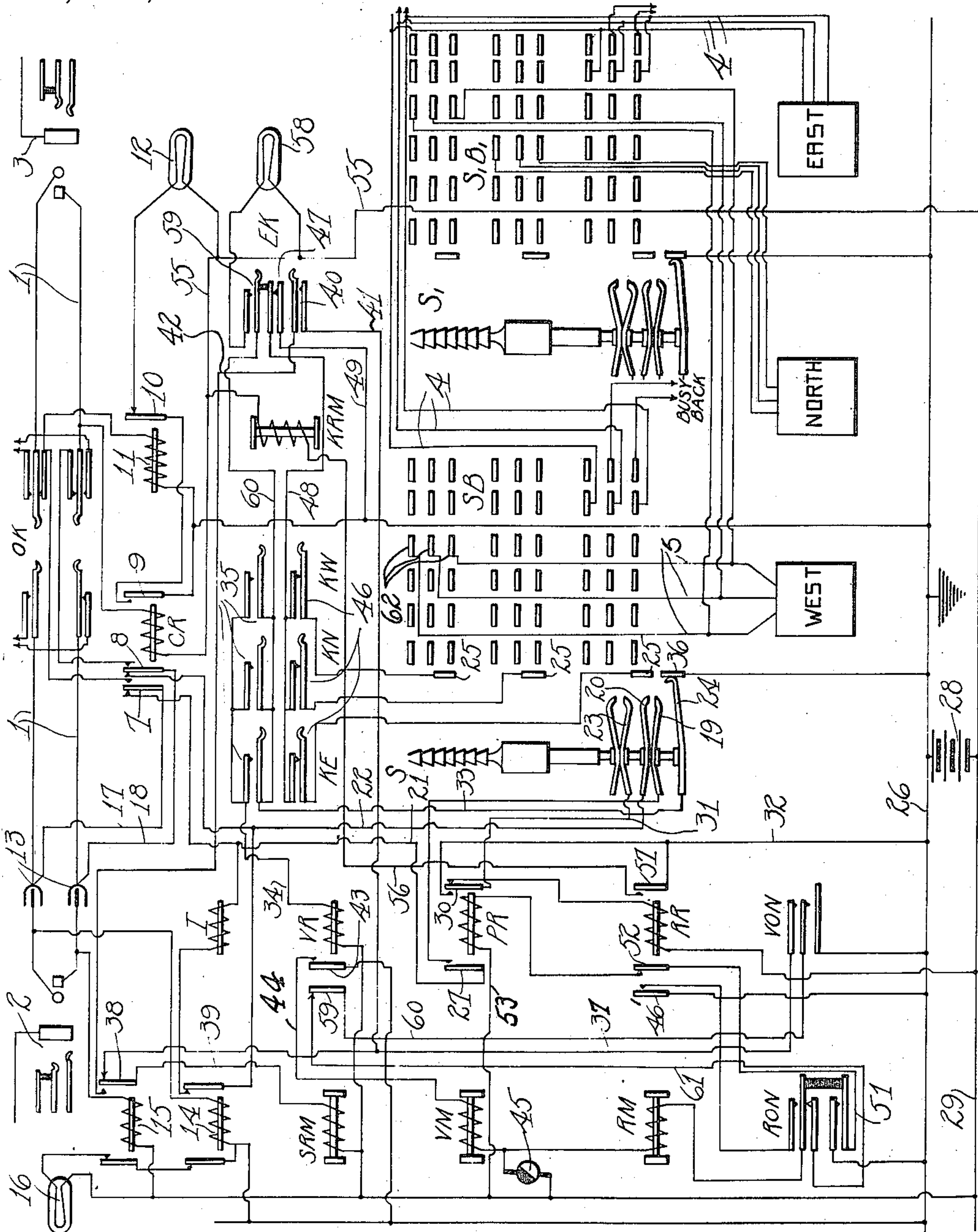


J. A. TAGGART.
TELEPHONE SYSTEM.
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TELEPHONE SYSTEM.

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To all whom it may concern:

Be it known that I, JOHN A. TAGGART, a citizen of the United States, residing at Rochester, in the county of Monroe and State of New York, have invented a certain new and useful Improvement in Telephone Systems, of which the following is a full, clear, concise, and exact description, reference being had to the accompanying drawings, forming a part of this specification.

My invention relates to an improved telephone system in which a portion of the connections required in establishing a talking connection from one subscriber to another through different exchanges is accomplished by automatic switching-mechanism for effecting the trunk connection.

The object of my invention is to provide a more rapid trunking system and to eliminate the necessity for the order wires employed in manual systems heretofore.

In carrying out my invention, automatic switching-mechanism is employed which is set in motion by the answering operator at the exchange at which the call is initiated after she inserts her answering plug into the answering jack of the calling line. The operation of the automatic switching-mechanism is begun by the operator pressing a key corresponding to the exchange through which the call must be completed, and, when once set in motion, the switching-mechanism automatically selects the proper exchange and then connects the calling or "A" operator automatically with an idle trunk extending to the called exchange.

In carrying out my invention, the trunks extending from one exchange to several other exchanges are connected in groups, one group for each exchange, and each of the trunks of each of the groups terminates at the calling exchange in contacts connected with the automatic switching-mechanism, as a result of which the actuation of the switching-mechanism, by the depression of a single key, first selects the proper group of trunks corresponding to the exchange desired and, second, selects an idle trunk extending to said exchange.

The present application is a divisional application of Serial No. 809,148, filed by me on December 29, 1913. According to this

form of the invention each operator answering incoming calls is provided with connecting cords which have automatic switching-mechanisms connected directly to their circuits, so that insertion of the answering plug in the answering jack will allow the call to be selectively transmitted through the automatic switching-mechanism, as will be described later.

The drawing comprises a diagram illustrating the manner in which this form of my invention may be carried out.

Each operator's position is supplied with the usual number of cord pairs 1, for making connection between the various subscribers' instruments in the same exchange, such as may be connected to the jacks 2 and 3. For trunking a call from the subscriber in the exchange to another exchange or to different boards in the same exchange, trunk lines 4, 5, etc., may be provided. These trunk lines terminate in switch banks S B, S₁ B₁, the contacts of which are all multiplied together, as shown in the drawing. Automatic switch-mechanisms S and S₁ serve these banks of contacts, making connection between the cord pairs and the trunks. The switch-mechanisms with their banks may be of the Strowger type or of any preferred type. Each cord pair, as 1, has its own switch-mechanism S and this switch can be caused to select groups of trunks leading to each of the exchanges or trunking terminals, and from these groups the switch automatically selects an idle trunk.

The cord pair 1 may be used to make connections between lines in the same exchange in a manner well known in manual telephone practice.

To effect trunking operations a special act, such as depressing a key, is performed by the operator. For this purpose I have provided each cord pair with a set of keys, the individual keys corresponding to the exchanges to which calls may be trunked. In the particular system illustrated, I have provided three groups of trunks leading to three different exchanges, and there are three keys, KE, KN and KW, corresponding to the exchanges East, North and West. The keys are so constructed mechanically that the depression of one key locks the re-

maintaining keys against actuation, so that no errors can be caused in the operation of the corresponding switch.

The strands of the cord-circuit are connected through the usual operator's key OK, but are normally discontinuous through the key, the through connection being broken at the contacts of the relay CR. This relay CR, which is the sleeve calling-end supervising relay, has three armatures, 7, 8, and 9. Armatures 7 and 8 are connected to the tip and sleeve strands, respectively, of the answering end of the cord pair and serve to make the connection through the operator's key OK when the calling plug is inserted in a jack. Armature 9, in conjunction with armature 10 of sleeve supervisory relay 11 controls the calling supervisory signal 12.

For purposes of supervision the cord-circuit is broken by the condensers 13 and the answering end of the cord-circuit is connected to the answering tip and sleeve supervisory relays 14 and 15, respectively, which control the answering supervisory signal 16.

The armatures 7 and 8 of the relay CR, which are connected to the cord pair by wires 17 and 18, normally rest upon their back contacts and make connection with the wipers 19 and 20 of the switch S by means of wires 21 and 22.

The switch S carries three rotary wiping contacts 19, 20 and 23, the first two being line terminals and the latter being a private terminal, and one vertical wiping contact 24, which does not partake of rotary motion but makes contact with one of the vertical contacts 25 during the entire time that the switch is off normal. The tip contact 19 is connected to the tip strand of the cord by wires 17 and 21. The wire 21 is broken through the armature 27 of the private relay PR. The sleeve contact is connected directly to the sleeve strand of the cord pair 1 by means of the wires 18 and 22. The private wiper 23 is connected to ground side 26 of battery 28 through the armature 30 of the private relay PR by wires 31 and 32. The vertical wiper 24 is connected through the vertical relay VR to battery 28 over wires 33, 34 and 29, the circuit being broken in multiple through the keys KE, KN and KW.

The switch S is provided with a vertical magnet VM, a rotary magnet RM and a release magnet SRM, a vertical relay VR, a rotary relay RR, a private relay PR, as well as rotary off-normal contacts RON, and vertical off-normal contacts VON, governing the various operations of the switch.

The vertical relay VR is controlled by each of the exchange-selecting keys, so that the operation of a key energizes the vertical relay by way of ground contact 36, vertical wiper 24, wire 33, through the upper pair of contacts 35 of the key which is actuated,

wire 34, through the winding of the relay VR to battery by way of wire 29.

The release magnet SRM for the switch has its circuit cut through the vertical off-normal switch VON by way of wire 26 from grounded side of battery 28 through the switch VON, wire 37, armature 38 of supervisory relay 15, wire 39, release magnet SRM to battery by way of wire 29, so that withdrawal of the answering plug will actuate the release magnet as soon as the switch is off normal. The release magnet may also be actuated by operating the error key EK, which is provided for correcting any error in depression of any one of the exchange-selecting keys. The wire 37 is connected to one of the normally-open springs 40 of the error key by wire 41, the other spring being connected by wire 42 to the front contact of armature 38 of relay 15. The vertical relay VR by its armature 43 closes a circuit from ground wire 26 through the vertical magnet VM, wire 44, interrupter 45, to battery 28. The circuit for the vertical relay is closed so long as the vertical wiper 24 remains on a grounded contact. The contacts 25 are normally grounded through the closed contact pairs 46. When one of these keys is depressed to make a selection the corresponding contact pair 46 is opened to remove ground from the corresponding group contact 25. The ground connection for the contact pairs 46 is connected through the normally-closed springs 47 of the error key EK by way of wires 48 and 49.

The switch upon the initial vertical movement closes the vertical off-normal switch VON, closing at that point circuits for the switch release magnet SRM and for the rotary magnet RM. The circuit of the rotary magnet, however, is broken by the armature 59 of vertical relay VR so long as the said relay is energized. As soon as the switch stops on the selected contact in front of the corresponding group of contact terminals, the vertical relay will be deenergized and the switch will be placed under the control of rotary magnet RM.

The rotary magnet will be energized by the next impulse through the interrupter 45 and moved upon the first set of trunk terminals. The first step of the switch closes the rotary off-normal switch RON and places the circuit of the rotary magnet under the control of the rotary relay RR, the circuit then being made from grounded side of battery by wire 26 to the armature 46' of the relay RR, through the rotary off-normal contacts RON, through the interrupter 45, to battery. The rotary relay depends at this time for its energization upon the condition of the private contact which is engaged by the private wiper 23. If this wiper is in engagement with a busy or grounded contact the rotary relay RR re-

mains energized until an idle contact is engaged. If all the trunks should be busy the last contact will give a busy tone to indicate such fact. During the stepping of the wipers 19, 20 and 23 on to an idle contact the private relay PR remains engaged over the following circuit: ground wire 26, rotary off-normal contact RON, wire 51, armature 52 of rotary relay RR, private relay PR, wire 53 to battery. But as soon as a non-busy terminal is selected the rotary relay, which has had a circuit from a grounded private contact to private wiper 23, wire 31, armature 30 of private relay PR, through rotary relay RR to battery, becomes deenergized, closing the circuit for the private relay PR and thereby closing the tip conductor 21 and placing a guarding ground potential upon the private terminal of the trunk selected to render the trunk non-selectable by the other switches. The selecting keys KE, KN and KW are controlled by a key-releasing magnet KRM. The energization of this magnet serves to unlock the key which has been depressed, as soon as the selection corresponding to the first depression of the key has been completed. This key-releasing magnet KRM is connected on one side to the battery wire 55 and on the other to the grounded side of battery by way of wire 56, which is cut through the armature contact 57 of the rotary relay RR. As soon as the rotary relay is energized to start the wipers in search of an idle trunk the depressed key will be released by energization of the magnet KRM.

If an error in selection of the key has been made, or if a different exchange is desired, the error key EK is operated to close the circuit of the release magnet as described previously and to remove ground from the contacts 25. At this time a pilot light 58 is switched into circuit by way of the following: battery wire 55, lamp signal 58, contact springs 59 on the key EK, wire 60, wire 33, wiper 24 and grounded normal contact 36. Lighting of the pilot light indicates return of the switch to normal, all of the contacts 25 being cut off from ground at this time. The switch may also be restored to normal by deenergization of the answering supervisory relay 15. Such deenergization occurs when the answering plug is withdrawn.

Assume that a connection is to be made between a calling subscriber's line such as might be connected to the jack 2, and a subscriber's line in the "West" exchange. The calling subscriber signals central by signaling-mechanism connected to the calling line, as is well known in the art, and the operator answers the call by inserting the answering plug in the jack 2. Upon receiving the number—and in this case we assume that the subscriber calls for "West 215"—the operator depresses the key KW. The key

is locked in this depressed position by means of the magnet KRM and the remaining keys are locked against actuation in a manner well known in the art.

By the operation of the contacts 46 ground is cut off from the contacts 35 corresponding to the group of trunks connected to the "West" exchange. By means of the contacts 35 the vertical relay VR is energized and it closes a circuit for the vertical magnet VM. The first impulse through the interrupter 45 to the vertical magnet raises the spindle of the switch S one step, bringing the vertical wiper 24 upon the lowermost contact 25, which is grounded through the springs of the key KE. The first step of the switch closes the contacts of the vertical off-normal switch VON, thereby closing at this point the circuit for the release magnet SRM and preparing the circuit for control of the rotary magnet RM to effect the first step in a rotary direction of the switch S. The switch spindle is raised to the uppermost level corresponding to the trunk terminals leading to the "West" exchange and at this point the vertical magnet becomes deenergized. The armature 59 of the vertical relay in its retracted position closes a circuit for the rotary magnet over the following path: grounded side of battery, switch VON, wire 60, armature 59, wire 61, switch RON, which at this time has not been actuated, rotary magnet RM, interrupter 45, battery 28. This causes the rotary magnet to rotate the spindle of the switch S to bring the wipers 19, 20 and 23 upon the first set of contacts on the uppermost level of trunk contacts. Assume that the first set of contacts is busy and that the private contact upon which the wiper 23 rests is grounded due to its busy condition, a circuit for the rotary relay RR will be formed over the following path: grounded contact, wiper 23, wire 31, armature 30 of the private relay PR, winding of relay RR, to battery. The relay RR attracts its armatures 46', 52 and 57, the first armature—46'—closing a circuit through the rotary off-normal switch RON for the rotary magnet RM by way of the interrupter 45, to battery 28, it being noted that the switch RON is operated upon the first rotary step of the switch spindle. The armature 52 breaks a circuit which would be closed through the switch RON through the private relay PR, by wire 53, to battery 28. The armature 57 closes the circuit of the key release magnet KRM, releasing the key KW, which was previously locked in depressed position.

The armatures 27 and 30 of the private relay PR rest on their back contacts, the armature 27 breaking the tip side of the talking circuit, and the armature 30 maintaining the circuit of the rotary relay RR.

As soon as the wipers of the switch rest upon idle contacts, for instance the contacts 62, the relay RR will be deenergized and the circuit for the private relay closed by armature 52. Energization of the private relay PR closes the talking circuit at the armature 27. Attraction of the armature 30 breaks the circuit for the rotary relay and places ground upon the private wiper 23 to provide a guarding potential to render this set of contacts 62 non-selectable.

The call now appears at the "West" exchange and is answered by an operator at that exchange. As soon as the conversation is completed the calling subscriber, by means of the supervisory signal 16, indicates to the operator at the central exchange that the call is concluded. The answering plug is withdrawn from the jack 2; thereby deenergization of the relay 15 occurs, and thereupon the armature 38 closes a circuit for the switch release magnet SRM from the ground side of battery through the vertical off-normal contacts, through the release magnet to battery. The release magnet restores the switch to normal in a manner well known in the art.

If the operator had selected the wrong key it would be possible to restore the switch by withdrawing the plug from the calling jack, but the error key furnishes a speedier means for accomplishing the same thing, operation of the error key restoring the switch to normal by energizing the switch release magnet SRM, to pilot lamp 58 indicating when the switch has been restored to normal. If it is desired to complete the call in the same exchange, the cord-circuit is employed in the usual manner, the number being ascertained by the operator through the the operator's key OK. The connection is secured by inserting the calling plug in the line of the called subscriber, this act energizing the supervisory relay CR to cut off the automatic switch mechanism and to complete the circuit of the cord.

It is obvious that my invention may be carried out by the use of other mechanism than that which I have illustrated in the present application, as numerous modifications will at once become apparent to those skilled in the art, all of which modifications and variations I consider to come within the spirit and scope of the present invention.

What I claim is:

1. In a telephone system, the combination of a cord circuit, an automatic trunking switch, a relay to connect said switch to said cord circuit, said switch comprising a plurality of groups of contacts, each having a plurality of sets of contacts, each set of contacts being connected to an outgoing trunk and the groups of contacts extending to the different exchanges, one

exchange for each group, a key for starting the actuation of the automatic switch, and devices operated by the key for actuating the switch to first pick out a desired group and then to make connection with the first idle set of contacts of the group.

2. In a telephone system, the combination of a cord circuit, an automatic trunking switch, a relay to connect said switch to said cord circuit, said switch having contacts arranged in separate groups, each corresponding with an exchange to which connection may be made through trunk circuits, each group of contacts comprising a plurality of sets of contacts, one for each of the trunks extending to the corresponding exchange, a selecting key for starting the actuation of the automatic switch and operating it to pick out one of the groups of contacts according to the selection effected by the switch, and devices for actuating the automatic switch in the selected groups to pick out the first idle trunk circuit of said group.

3. In an automatic telephone system, a plurality of subscribers' lines, a plurality of cord circuits grouped into an operator's position, each cord circuit comprising an answering plug, a calling plug and a supervising relay, a plurality of automatic trunking switches for each operator's position, each trunking switch having a plurality of groups of contacts, one for each exchange to which connection is to be made, and means to energize said relay to disconnect said automatic switch from said cord circuit.

4. In an automatic telephone system, the combination of a plurality of automatic trunking switches for each operator's position, each trunking switch having a plurality of groups of contacts, one for each exchange to which connection is to be made, each group of contacts having a plurality of sets of contacts, one for each trunking circuit, extending to the corresponding exchange, corresponding contacts of the several automatic switches being multiplied together, and a single selecting switch for each position for connecting a desired automatic switch with a first selected group of contacts and thus extending the connection to a selected exchange, devices for actuating the desired automatic switch to make connection with the first idle set of contacts of said group, a cord circuit for each automatic switch, said cord circuit comprising an answering and a calling plug and means to connect said automatic switch to said answering plug, and means to disconnect said answering plug from said calling plug.

5. In a telephone system, the combination of a plurality of cord pairs, an automatic trunking switch connected with each cord pair for extending the connection when desired to one of several exchanges, each automatic switch having a plurality of groups of

contacts corresponding to said exchange and each group comprising a plurality of sets of contacts, one for each trunk extending to the corresponding exchange, a selecting key for actuating a desired one of the automatic switches to establish connection with the group of contacts determined by the selection of the key, and devices for moving the selected automatic switch to connect with the first set of idle contacts of said group.

6. In a telephone system, the combination of a plurality of cord pairs, an automatic trunking switch connected with each cord pair for extending the connection when desired to one of several exchanges, each automatic switch having a plurality of groups of contacts corresponding to said exchanges and each group comprising a plurality of sets of contacts, one for each trunk, extending to the corresponding exchange, a selecting key for each cord pair for determining the group of the contacts selected by the corresponding automatic switch, and devices for actuating said automatic switch to make connection with the first idle set of contacts of the group selected.

7. In a telephone system, the combination of an automatic trunking switch having vertical and rotary motions, said trunking switch having a plurality of groups of contacts corresponding to exchanges to which connection is to be extended, each group comprising a plurality of sets of contacts, one for each trunk extending to the corresponding exchange, a key for determining the vertical motion of said automatic switch to select a desired group of contacts, devices for controlling the rotary motion of said automatic switch to select the first idle set of contacts of the selected group, a cord circuit comprising answering and calling plugs, said plugs being normally disconnected, switch mechanism connecting said answering plug with said automatic trunking switch, and a relay for operating said switch to connect said answering and calling plugs.

8. In a telephone, the combination of an automatic switching mechanism, a key for selectively actuating said switching mechanism to select a desired exchange, an idle trunk extending to said exchange, an operator's cord-circuit comprising an answering and a calling plug, and means for connecting said switch mechanism to said answering plug only.

9. In a telephone system, the combination of an automatic switching mechanism having contacts terminating trunk circuits in a plurality of groups, one for each of a plurality of exchanges, a key for selectively actuating said switching mechanism to select a desired exchange and to select an idle trunk extending to said exchange, an operator's cord-circuit comprising answering and

calling plugs, and relay means for connecting said automatic switching mechanism to the answering plug of said cord-circuit only.

10. In a telephone system, the combination of a plurality of operators' cord-circuits comprising calling and answering plugs, an automatic switching mechanism for each operator's cord-circuit, means for connecting the answering plug of each cord-circuit to the automatic switching mechanism, and means individual to each cord-circuit for operating the corresponding automatic switching mechanism to select the desired exchange and to select an idle trunk extending to said exchange.

11. In a telephone system, the combination of a plurality of operators' cord-circuits comprising calling and answering plugs, an automatic switching mechanism for each cord-circuit, each automatic switching mechanism having contacts terminating a plurality of trunk circuits arranged in groups, one for each of a plurality of exchanges, selecting keys for each cord-circuit, said selecting keys operating the corresponding automatic switching mechanism to select the desired exchange and to select an idle trunk extending to said exchange.

12. In combination an operator's cord-circuit, an automatic switching mechanism, said switching mechanism having contacts terminating a plurality of trunk circuits arranged in groups, one for each of a plurality of exchanges, selecting keys for governing said switching mechanism, a contact for each group of trunks and means controlled by the corresponding key for placing a potential upon said contact to stop said switch in selective relation to said group, said switch having means for causing selection of an idle trunk in said group.

13. In combination an operator's cord-circuit, comprising answering and calling plugs, an automatic switching mechanism, normally connected to said cord-circuit, means controlled by said answering plugs for disconnecting said automatic switching mechanism from said cord-circuit.

14. In combination an operator's cord-circuit, comprising answering and calling plugs, a plurality of trunks an automatic switching mechanism having contacts terminating said trunks and means controlled by one of said plugs for governing the connection of said switch to said cord-circuit.

15. In combination an operator's cord-circuit, comprising an answering and a calling plug, an automatic switch and a manual key for controlling said switch for causing extension of a call from the answering plug through said automatic switch.

16. In combination an operator's cord-circuit, comprising an answering and a calling plug, said calling plug being normally disconnected from the cord-circuit, an auto-

matic switch, a key for controlling said switch for causing extension of a call from the answering plug through said automatic switch, and means controlled by said calling
5 plug for connecting the same with said cord-circuit and for disconnecting said automatic switch.

In witness whereof, I hereunto subscribe my name this sixth day of January, A. D. 1915.

JOHN A. TAGGART.

Witnesses:

KATHERINE C. ROGAN,
GEORGE C. ALEMIN.