Jan. 3, 1939. E. WOCHINGER 2,142,664

TELEPHONE SYSTEM

Filed May 20, 1937 3 Sheets-Sheet 1

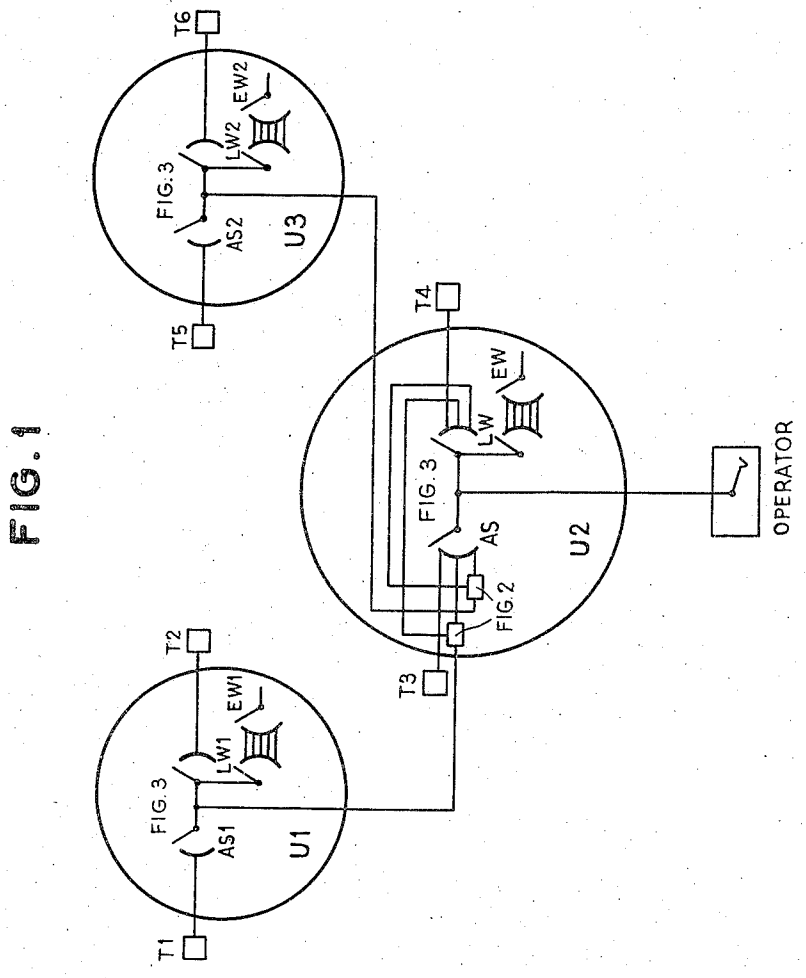


FIG. 1

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TELEPHONE SYSTEM

Filed May 20, 1937 3 Sheets-Sheet 2

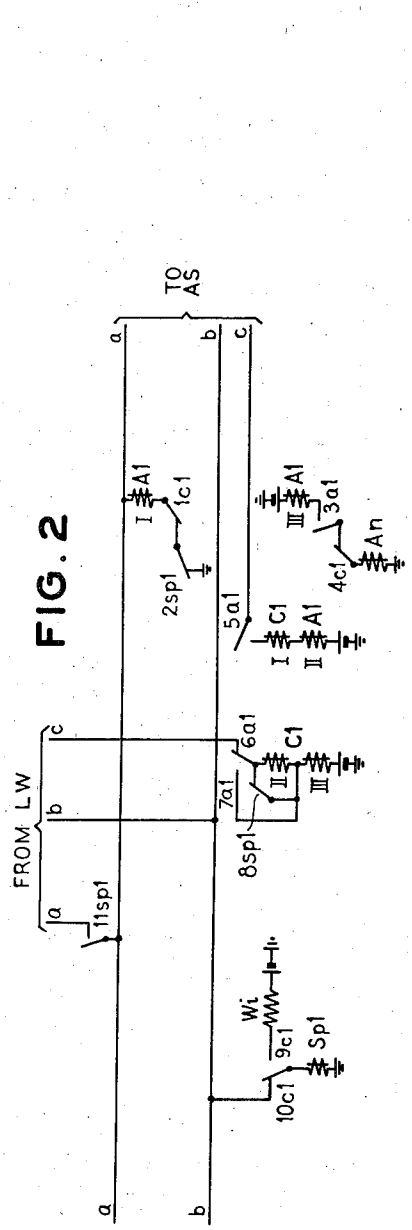


FIG. 2

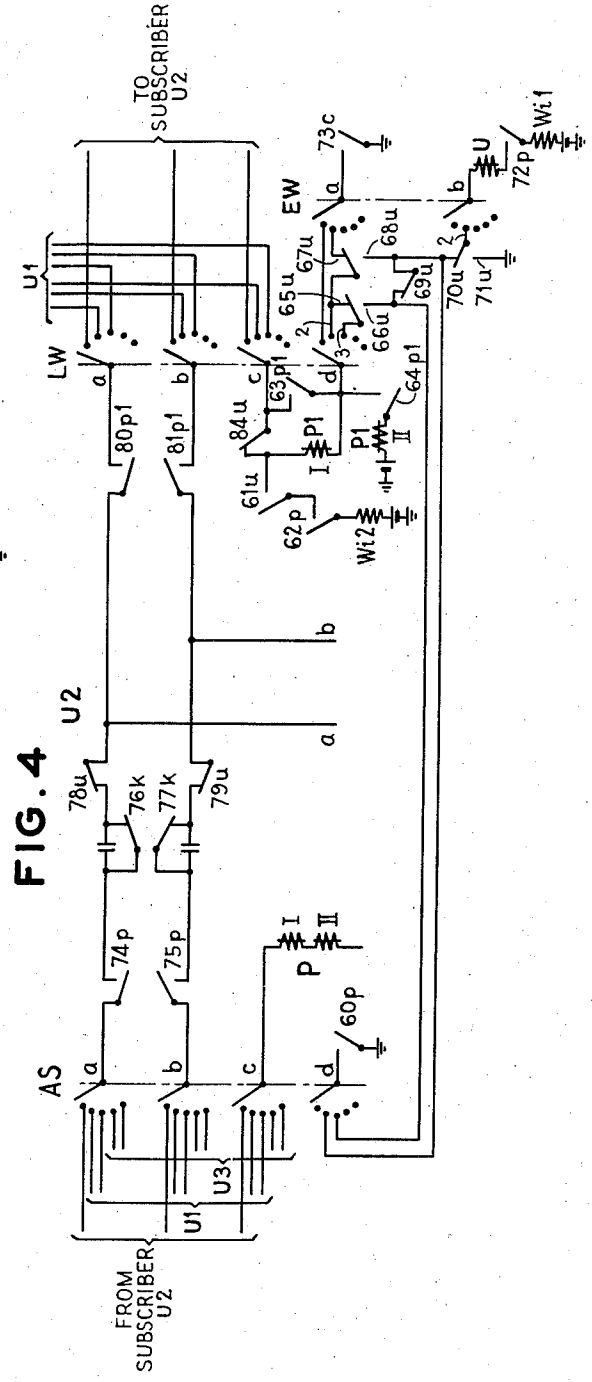


FIG. 4

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TELEPHONE SYSTEM

Filed May 20, 1937 3 Sheets-Sheet 3

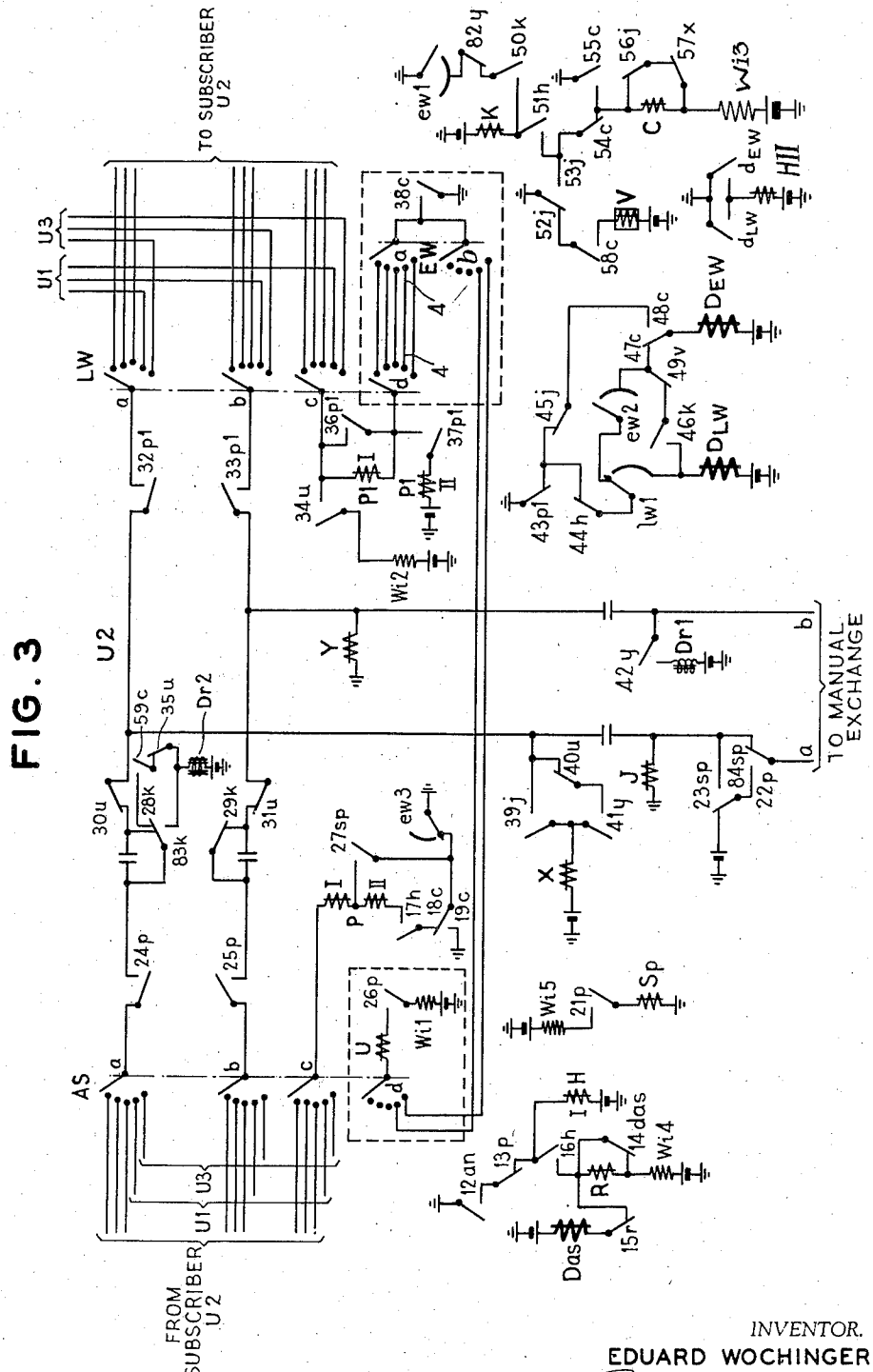


FIG. 3

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UNITED STATES PATENT OFFICE

2,142,664

TELEPHONE SYSTEM

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Application May 20, 1937, Serial No. 143,701
In Germany June 27, 1936

16 Claims. (Cl. 179—26)

The present invention relates to automatic telephone systems having a plurality of exchanges disposed in series and in which calling stations extend a connection to a control position, from which a desired call is established, over connecting lines passing between these exchanges. The invention aims at utilizing the same connecting line seized on calling for establishing the call when setting up a call to an exchange (or station) which belongs to the same group as does the calling exchange (or station).

Arrangements are already known wherein the individual connecting devices of the connecting path passing over a plurality of exchanges in series, after having been set by the numerical impulses in the desired traffic direction, seek out the connecting line seized by the calling party. This seeking operation of the connecting devices subsequent to the numerical selection requires, however, specially devised circuits especially as regards the testing circuits of the individual connecting devices, since, during the selecting motion following the numerical selection, in addition to the engaged connecting lines (assuming there are a number of connecting lines present) all the other free connecting lines passing in the same direction must also be guarded; and if during this time another call is to be set up over another connecting path in the same direction the connecting lines in this path must also be guarded. Thus all the seized and non-used lines in the direction characterized and also the outgoing lines in the same direction available for the second call must be made inaccessible to the searching switch, while the line already seized by the calling station for whose call the connecting device is set must appear free in the contact bank of this switch. Such arrangements naturally require a considerable amount of switching means and in particular require complicated testing circuits.

Another course has therefore been resorted to, namely that of associating characterizing switches with the connecting devices which are to effect the establishment of the desired connecting path, which switches receive the digit characterizing the desired traffic direction and, if this digit corresponds to the digit characterizing the calling subscribers line, prevent the connecting device in question from searching for an idle trunk in the customary manner. Such a switching over is therefore effected that the connecting device is disconnected, and the connecting path serving for the establishment of the desired call is switched over on to the calling portion of the connecting path.

The present invention avoids having to renounce the advantageous multiple use of the connecting line (incoming and outgoing) when setting up a call in the same group as the calling exchange (or station) and at the same time avoids the disadvantage of the complicated testing circuits and the separate switching over in the connecting devices. To accomplish this a switching device which carries out a busy test in connection with the setting of a connecting device in a desired traffic direction is operated in a local circuit independent of the state of this connecting line (busy or free); this switching device serves to set the connecting device on the line seized by the call and determines the coincidence of the desired traffic direction with the traffic direction of the connecting line seized by the call.

The invention will now be explained by way of two embodiments.

Fig. 1 shows a diagrammatic layout according to which a subsidiary exchange U1 is connected with a subsidiary exchange U2 over a connecting line and is connected over the second exchange with an operator in a main exchange. In a corresponding way a subsidiary exchange U3 can reach the operator in the main exchange via subsidiary exchange U2. Calls between the individual subscribers both of the same subsidiary exchange and also of different subsidiary exchanges are established by way of this operator in the main exchange.

Fig. 2 shows a repeater disposed in the subsidiary exchange U2 and which connects the connecting lines passing between the subsidiary exchanges U1 and U2 or U2 and U3 with the call finders AS and the final selectors LW in the subsidiary exchange U2.

Fig. 3 shows a link comprising a call finder and final selector disposed in the subsidiary exchange U2. To the contacts of this link both the subscribers' lines of the subscribers belonging to exchange U2 and also those of subscribers belonging to the exchanges U1 and U3 are connected, only one connecting line being shown in the link represented in Fig. 3 for each subsidiary exchange. Links of the same type are disposed in the subsidiary exchanges U1 and U3. In these two cases only the subscribers' lines of the subscribers belonging to the particular exchange in question are connected.

Fig. 4 shows a link disposed in the subsidiary exchange U2, to the contacts of the switches in

which both subscribers' lines of subscribers associated with the exchange U2 and also of those associated with the exchanges U1 and U3 are connected as is the case with the link shown in Fig. 3. This call finder final selector link offers greater possibilities of connection than does the corresponding link shown in Fig. 3. The link shown in Fig. 4 is only shown insofar as it differs from the link shown in Fig. 3 on account of the provision of a larger number of connecting lines. All the other necessary relays and connecting devices correspond to those shown in the link according to Fig. 3.

The invention is not limited to the embodiments shown. Thus for example, further subsidiary exchanges could be connected to the subsidiary exchange U2 and to the exchanges U1 and U3. Also the establishment of calls could be effected by means of a register disposed in the main exchange instead of by an operator, this register receiving impulses transmitted by subscribers and later transmitting them in the desired traffic direction.

A general description of the establishment of a call will be given with reference to Fig. 1. A calling subscriber T1 of the exchange U1 first reaches a connecting line to the exchange U2 over a call finder AS1 which has become set on the line of this subscriber T1 on the initiation of the call. In the subsidiary exchange U2 a call finder AS is started up through the intermediary of the repeater and sets itself on the connecting line seized by the calling subscriber and now connects the calling subscriber over a further connecting line to the operator in the main exchange. The operator in the main exchange makes her enquiry and in the event of the desired call not proceeding through the main exchange but remaining within the subsidary exchange group transmits numerical impulses back over the connecting line to the exchange U2. By these impulses the setting switches EW in the exchange U2 are first influenced and by means of these the final selector LW is set in a manner to be explained later. If for example subscriber T4 of the exchange U2 is wanted the final selector LW is set on the corresponding line. In the same way if a subscriber of the subsidiary exchange U3 for example subscriber T6 is wanted the final selector LW is set on a connecting line leading to the exchange U3 after the switch EW has been set in the exchange U2 and then a setting switch EW2 in the exchange U3 is influenced by a further impulse train over the connecting line passing to the subsidiary exchanges U2 and U3. This switch EW2 causes the final selector LW2 in the exchange U3 to be set on the desired subscriber T6. In this latter case the final selector LW executes a hunting motion after the numerical selection in the event of there being a number of connecting lines to the exchange U3.

If however the calling subscriber T1 desires a call to a subscriber T2 of his own subsidiary exchange U1 the setting switch EW is set as before by the transmission of a corresponding impulse train. Now, however, the final selector LW searches for the connecting line between the exchanges U1 and U2 which was seized on calling. Over this connecting line the setting switch EW1 in the exchange U1 is then operated by a further impulse train in order to set the final selector LW1 in the subsidiary exchange U1 on the desired subscriber's line. If there are a number of lines passing between the exchanges U1 and U2 the final selector LW in the exchange U2 does not in this case become set on a free connecting line but seizes the connecting line already seized by the calling subscriber.

The establishment of a call of the last mentioned kind, namely, between subscribers T1 and T2 of the same subsidiary exchange U1, takes place in the following way:

When the calling subscriber T1, in order to set up a call operates, for example, a magneto disposed at his station a calling relay is switched on in the known way and starts up the call finder AS1 through the intermediate of a starting relay. The call finder sets itself on the calling subscriber's line T1 and connects the latter to a connecting line leading to the subsidiary exchange U2. After the call finder AS1 has been set, battery potential is transitorily connected to the *a*-lead of this connecting line in a manner with which we are not concerned so that in the repeater shown in Fig. 2 relay A1 is energized over its winding I and the contacts 1*c*1 and 2*sp*1. Relay A1 locks up by closing its contact 3*a*1 in a circuit which passes over: earth, battery, winding III on relay A1, contacts 3*a*1 and 4*c*1, relay A*n* and earth. In this circuit relay A*n* also energizes and closes contact 12*an* which switches on winding I of relay H in the circuit: earth, contacts 12*an* and 13*p*, winding I of relay H, battery and earth. Through the closing of contact 16*h* the following circuit is set up: earth, contacts 12*an*, 13*p*, and 15*r*, rotary magnet D*as*, battery and earth. The magnet D*as* switches the call finder AS one step forward. By means of the relay R which is energized and which is disposed in parallel with this magnet (earth contacts 12*an*, 13*p*, 16H, relay R, resistance W*i*4, battery and earth) the energizing circuit of the rotary magnet D*as* is broken at contact 15*r*. Consequently contact 14*das* is again closed and relay R is caused to release again on account of the short-circuit at contact 14*das*. The rotary magnet D*as* now energizes after contact 15*r* has closed and promotes a further advancement of the call finder AS. This reciprocal play between relay R and the rotary magnet D*as* continues until the call finder AS has reached the connecting line seized by the calling subscriber T1. When this has occurred the following circuit is set up (Fig. 2): earth, battery, winding II of relay A1 winding I of relay C1, contact 5*a*1, the *c*-lead (Fig. 3), wiper *c* of the call finder AS, winding I and II of relay P, contacts 17*h* and 18*c*, wiper *ew*3 of the setting switch EW and earth. In this circuit relays C1 and P energizes. Relay C1 brings about switching operations represented in Fig. 2 which do not concern us here. Relay A1 whose winding II was influenced in the above-mentioned circuit is now held energized over this winding. Through the energizing of relay P (Fig. 3) the energizing circuit for the magnet D*as* and for the relays R and H is broken at contact 13*p* and at contact 21*p* relay S*p* is switched on. During the time from the energizing of relay P to the energizing of relay S*p* battery potential is temporarily applied over contacts 23*sp* and 22*p* to the *a*-lead passing to the manual exchange, and this in any desired manner operates a calling signal at the manual exchange. It may be noted at this point that a temporary connection of potential similar to that described above may be used for energizing relay A1 when the connecting line between the subsidiary exchanges U1 and U2 is seized.

After relay P has energized the calling subscriber is switched through to the manual ex-

change through the closing of contacts 24*p* and 25*p* after contact 84*sp* has closed. At contact 27*sp* the connecting line between the exchanges U1 and U2 seized by the calling subscriber is guarded by the short-circuiting of winding II of relay P so that in the event of there being a further connecting link in the exchange U2 a call finder associated therewith cannot become set on this connecting line. In a similar way the seizure of the connecting line by a final selector of a second link is prevented by holding contact 6*a*1 open (Fig. 2).

On replying the operator plugs the jack of the connecting line seized by the calling subscriber. By this plugging in of the jack relay J in the exchange U2 is operated over the *a*-lead of the connecting line in any desired manner. Since the connecting link provided in the exchange U1 corresponds with that shown in Fig. 3, the following circuit is set up when contact 39*j* is closed: earth, battery, relay X, contacts 39*j*, 30*u*, 26*k*, 24*p*, wiper *a* of the call finder AS, *a*-lead, connecting line (Fig. 2) the corresponding contacts *p* and *sp*, the corresponding relay J in the subsidiary exchange U1 and earth. In the exchange U1 a contact corresponding to contact 39*j* is then closed and in consequence a relay corresponding to relay Y is energized over the loop of the calling subscriber T1. This relay closes a contact corresponding to contact 42*y* and in consequence the following circuit is set up (subsidiary U1): earth, battery, choke-coil, *y*-contact (corresponding to Fig. 3) *b*-lead of the connecting line (Fig. 2), (Fig. 3) wiper *b* of the call finder AS, contacts 25*p*, 29*k* and 31*u*, relay Y and earth. Relay Y connects battery potential to the *b*-lead leading to the manual exchange over its contact 42*y* and the choke-coil Dr1 so that the operator receives a signal indicating that the calling subscriber is waiting.

Meanwhile in the subsidiary exchange U2 relay C has been energized after the energizing of relay J and in consequence of the closing of contact 53*j* subsequent to the opening of contact 56*j*: earth, contact 53*j*, 54*c*, relay C, resistance Wi3, battery and earth. Relay C locks up by closing its contact 55*c*. An energizing circuit is prepared for the rotary magnet DEW of the setting switch by the closing of contact 46*c*. In addition further circuits are closed and further switching operations are prepared by the other contacts of relay C. Thus, for example, the battery connected up over contact 39*j* is applied over contacts 59*c* and 35*u*, since during the subsequent dialling contact 39*j* is impulsively opened.

The calling subscriber now tells the operator the number of the wanted party T2. Since it is a question of setting up a call to subscriber T2, i. e., to a subscriber of the calling subsidiary exchange the operator transmits the first impulse train over the line between the manual exchange and the auxiliary exchange U2. Relay J is impulsively deenergized in the *a*-lead of this connecting line by this impulse train so that the following circuit is set up each time it deenergizes: earth, contacts 43*p*1, 45*i*, and 48*c*, rotary magnet DEW, battery and earth. The setting switch EW is correspondingly advanced and, for example after four impulses have been transmitted, reaches the fourth contact in its contact bank. In addition to the stepping of the setting switch relay V is energized on the first deenergization of relay J in the circuit: earth, contacts 52*j* and 58*c*, relay V, battery and earth. Relay V being a slow acting relay holds up during the impulse train and by holding open contact 49*v* prevents any premature influencing of the rotary magnet DLW of the final selector LW. During the influencing of the rotary magnet DEW relay H is operated over its winding II over the operator contact *d*EW so that on the termination of the first impulse, that is when relay J energizes again, relay K energizes over: earth, battery, relay K, contacts 51*h* and 53*j* and earth. After the stepping of the setting switch EW relay K holds up over wiper *ew*1 of the latter, contact 82*y* (relay Y deenergized through the opening of contacts 28*k* and 29*k*) and its own contact 50*k*. In addition the final selector LW is disconnected from the call finder AS at contacts 28*k* and 29*k*. The battery connected over the *a*-lead is now connected over contact 83*k*. When the first impulse train has passed and the setting of the switch EW is completed the following circuit is set up since the digit dialled corresponds to the characterizing digit of the connecting line seized by the calling subscriber T1 and thus wiper *d* of the call finder AS and wiper *b* of the setting switch EW stand on the same line: earth, contact 38*c*, wiper *b* of the setting switch EW wiper *d* of the call finder AS, relay U, contact 26*p*, resistance Wi1, battery and earth. In this circuit relay U energizes and prepares a local circuit for the testing relay P1 at contact 34*u*.

Meanwhile relay V releases again through the opening of contact 52*j* since relay J remains energized after the termination of the first impulse train. Consequently the following circuit is set up; earth, contacts 43*p*1 and 44*h* wiper *lw*1, wiper *ew*2 of the setting switch EW in the position to which it has been set, contacts 49*v* and 46*k*, rotary magnet DLW of the final selector LW, battery and earth. In this circuit the rotary magnet DLW is operated and advances the wipers of the final selector LW one step. Relay H is now switched in over its winding II by the contact *d*LW operated on the energizing of the magnet DLW so that now the magnet DLW is again deenergized through the opening of contact 44*h*. Relay H is deenergized again by the opening of contact *d*LW which then occurs so that on the closing of contact 44*h* the following circuit is again set up: earth, contacts 43*p*1 and 44*h*, wiper *lw*1, rotary magnet DLW, battery and earth. The final selector LW consequently takes another step forward. Relay H is now energized again so that the final selector LW is advanced by the mutual interaction between the rotary magnet DLW and relay H until the final selector has reached the contact 4 characterized by the setting switch. The following circuit is then established: earth, battery, resistance Wi2, contact 34*u*, winding I of relay P1, wiper *d* of the final selector LW, contact 4 in the final selector LW and contact 4 in the setting switch EW, wiper *a* of the setting switch EW, contact 38*c*, and earth. In this circuit relay P1 energizes and by opening contact 43*p*1 prevents any further influencing of the magnet DLW. By closing contact 37*p*1 relay P1 locks up over its winding II, while at contact 36*p*1 winding I of relay P1 is short-circuited to guard the connecting line which has been reached. The speaking leads are switched through at contacts 32*p*1 and 33*p*1. The final selector LW now stands on the connecting line passing between the subsidiary exchanges U1 and U2 which was seized on calling. It is only possible for this final selector to seize this line, which as set out above is guarded against in-

coming seizure by the opening of contact **6***a***1**, since the testing relay of this final selector is operative in a circuit which is independent upon the busy state and is only established in the case of a so-called revertive call to the calling subsidiary exchange. Since relay S*p***1** in the repeater (Fig. 2) is energized over **9***c***1**, the *a*-lead of the connecting line seized by the final selector is switched through to the called subsidiary exchange U**1** at contact **11***sp***1** in the repeater. Since as described above the relay corresponding to relay Y in the connecting link corresponding to the link in the subsidiary exchange U2 (Fig. 3) is energized over the calling subscriber's loop, i. e., since the contact corresponding to contact **42***y* is closed the following circuit is established after the line has been switched through to the subsidiary exchange U**1** (Fig. 3) earth, relay Y, contact **33***p***1**, wiper *b* of the final selector LW, *b*-lead of the connecting line (Fig. 2), (subsidiary exchange U**1**): the contact corresponding to **42***y* and the choke-coil corresponding to the choke-coil D*r***1**, battery and earth. Relay Y is energized in the subsidiary exchange U2 (Fig. 3) by this battery potential on the *b*-lead and transmits the signal to the operator over contact **42***y*. Moreover relay K is deenergized by the opening of contact **82***y*. The operator dials the next digit. The stepping switch in the exchange U**1** is now influenced in the manner described a propos of Fig. 3 and in this exchange causes the associated final selector to be set on the called subscriber's line. The subscriber is called in any desired way. When he replies the operator receives a signal. These switching operations can take place in any desired manner and do not concern the present invention. The operator withdraws the plug from the jack and relay J consequently deenergizes. Relay X and the corresponding relay J in the subsidiary exchange (U**1**) link deenergizes through the opening of contact **39***j*. In the connecting link in exchange U2 (Fig. 3) relay C is short-circuited over contacts **56***j* and **57***x* and consequently releases. Relay P is deenergized by the opening of contact **19***c* and this relay by opening contacts **24***p* and **25***p* releases the call finder AS. Meanwhile relay U and winding II of relay P**1** have been deenergizing by the opening of contact **38***c*. The rotary magnet DLW is switched on by the opening of contact **43***p***1** and advances the switch by mutual interruption with relay H until the switch reaches the rest position and wiper **1***w***1** has left the contact segment. The rotary magnet DEW is now switched in a corresponding way and the setting switch is stepped to normal so that now the whole connecting link in the subsidiary exchange U2 is restored to the normal condition. The speaking connection between the speaking subscribers T**1** and T2 is entirely within the subsidiary exchange U**1**.

If there are a number of connecting lines between the subsidiary exchanges U**1** and U2 or between U3 and U2 the connecting devices represented in that portion of Fig. 3 which is enclosed by dotted lines are constructed in the manner shown in Fig. 4.

The establishment of the call in the subsidiary exchange U2 then proceeds in the following way.

The calling subscriber T**1** of the exchange U**1** has again reached the call finder AS in the exchange U2, for example, over the first connecting line between exchanges U**1** and U2, and this call finder has become set on his line so that now wiper *d* of the call finder as well as the other wipers of this switch stands on contact **2**. A signal has been transmitted to the operator in the manual exchange and the operator has plugged the jack and made her enquiry. Relay J is now operated by the numerical impulse trains transmitted by the operator and consequently sets the setting switch EW. If, for example, the operator transmits two impulses which correspond to the characterizing digit of the subsidiary exchange U**1** the setting switch EW moves its wipers *a* and *b* on to the second contact. The following circuit is now set up: earth, contact **60***p*, wiper *d* of the call finder AS on contact **2**, wiper *b* of the setting switch EW on contact **2**, relay U, contact **72***p*, resistance W*i***1**, battery and earth. In this circuit relay U energizes and at contact **61***u* prepares a local circuit for relay P**1**. Other circuits are prepared over further *u*-contacts. In a manner corresponding to the circuits shown in Fig. 3, the final selector LW is now set in operation and is stepped forward until its setting corresponds to the traffic direction desired, which in this case occurs when it reaches contact **2**, when the following circuit is established: earth, battery, resistance W*i***2** contacts **62***p*, **61***u*, winding I of relay P**1**, wiper *d* of the final selector LW on contact **2**, contact **68***u*, wiper *d* of the call finder AS on contact **2**, contact **60***p* and earth. Relay P**1** energizes in this circuit and brings the final selector to rest. Winding I of relay P**1** is short circuited by the closing of contact **63***p***1**. Relay P**1** locks up over its winding II and contact **64***p***1**. The line is switched through to the line which was seized by the call at contacts **80***p***1** and **81***p***1**. It can then be seen that the final selector remains on the connecting line seized by the call from the subsidiary exchange U**1** and does not seek out any other connecting line in the same traffic direction. This testing of a free line is prevented in that on account of the operation of the *u*-contacts only contact **2** in the contact bank traversed by wiper *d* in the final selector is characterized as that contact on which the final selector LW is to be brought to rest, the characterizing of this contact taking place after the setting of the setting switch EW in dependence upon the setting of the call finder.

After the setting of the final selector LW the operator can now set the switch in the subsidiary exchange U**1** on the called subscriber's line (T2) by transmitting further impulse trains. In this case also the connecting link in the exchange U2 is released in the case of a call internal to the exchange U**1**.

If a revertive call to the calling subsidiary exchange is not involved but the setting switch has been set according to the characterizing digit **2** of the exchange U**1** by the call incoming from the manual exchange the final selector LW first proceeds to contact **2**. Since, however, relay U is not energized in this case the normal testing operation sets in. If the connecting line which is first reached is engaged relay P**1** again fails to energize. The final selector accordingly steps on and tests the second connecting line to the exchange U**1** over contact **3** in accordance with the setting of the set switch EW and so on for further lines—all the characterizing lines in the same direction are connected in multiple to the same characterizing contact in the setting switch.

What is claimed is:

1. In an automatic switch, an incoming line, a plurality of outgoing lines appearing in the contact bank of said switch and accessible to its wipers, means for making any of said outgoing lines

busy, means for marking one of said outgoing lines in said contact bank, means effective upon the completion of said marking for associating the wipers of said switch with the marked line, means for determining over said wipers whether or not said marked line is busy, said last means effective under one condition to cause a connection to be completed over said wipers from said incoming line to said marked outgoing line only if said marked outgoing line is idle, and effective under an alternative condition to cause a connection to be completed over said wipers from said incoming line to said marked outgoing line even though said marked outgoing line is busy.

2. In a device for extending a connection to any one of a group of lines, means for making any of said lines busy, an automatic connecting switch having access to said lines, an automatic characterizing switch associated with said connecting switch, means for controlling said characterizing switch to mark one of said lines in said connecting switch, means effective upon completion of said marking for causing said connecting switch to extend an incomplete connection to the marked line, means for determining whether or not the marked line is busy, last said means effective under one condition to cause said connecting switch to complete the connection to said line only if said line is not busy and effective under an alternative condition to cause said connecting switch to complete the connection to said line whether it is busy or not.

3. In a device for extending a connection to any one of a group of lines, means for making any one of said lines busy, an automatic connecting switch having access to said lines, an automatic characterizing switch associated with said connecting switch, means for setting said characterizing switch by digits, said characterizing switch effective under one condition to cause all of said lines to be marked in said connecting switch and effective under an alternative condition to cause only one of said lines to be marked in said connecting switch, means effective upon completion of said marking if all of said lines are marked in accordance with said one condition for causing said connecting switch to search for and seize an idle one of said lines, or, if only one of said lines is marked in accordance with said alternative condition, for causing said connecting switch to search for and seize that one line whether it is idle or busy.

4. In a device for extending a connection to any line in any group of a plurality of groups of lines, means for making any of said lines busy, an automatic connecting switch having access to said lines, an automatic characterizing switch, means for controlling said characterizing switch by digits to mark one of said lines in the connecting switch, means effective under one condition upon completion of said marking for causing said connecting switch to complete a connection to said one line whether it is busy or idle, last said means effective under an alternative condition upon completion of said marking for causing said connecting switch to complete a connection to said one line only if said one line is idle and, if said line is busy, for causing said connecting switch to search for and seize another line in the same group which is idle.

5. In a device for extending a connection to any of a group of local lines or to any of a group of outgoing lines, means for making any of said lines busy, an automatic connecting switch having access to said lines, an automatic characterizing switch associated with said connecting switch, means for controlling said characterizing switch to mark one of said lines in said connecting switch, means effective upon completion of said marking if said one line is a local line for causing said connecting switch to complete a connection to said one line only if said one line is idle and, if said one line is an outgoing line, either for causing said connecting switch under one condition to complete the connection to said one line whether it is busy or idle or for causing said connecting switch under an alternative condition to complete a connection to said one line only if said one line is idle and, if said one line is busy, to search for and seize another outgoing line which is idle.

6. In a device for establishing a connection between any of a plurality of lines, an automatic switch having access to said lines, a characterizing switch associated with said automatic switch, means for extending a connection from any one of said lines to said automatic switch, last said means effective also to mark said one line in said characterizing switch, means for operating said characterizing switch to mark any desired one of said lines in said automatic switch, means for causing said automatic switch to search for said desired line and to extend an incomplete connection thereto, means for determining the condition of said desired line and for completing said connection thereto if said desired line is idle, means effective only if the desired line marked by said characterizing switch in said automatic switch is the same line which is marked in said characterizing switch for causing last said means to complete said connection to said desired line regardless of its condition.

7. In a device for establishing a connection between any lines in a plurality of groups of lines, an automatic switch having access to said lines, a characterizing switch, means for extending any one of said lines to said automatic switch, last said means also effective to mark, in said characterizing switch, the group of lines of which said line is one, means for operating said characterizing switch to characterize any desired one of said groups of lines, means for marking, in said automatic switch, the lines of the characterized group, means effective upon completion of last said marking for causing said automatic switch to search for and seize an idle line marked in said automatic switch, means effective only if said characterizing switch is operated to characterize the same group of lines that is marked in said characterizing switch for causing third said means to mark only said one line in said automatic switch and for rendering last said means effective to cause said automatic switch to search for and seize said one line regardless of its condition.

8. In a switching center, incoming lines, a remote control line, means responsive to a call over any one of said incoming lines for associating the calling line with said remote control line, means controllable over said remote control line for characterizing any one of said incoming lines, an automatic switch having access to said incoming lines effective to extend an incomplete connection from the calling line and said remote control line to the characterized line upon completion of said characterization, means for determining the condition of the characterized line and for preventing the completion thereto of said connection if said characterized line is engaged, means effective upon completion of said characterization only if said calling line is the one

which is characterized for rendering said determining means effective to complete a connection to said characterized line from said remote control line only.

9. In a switching center, incoming lines, connecting means having access to said lines, means responsive to a call over any one of said lines for extending the calling line to said connecting means, means for characterizing any one of said lines in said connecting means, said connecting means effective upon completion of said characterization to extend an incomplete connection to the characterized line, means for determining the condition of the characterized line and for preventing the completion thereto of said connection if said characterized line is engaged, means effective upon completion of said characterization only if said calling line is the one which is characterized for rendering said determining means ineffective.

10. In a switching center such as claimed in claim 9, wherein said determining means also causes said connecting means to search for a free one of said lines if said characterized line is engaged if it is not said calling line which is characterized.

11. In a switching center, a plurality of lines, a plurality of links, connecting means in each of said links having access to said lines, means responsive to a call over one of said lines for associating an idle one of said links with said calling line, means in said link for extending said calling line to the connecting means in said link, last said means effective also to characterize said calling line in said connecting means, means for controlling said connecting means to extend an incomplete connection to any desired one of said plurality of lines, means for determining the condition of the desired line and for completing said connection thereto if said desired line is idle, means effective only if the desired line is the line which is characterized in said connecting means for causing last said means to complete said connection to said desired line regardless of its condition.

12. In a switching center, a plurality of groups of lines, a plurality of links, connecting means in each of said links having access to said lines, means responsive to a call over any one of said lines for associating an idle one of said links with said calling line, means in said link for extending said calling line to the connecting means in said link, last said means also effective to characterize, in said connecting means, the group of lines of which said calling line is one, means for controlling said connecting means to search for and seize an idle line in any selected group, means effective only when the selected group is the group which is characterized in said connecting means for causing said connecting means to search for said calling line and to complete a connection thereto regardless of its condition.

13. In a telephone system, a primary exchange, trunk lines connecting each of a plurality of secondary exchanges to said primary exchange, a connecting device in said primary exchange having access to said lines, means in each secondary exchange for seizing any of the lines extending to said primary exchange, means in said primary exchange for extending the seized line to said connecting device, a control position, means controllable at said control position for characterizing, in said connecting device, any secondary exchange, means for causing said connecting device to search for and seize an idle trunk line to the characterized secondary exchange to extend thereover the connection from first said secondary exchange, and means effective immediately upon completion of said characterization only if first said secondary exchange is the one which is characterized thereby to render last said means effective to cause said connecting device to search for and seize only that trunk line by which the connection was extended from first said secondary exchange to said primary exchange.

14. In a telephone system, an exchange, a plurality of lines incoming to said exchange, a connecting switch having access to said lines, means for seizing any one of said lines and for extending it to said connecting switch, a characterizing switch associated with said connecting switch, means for controlling said characterizing switch to mark one of said lines in said connecting switch, a testing relay in said connecting switch, means for operating said connecting switch under control of said relay to search for said marked line, means for operating said relay if said marked line is free to complete a connection thereby from said one line to said marked line, means rendered effective only if said one line is marked by said characterizing switch for operating said relay independently of the condition of the marked line.

15. In combination, a plurality of lines, means for making any of said lines busy, an automatic switch having access to said lines, means for seizing said switch, a second switch, means for setting said second switch in any of a plurality of positions to thereby mark a corresponding position in said first switch, a relay, means for causing first said switch to search for said marked position under control of said relay, said relay effective to test each position successively and to operate when the marked position is encountered if the line associated with that position is idle to thereby cause first said switch to complete a connection to said line, means for characterizing any one of said positions of said second switch, means effective only if the characterized position coincides with the setting of said second switch for causing said relay to operate independently of the condition of the marked line to thereby cause said first switch to complete a connection to said marked line regardless of its condition.

16. In combination, a plurality of lines, means for making any of said lines busy, an automatic switch having access to said lines, means for seizing said switch, a second switch, means for setting said second switch in any of a plurality of positions to mark, by said setting, a plurality of positions in first said switch, a relay, means for causing said first switch to search under control of said relay, said relay effective to test each position successively and to operate when a marked position which has an idle line associated with it is encountered to thereby seize said line, means for characterizing any one of said positions in said second switch, means effective only if the characterized position coincides with the setting of said second switch for causing only one position in first said switch to be marked and for causing said relay to operate independently of the condition of the line associated with said marked position to thereby cause first said switch to extend a connection to the line associated with said marked position regardless of its condition.

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