2 and CO^2 . When an operator connects with the trunk jack TJ the associated cut-off relay CO^2 is operated over the sleeve strand and this lights all of the associated lamps BS. Also if the plug of the trunk C is in the jack of a called line and the plug CP has been withdrawn from the trunk jack TJ then the line relay LR^2 is operated over the trunk conductor to maintain the signals BS lighted until the trunk plug is removed. We also provide a repeating coil for the trunk circuit and a high resistance bridged relay H which relay in accordance with well-known practice is of a high enough resistance to prevent the actuation of the tip relay CT of a connected cord B.

When an operator inserts a plug CP in a trunk jack TJ, relay H energizes followed by the operation of an operator's cut-in relay OC which relay serves to connect the distant operator's telephone O^1 to the trunk circuit, this relay also serving to light the combined guard and disconnect lamp GD which remains lighted until the trunk plug is inserted in the jack of the called line. Upon the connection of the distant operator's telephone O^1 with the trunk the operator's busy relay BO^1 energizes to connect ground to the sleeve conductor of all of the idle incoming trunks terminating at this distant operator's position which ground connection serves to operate the line relays LR^2 of these trunks and thereby light their associated busy signals BS so that no originating operators will attempt to connect to any of the trunks going to this busy distant operator, this busy condition being maintained until the operator has extended the call by inserting the trunk plugs TCP in the line jack of the wanted line. In connection with relay BO^1 the conductor leading from its contact 22 is common to all of this operator's trunk circuits. That is, there is a connection 23 extended from the alternate contact 22 of BO^1 to a normal contact 24 on each of the relays TS^1 of this operator's trunks. It will thus be seen that no matter which one of her trunks are used all of the idle ones terminating at her position are maintained busy as long as the relay BO^1 is energized.

As each operator's telephone is common to both the operator's cord circuits B and the incoming trunk circuits C at her position it will be apparent that relay BO^1 energizes each time a link circuit is used, energizing when the incoming end of the link is connected with, and deenergized when the outgoing end of the link is connected with,

this period of energization of BO^1 maintaining all the distant trunk jacks extending to her position busy.

At the calling or outgoing end of trunk circuit C (which is preferably of the two-conductor type although our invention is not limited to this), we provide a trunk sleeve relay TS and an auxiliary trunk sleeve relay TS^1 , both relays always operating together and being provided because there are more contacts to be controlled than good practice will permit to be placed upon a single electromagnet. A trunk tip supervisory relay TRT is also provided, and automatic party line ringing, and to this end we provide a ringing key RK^1 and ringing control relay RCR^1 energized when the ringing key is actuated. A trunk interrupter relay TIR is also provided being adapted to alternately connect ringing current and the trunk tip relay to the tip conductor of the trunk. In connection with the trunk circuit we have also shown a meter device consisting of a meter relay MR^1 and a meter magnet MM^1 .

Operation.

Having described in general the apparatus embodied in our preferred arrangement we will now describe more in detail the operation of the system.

Assuming that a call is initiated at station A by the removal of the receiver thereat, line relay LR is energized over the calling line effecting the operation of line signals S. An operator inserts an answering plug AP into a jack J of the calling line connecting relays TE and CO in series and causing the energization of TE but not that of CO whereupon the sleeve relay AS is connected to the sleeve conductor of the cord through alternate contact 1 causing the energization of AS and CO in series followed by the energization of the tip relay AT over the calling line. Relay AS therefore closes its alternate contact 2 effecting a locking circuit for itself through the sleeve conductor independent of alternate contact 1. The closing of alternate contact 3 of AS does not effect the lighting of supervisory lamp 4 on account of the interruptions of normal contact 5. The closing of alternate contacts 6, 7, of AS connects operator's telephone O in circuit with the cord through normal contacts 8, 9 of the calling sleeve relay CS. Upon the connection of the operator's set O with the cord circuit, a circuit is closed through the relay BO (only the tap leading to the relay BO being shown at cord circuit B). The relay BO upon energizing operates to cause the busy lamps associated with the distant ends at all the incoming trunk circuits associated with the operator's position to show busy, thus notifying the operators at the distant exchange that the operator at B is busy.

Before proceeding further with the description of the connection we will refer briefly to the arrangement for excluding operators who may subsequently connect to this same line. Assuming that a second operator inserts a plug AP into another jack J of this calling line subsequent to the insertion of the first plug, this second operator's telephone will not be connected to this calling line due to the fact that the relay TE of the second cord will not become energized because of the parallel circuit established through the comparatively low resistance relay AS of the first cord. Therefore the sleeve relay AS of the second cord does not energize and the second operator receiving no reply to her inquiry knows that the call has been seized.

Again taking up the first connection above referred to, the first operator ascertains the number of the wanted subscriber and finding that the wanted line terminates at a distant exchange, she will insert the calling plug CP into an idle trunk jack TJ leading to the wanted exchange, such idle condition being indicated by the absence of the illumination of busy signals BS. Upon insertion of plug CP into the trunk jack, the circuit for relays CS and CO^2 is established over the sleeve contacts of the plug and jack effecting their energization, the energization of CO^2 causing the closure of its alternate contact 10 and the lighting of all of the busy signals BS associated with the jacks of this trunk. The closing of alternate contact 11 of CO^2 effects the continuity of the sleeve talking conductors of the trunk. The relay CS having energized, its normal contacts 8, 9 disconnect the operator's telephone O and the closing of alternate contact 12 establishes a circuit through normal contacts 13, 14 and supervisory lamp 15 effecting its illumination until the called subscriber responds as will be more clearly described.

Connection having been made to trunk C as described, sleeve relay CS and tip relay CT of cord circuit B are connected in series with the high resistance trunk relay H, which relay is energized but due to its high resistance prevents the energization of CT. Responsive to the closing of alternate contact 14 of H a circuit for the operator's connecting relay OC is established whereby said relay energizes closing its alternate contact 15 and establishing a circuit for the guard lamp GD through normal contact 16 of TS^1 to ground. The closing of alternate contacts 17, 18 of OC connects the operator's telephone O^1 through normal contacts 20, 21 of sleeve relay TS to the trunk talking conductors. At this time the operator's busy relay BO^1 is connected through contacts 18 and 21 and then through the winding of trunk sleeve relay TS to battery causing the energization of

BO¹ but its high resistance prevents the energization of TS. Therefore alternate contact 22 of BO¹ is closed connecting ground to its common conductors 23, the
 5 conductors 23 which extend to idle trunks being effective to cause the illumination of the busy signals BS, associated with the jacks of such idle trunks. This busy indication serves to keep other operators from
 10 extending connections to this busy operator. That is, while she is answering this trunk call it is desirable to keep other operators from extending trunk connections to her positions, such other operators in such case
 15 selecting trunks which extend to idle operators in the desired exchange. The circuit by which the busy lamps are maintained lighted may be traced from ground at alternate contact 22 of relay BO¹, conductors 23
 20 to normal contacts 24 of all the idle trunk circuits at this operator's position, sleeve conductor of such trunks C, normal contacts 11 and relays LR² to battery. The relays LR² of these trunks are thus energized closing their alternate contacts 25
 25 and lighting the associated busy lamps BS. This ground connection from alternate contact 22 does not effect the trunks which are included in taking connections between or
 30 to substations due to the fact that the relays TS¹ of such trunks are energized and their normal contacts 24 open. Thus this common ground at 22 cannot interfere with established connections by tying a number
 35 of trunks together.

Connection having been established between the cord B and trunk C, the operator at B actuates the orderwire key OW thereby interrupting the talking conductors
 40 of the cord circuit and connecting her operator's telephone O to the calling end of the cord and thus into talking association with the operator's telephone O¹ at the distant exchange. The operator at B now orders
 45 the number of the wanted substation but due to the interruption of the talking strands of B the calling subscriber does not hear this number as it is being passed along to the distant operator. The operator
 50 at B after having given the order, restores the orderwire key OW and the operator at C after testing the wanted line in the usual manner and finding it idle inserts the trunk plug TCP into a jack J¹ thereof connecting
 55 the trunk sleeve relay TS and cut-off relay CO¹ in series and effecting their energization. Upon energization of TS its normal contacts 20, 21 are interrupted effecting the deenergizations of the associated
 60 relay BO¹ and thus removing the busy condition of all of this operator's incoming trunks by extinguishing their signals BS. The interruption of contacts 20, 21 also disconnects the operator's telephone and the
 65 closing of alternate contact 26 causes the

energization of the auxiliary trunk sleeve relay TS¹ whereupon its normal contact 24 is interrupted preventing any subsequent energization of relay BO¹ from interfering with the conversational connection of this
 70 trunk. The closing of alternate contact 27 of TS¹ establishes the continuity of the tip conductor of the trunk and the interruption of normal contact 16 effaces guard lamp GD.
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The operator at C now actuates the proper ringing button thereby connecting generator to the ringing conductor 28, the actuation of such button while in its fully actuated position, also effecting the closure
 80 of common contacts 29, 30 whereupon a circuit for the meter relay MR¹ is established from battery through the winding of MR¹, alternate contact 30, normal contacts 31, 32, conductor 33 and alternate contact 16 to
 85 ground. Relay MR¹ therefore energizes causing the operation of meter magnet MM¹ and a single operation of the meter to record the established connection. The closing of the alternate contact 29 of the
 90 ringing key establishes an energizing circuit for the ringing control relay RCR¹ traced from battery through the winding of said relay, alternate contact 29, normal contact 32, conductor 33 to ground at al-
 95 ternate contact 16. Relay RCR¹ therefore closes its alternate contact 34 establishing a locking circuit for itself through said normal contact 32 to ground at alternate contact
 100 16. Alternate contact 35 of RCR¹ also closes establishing an operating circuit for the trunk interrupter relay TIR traced from battery through interrupter TI, relay
 105 TIR, alternate contacts 35 and 14 to ground. Relay TIR therefore alternately connects the ringing conductor 28 and the tip trunk conductor and relay TRT to the called line, each energization of TIR being effective to cause the transmission of ringing current
 110 through alternate contact 37 and over the called line back through alternate contact 38 to battery and ground.

Upon response of the called subscriber and the first subsequent closure of normal contact 37, a circuit for the trunk tip relay TRT is established traced from ground
 115 through the winding thereof, alternate contact 27, normal contact 37 over the called line returning through the winding of trunk sleeve relay TS to battery. The tip relay
 120 TRT is therefore energized closing its alternate contact 38 thereby shunting relay H which deenergizes and due to the interruption of normal contact 32 of tip relay TRT, relay RCR¹ is deenergized and further
 125 operations of the interrupter relay are prevented. The closing of the shunt across the winding of relay H also establishes a low resistance path over the trunk circuit so that the tip relay CT of the cord is energized in-
 130

interrupting the circuit for the supervisory signal 15 which is thereby effaced. The subscribers are now connected over a conversational circuit traced over the heavily marked conductors.

After completing conversation the subscribers replace their receivers upon their respective switch-hooks, the replacing at called station D effecting the restoration of trunk tip relay TRT whereby the shunt is removed from around the winding of relay H so that its high resistance causes the restoration of the calling tip relay CT of cord circuit B. The restoration of CT closes an operating circuit for the supervisory lamp 15 through normal contacts 14, 13 and alternate contact 12. The replacing of the receiver at substation A effects the restoration of answering tip supervisory relay AT whereby a circuit for the supervisory lamp 4 is established through normal contact 5 and alternate contacts 3, 12 to ground lighting said lamp 4. It will be noted that link disconnect relay LD being in multiple with lamp 4 also energizes when relay AT restores, the energization of LD causing the disconnection of the link circuit at contacts 40, 41 so that the subscriber at A can recall without awaiting the removal of the answering plug from the jack. The closing of alternate contact 42 of relay LD establishes a locking circuit for the sleeve relay AS traced from battery through the winding of AS alternate contact 42, 3, 12 to ground. Thus the supervisory lamps are maintained lighted until the cord is taken down irrespective of whether the subscriber at A does or does not recall.

The operator at cord B noting the disconnect signal withdraws plugs AP and CP from their respective jacks, the restoration of plug CP permitting the deenergization of sleeve relay CS whereby the interruption of its alternate contact 12 allows the restoration of relays LD, TE and AS so that the cord B is again at normal.

Also upon the removal of the plug CP from the trunk jack TJ the trunk cut-off relay CO² deenergizes, but the lamps BS are not effaced because line relay LR² is connected to the sleeve conductor of the trunk and is energized over a circuit traced to ground through alternate contact 24 of relay TS¹. Thus the busy signals BS of this trunk are maintained lighted, and remain so until the trunk plug TCP is removed from the jack of the called line. However, when the cord plug CP was removed from the trunk jack the bridge relay H of the trunk deenergized interrupting the circuit of relay OC which restores connecting disconnect lamp GD in circuit with battery and ground through normal contacts 15 and 32 and alternate contact 16 whereupon the operator withdraws the trunk plug from the jack

of the called line. This last act permits of the restoration of relays TS and TS¹ and the interruption of alternate contact 16 of TS¹ interrupts the circuit for lamp GD causing its effacement. The interruption of alternate contact 24 of TS¹ removes ground from the sleeve conductor of the trunk causing the restoration of the trunk line relay LR² and the effacement of the associated busy signals BS¹. The apparatus of the trunk being at normal it is now available for other connections.

From the above, it will be noted that from the time the cord plug CP is withdrawn until the trunk plug TCP is withdrawn, although the trunk or distant operator is busy in taking down this connection, only the busy lamps of this trunk are maintained lighted as the period of disconnection is very short.

Also from the foregoing it will be seen that there are a number of new features to our system of handling connections and by the use of the circuits illustrated special trunking operators are eliminated. In the preferred arrangement of the system we provide each operator with a number of cord circuits B and also a number of trunk circuits C terminating at her position in plugs TCP which extend from outgoing trunk jacks TJ from different exchanges. Thus each operator will also have a number of outgoing trunk jacks TJ extending to other exchanges. In order that an operator who seeks to extend a call over a trunk to a distant exchange may always know without preliminary testing of an operator in the desired exchange who is idle, and in order to provide a more equal distribution of the trunked connections or extensions, we preferably arrange the busy signals so that when any operator is busy in the act of answering any call, that is a local call at her position or a trunked call, all trunk jacks at their exchange leading to her position are maintained busy. Thus it will be seen that when a call is to be extended from a cord circuit B to a trunk circuit, the operator can tell at a glance which trunks lead to idle operators at the desired exchange. In this way the trunk calls will not pile up on one operator but will be distributed among the idle ones.

It will also be apparent from the foregoing that in our improved system the originating operator communicates with the distant operator over the connecting trunk which in this instance is also used as an orderwire for ordering up the connection with the distant subscriber. In this way we distinguish from the system wherein special orderwires are provided independent of the trunk circuits. Thus it will be seen that in our system instead of the originating operator communicating with a distant operator who assigns the trunk, the originating operator se-

lects the trunk and then orders up the connection to the distant desired substation over the selected trunk. By means of the busy signals which are provided over the trunk jacks, the originating operator selects an idle trunk and upon plugging into the trunk jack automatically connects her cord circuit with the telephone of the selected operator, so that the actuation of the order wire key OW will immediately place the two operators' telephones in communication. It must be apparent that with this arrangement great efficiency of the trunks is secured and at the same time the extra orderwires are eliminated.

Even with the best distribution of lines by the use of the intermediate and main distributing frames we have found all A operators have considerable idle time between calls and it will be seen from the foregoing that the trunk connections coming into the operators are extended to them only when idle so that what formerly was lost time is now used for handling trunked connections. Having described our invention what we claim as new and desire to secure by Letters Patent is:

1. A telephone system comprising telephone lines terminating at operators' positions in different exchanges, subscribers' cord circuits at each of such positions, trunk jacks accessible from each of said positions and having outgoing trunk circuits terminating at connecting plugs at A or subscribers' operators positions in all of the other exchanges whereby each subscriber's operator may effect connection between telephone lines accessible from her position or may extend connections from calling lines accessible from her position through said subscribers' cord circuits and said trunk circuits to operators' positions at distant switchboards, and a common relay associated with each operator's position for rendering the incoming trunk circuits associated with her position busy at their distant ends.

2. A telephone system comprising telephone lines terminating at operators' positions, subscribers cord circuits at each of such positions, trunk jacks having outgoing trunks extending from each operator's position to plug terminals at other operators' positions whereby each operator's position has both jack and plug terminals of outgoing and incoming trunks at her position, said cord and trunk circuits having control circuits whereby each operator may effect connection between telephone lines accessible from her position by said cord circuits or may extend connections from calling lines accessible from her position through said subscribers' cord circuits and said trunk circuits to operators at distant positions, and means associated with the distant ends of the trunk circuit extending from an opera-

tor's position to a distant exchange for rendering all incoming trunk circuits at the said distant exchange busy.

3. A telephone system comprising telephone lines terminating at operators' positions in different exchanges, subscribers' cord circuits at each of such positions, trunk jacks having outgoing trunks extending from each operator's position to plug terminals at other operators' positions whereby each operator's position has both jack and plug terminals and outgoing and incoming trunks at her position, and visual busy signals for said trunk jacks having control circuits whereby such signals associated with the incoming trunks of an operator's position are effected to indicate the busy condition of the operator whenever a call is being answered at her position from a telephone line or from an incoming trunk at her position.

4. A telephone system comprising telephone lines terminating at operators' positions in different exchanges, subscribers' cord circuits at each of said positions, trunk circuits, outgoing terminals at each operator's position for such circuits terminating at incoming terminals at operators' positions in the other exchanges whereby each operator's position may be connected over said trunks to operators' positions in other exchanges, a visual busy signal associated with each outgoing trunk terminal, and control circuits whereby when an operator is answering a call at her position from a telephone line or an incoming trunk all busy signals of trunks leading to her position will be rendered effective.

5. A telephone system comprising telephone lines terminating at operators' positions in different exchanges, subscribers' cord circuits at each of said positions, trunk circuits, outgoing terminals at each operator's position for such circuits terminating at incoming terminals at operators' positions in the other exchanges whereby each operator's position may be connected over said trunks to operators' positions in other exchanges, a visual busy signal associated with each outgoing trunk terminal, and control circuits whereby when an operator is answering a call at her position from a telephone line or an incoming trunk all busy signals of trunks leading to her position will be rendered effective, and means for rendering the busy signals at all but the used trunks leading to her position ineffective upon extending an answered call.

6. A telephone system comprising telephone lines, terminating at an operator's position, subscribers' cord circuits for said position, trunks leading from other switchboards and terminating in incoming terminals at said operator's position, an operator's telephone common to said cord and trunk circuits, an operator's busy relay for

said operator's telephone, connections extending from said relay to each of said trunk circuits, and means including said connections whereby when a call is being answered at said operator's position at any of her telephone lines or trunk circuits, said relay is operated to effect a busy condition at the outgoing end of the trunk circuit.

7. A telephone system comprising telephone lines terminating at operators' positions in different exchanges, subscribers' cord circuits at each of said positions, trunk circuits, multiply connected outgoing terminals for each of said trunk circuits distributed among several operators' positions, incoming terminals for said trunks at each operator's position, whereby each operator's position may be connected over said trunks to operator's positions in any of the other exchanges, a visual busy signal associated with each outgoing trunk terminal, and control circuits whereby when an operator is answering a call at her position from a telephone line or incoming trunk such condition will be indicated by the busy signals of trunks leading to her position.

8. A telephone system comprising telephone lines terminating at operators' positions in different exchanges, subscribers' cord circuits at each position, trunk circuits extending between each operator's position and an operator's position in the other exchanges whereby an operator may interconnect lines of her position by one of said cord circuits, or interconnect lines of her position and a trunk circuit by said cord, and control circuits effective when an operator is answering a call by one of her cord circuits or at a trunk incoming to her position, whereby a visual busy condition at the outgoing end of all trunks terminating at her position will be rendered effective.

9. A telephone system comprising telephone lines, divided into groups and appearing at operators' positions in different exchanges, link circuits at each of said positions, incoming trunk lines and outgoing trunk lines extending from each of said exchanges to each of said other exchanges, means including a link circuit of one of said operators' positions for interconnecting telephone lines accessible to said operator, means including one of said link circuits and one of said trunk circuits for connecting a subscriber's line of one exchange to a subscriber's line of another exchange, and means responsive to the connection of said link circuit to said trunk circuit for causing all of the idle trunks extending to the operator's position at said last exchange to indicate busy.

10. A telephone system comprising telephone lines terminating in different exchanges, link circuits at each of said exchanges, incoming and outgoing trunk cir-

cuits extending from one of said exchanges to each of the other of said exchanges, visual busy signals associated with the said trunk circuits, and control circuits whereby when an operator is answering a local call at one of said exchanges the busy signals of all the trunks leading to said last exchange will be operated.

11. A telephone system comprising telephone lines terminating in different exchanges, link circuits at each of said exchanges, incoming and outgoing trunk circuits extending from one of said exchanges to each of the other of said exchanges, a visual busy signal associated with each of said trunk circuits, and control circuits whereby when a call is extended to one of said exchanges all busy signals associated with idle trunks leading to said last exchange will be rendered effective to prevent other calls from being extended to said exchange.

12. A telephone system comprising telephone lines terminating at different exchanges, link circuits at each of said exchanges, incoming and outgoing trunk circuits extending from one of said exchanges to each of the other of said exchanges, means including one of said link circuits and an outgoing trunk circuit for extending a call from a subscriber's line of one of said exchanges to a subscriber's line of another of said exchanges, and means responsive to the connection of said link to said trunk circuit for connecting the operator's telephone associated with the said trunk circuit to the said link circuit and for causing all of the incoming trunk circuits associated with the operator's telephone to indicate busy.

13. A telephone system comprising subscribers' lines terminating at operators' positions in different exchanges, link circuits at each of said positions, incoming trunk lines extending from one of said exchanges to another of said exchanges, outgoing trunk lines extending from the said first exchange to the said second exchange, means including the said link circuits whereby each subscriber's operator may effect connection between lines associated with her position, means including said link circuit and one of said trunk circuits for extending connection from a subscriber's line terminating at said first exchange to a subscriber's line terminating at said second exchange, and means for rendering all the idle incoming trunk lines associated with the operator's position at said first exchange busy when her telephone is connected to one of said subscriber's lines.

14. A telephone system including telephone lines terminating at a central office exchange, other telephone lines terminating at a second central office exchange, link cir-

circuits at each of said exchanges, trunk circuits extending from the first of said exchanges to the second of said exchanges for extending calls to said second exchange, trunk circuits extending from said second exchange to said first exchange for extending calls from said second exchange to said first exchange, busy signals associated with the outgoing ends of said trunk circuits, and
 10 circuit connections whereby the connection of a link circuit at said first exchange to a calling subscriber's line operates the busy signals associated with the trunks extending from said second exchange to said first exchange.

15 15. A telephone system including telephone lines terminating at a central office exchange, other telephone lines terminating at a second central office exchange, link circuits at each of said exchanges, trunk circuits extending from the first of said exchanges to the second of said exchanges for extending calls to said second exchange, trunk circuits extending from said second
 20 exchange to said first exchange for extending calls from said second exchange to said first exchange, busy signals associated with the outgoing ends of said trunk circuits, circuit connections whereby the connection
 25 of a link circuit at said first exchange to a calling subscriber's line operates the busy signals associated with the trunks extending from said second exchange to said first exchange, and circuit connections whereby
 30 the connection of said link circuit to a called subscriber's line removes the busy indication of said signals.

16. A telephone system including telephone lines terminating at a central office
 40 exchange, other telephone lines terminating at a second central office exchange, link circuits at each of said exchanges, trunk circuits extending from the first of said exchanges to the second of said exchanges for extending
 45 calls to said second exchange, trunk circuits extending from said second exchange to said first exchange for extending calls from said second exchange to said first exchange, busy signals associated with the outgoing ends of
 50 said trunk circuits, and circuit connections whereby the connection of a link circuit at said second exchange to a trunk circuit extending to said first exchange renders effective the busy signals associated with the idle
 55 trunks extending from said second exchange to said first exchange.

17. A telephone system including telephone lines terminating at a central office
 60 exchange, other telephone lines terminating at a second central office exchange, link circuits at each of said exchanges, trunk circuits extending from the first of said exchanges to the second of said exchanges for extending calls to said second exchange,

trunk circuits extending from said second
 exchange to said first exchange for extending
 calls from said second exchange to said
 first exchange, busy signals associated with
 the outgoing ends of said trunk circuits, circuit
 connections whereby the connection of
 70 a link circuit at said second exchange to a trunk circuit extending to said first exchange renders effective the busy signals associated with the idle trunks extending
 75 from said second exchange to said first exchange, and circuit connections whereby the connection of said trunk circuit to a called line removes the busy indication of said busy signals.

18. A telephone system including telephone lines terminating at a central office
 exchange, other telephone lines terminating at a second central office exchange, link circuits at each of said exchanges, trunk circuits extending from the first of said ex-
 85 changes to the second of said exchanges for extending calls to said second exchange, trunk circuits extending from said second exchange to said first exchange for extending calls from said second exchange to said
 90 first exchange, busy signals associated with the outgoing ends of said trunk circuits, and circuit connections whereby the connection of a link circuit at said first exchange to a calling subscriber's line renders
 95 effective the busy signals associated with the trunks extending from said second exchange to said first exchange, and means responsive to the connection of said link circuit to a called subscriber's line for rendering effective
 100 the busy signals associated with the trunks extending to said exchange.

19. A telephone system including telephone lines terminating at a central office
 exchange, other telephone lines terminating
 105 at a second central office exchange, link circuits at each of said exchanges, trunk circuits extending from the first of said exchanges to the second of said exchanges for extending calls to said second exchange, trunk circuits
 110 extending from said second exchange to said first exchange for extending calls from said second exchange to said first exchange, busy signals associated with the outgoing ends of said trunk circuits, means responsive to
 115 the connection of a link circuit at said first exchange to a calling subscriber's line for rendering effective the busy signals associated with the trunks extending from said second exchange to said first exchange, means
 120 for removing the busy indication of said busy signals, means responsive to the connection of said link circuit to a trunk extending to said second exchange for rendering effective the busy signals associated with the
 125 trunks extending from said first exchange to said second exchange, and means responsive to the connection of said trunk cir-

cuit to a called line at said second exchange for removing the busy indication of said last busy signals.

20. A telephone system including telephone exchanges, telephone lines terminating at operators' positions at the exchanges with cord circuits for interconnecting the same, outgoing trunk circuits extending from each exchange to an operator's position in the distant exchange, busy signals at the outgoing ends of the trunks, and means whereby when an operator is interconnecting telephone lines at her position through one of her cord circuits such act is indicated by the operation of the busy signals at the outgoing ends of the trunks extending to her position.

21. A telephone system including telephone lines terminating at a central office exchange, other telephone lines terminating at a second central office exchange, link circuits at each of said exchanges, trunk circuits extending from the first of said exchanges to the second of said exchanges for extending calls to said second exchange, trunk circuits extending from said second exchange to said first exchange for extending calls from said second exchange to said first exchange, and circuit connections whereby the connection of a link circuit at said first exchange to a calling subscriber's line oper-

ates to make the trunks indicate busy at their outgoing ends that extend from said second exchange to said first exchange.

22. A telephone system including telephone lines terminating at a central office exchange, other telephone lines terminating at a second central office exchange, link circuits at each of said exchanges, trunk circuits extending from the first of said exchanges to the second of said exchanges for extending calls to said second exchange, trunk circuits extending from said second exchange to said first exchange for extending calls from said second exchange to said first exchange, and circuit connections whereby the connection of a link circuit at said second exchange to a trunk circuit extending to said first exchange causes the trunk circuits to indicate busy at their outgoing ends that extend from said second exchange to said first exchange.

Signed by us at Chicago, county of Cook and State of Illinois, in the presence of two witnesses.

HIRAM D. CURRIER.
RICHARD I. UTTER.
MICHAEL B. STAZAK.

Witnesses:

M. R. ROCHFORD,
WM. BERGMANN.

DISCLAIMER

1,261,492.—*Hiram D. Currier, Richard I. Utter, and Michael B. Stazak, Chicago, Ill.*
TELEPHONE SYSTEM. Patent dated April 2, 1918. Disclaimer filed November 30, 1934, by the assignee, *Kellogg Switchboard & Supply Company*.

Hereby enters this disclaimer to claims 11, 12, 16, 17, and 22 except when at least one exchange includes one or more combined A and B operators' positions.

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