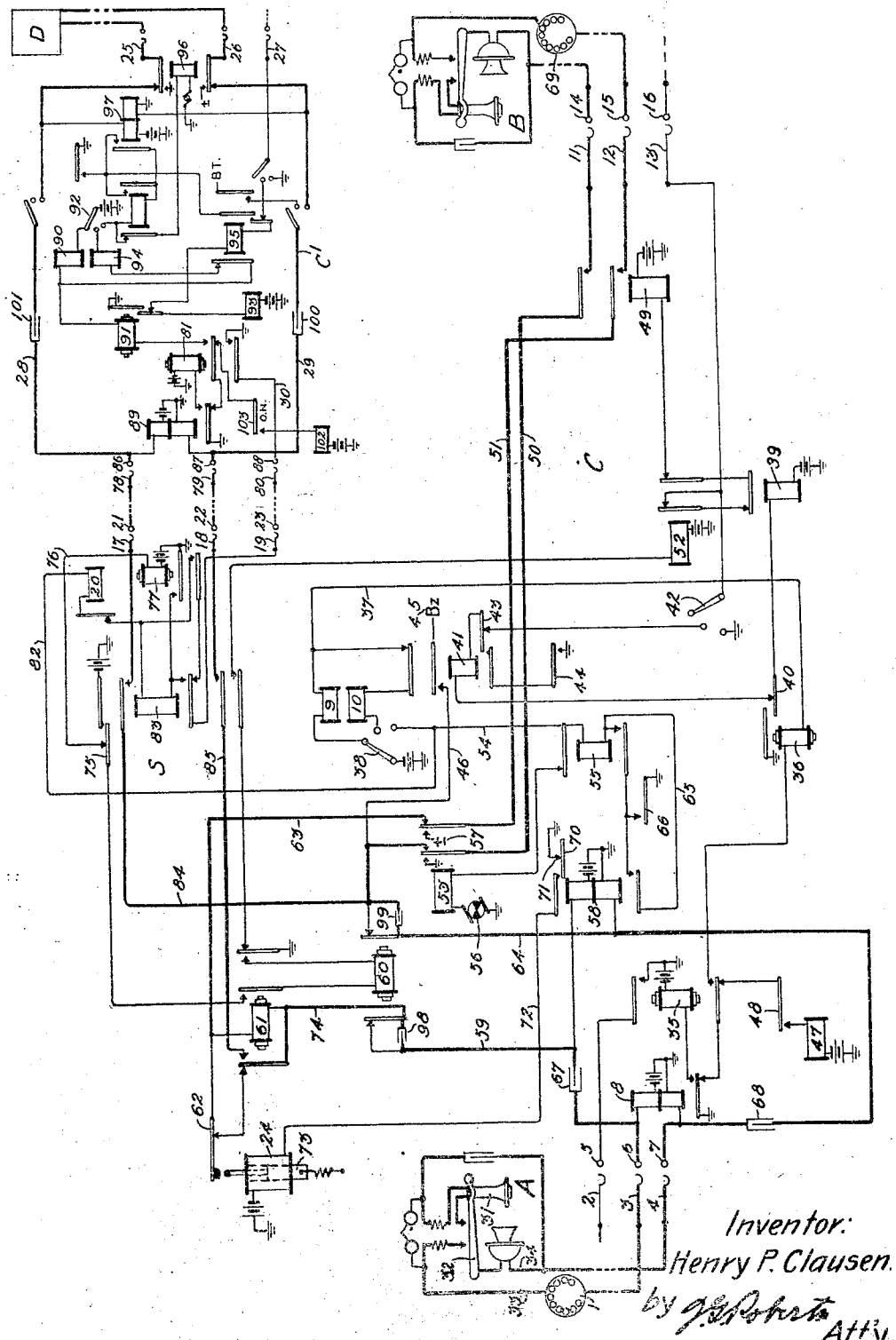
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TELEPHONE EXCHANGE SYSTEM.

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UNITED STATES PATENT OFFICE.

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TELEPHONE-EXCHANGE SYSTEM.

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To all whom it may concern:

Be it known that I, HENRY P. CLAUSEN, a citizen of the United States, residing at Mount Vernon, in the county of Westchester, State of New York, have invented certain new and useful Improvements in Telephone-Exchange Systems, of which the following is a full, clear, concise, and exact description.

This invention relates to telephone exchange systems employing automatic switching mechanism controlled from the subscribers' substations for establishing connections.

The object of the invention is the provision of a system comprising circuits and apparatus arranged to be controlled from the subscribers' substations, and which may become effective after a connection has been established over a train of switches from one subscriber's line to another, to place a second train of switches under the control of one of the subscribers. Such subscriber may thereupon cause the operation of the second train of switches in accordance with the number of a desired third party, to bring the third party into the connection, while at the same time the originally established connection is maintained intact, and interference by other subscribers prevented by the application of the usual busy condition to each of the several lines concerned in the conversational connection.

More particularly there is contemplated a system in which, a connection having been built up over a series of switches from a calling to a called subscriber's line, the called subscriber may thereupon manipulate his sender to cause the extension of the conversational connection over a second series of switches to the line of a third subscriber.

A feature consists in the provision of a special automatically operated hunting switch associated with the final or connector switch, and so arranged that, after the connector has completed the connection from the calling line to the called line, a series of impulses transmitted from the called substation to the connector switch serves to initiate the operation of said special switch. The special switch has appearing in its terminal bank the terminals of circuits leading to first selector switches, and when thus set in operation by the called subscriber it automatically operates to find the first idle one of these circuits, thereby extending the talking conductors of the established connection to an idle first selector trunk. The called subscriber may then send impulses from his station directly to the first selector switch to operate the same, and to subsequently actuate the requisite number of succeeding switches to finally include the telephone line of a desired third party in the conversational connection previously established between himself and the calling subscriber.

Such other features as are contemplated by the present invention will appear from a consideration of the following description.

In the drawing the figure shows a portion of an automatic telephone system comprising the telephone lines and substations of three subscribers, together with the circuits and switching mechanism employed in effecting connections between said lines in accordance with the principles of the invention.

Briefly stated, there is shown a subscriber's substation A consisting of the usual apparatus and the lines of which terminate at the exchange in a preliminary switch (not shown) such as a line or finder switch. The substation A is also provided with an impulse sender 1 by means of which the calling subscriber may control the directive operation of a series of selective switches to extend his line in the direction of the called line. Only one of these selective switches is indicated in the drawing, being diagrammatically illustrated by the brushes 2, 3, 4, as the selector arranged to coöperate with terminals, such as 5, 6, 7 of trunks leading to connector switches. It is apparent that any number of selectors may be included in the train of switches intermediate of the calling line and the connector. The circuits and apparatus of one of the connector switches C are shown in detail in the lower portion of the drawing and include a line relay 8, operating magnets 9 and 10, and movable brushes 11, 12, 13. The brushes 11, 12, 13 are arranged to be directively operated by magnets 9 and 10 in two separate movements into connection with the multiple terminals of telephone lines, the terminals of one of these lines, such as that associated with substation B, being shown at 14, 15, 16. Associated with the connector switch is a special hunting switch S having brushes 17,

18, 19, which may be constructed to operate as a single movement rotary switch, actuated step by step by means of a stepping magnet 20. The brushes 17, 18, 19 of the special switch are arranged to coöperate with terminals 21, 22, 23 of circuits which are joined to trunk lines leading to first selector switches. Associated with each of the connectors provided with one of these special switches is a solenoid magnet 24 adapted to respond to the transmission of a special series of impulses from a called substation, as B, to initiate the operation of the said special hunting switch S.

At the upper right-hand portion of the drawing are shown in detail the circuits and apparatus of another connector switch C' substantially identical in all respects to the connector already described. This switch is provided with brushes 25, 26, 27 arranged to coöperate with the terminals of telephone lines, and which are shown in operative relation to the line of substation D.

A detailed description will now be given of the operation of the system embodying this invention, explaining first the manner in which a call is extended from a calling to a called subscriber's line, and then the manner in which a second connection may be extended to the line of a third subscriber from the connection already established. For this purpose, it is assumed that the party at substation A desires to converse with the party at substation B. Upon the removal of the receiver 31 from the switch-hook 32, the conductors 33 and 34 of the calling line are closed to cause the operation of a line or finder switch (not shown in the drawing) in the well-known manner. The subscriber now manipulates his sender 1 to directively control the operation of the first selector, and as many succeeding selectors as may be involved, the actuation of the last of these selectors 2, 3, 4 serving to extend the line 33, 34 by way of terminals 6 and 7 to a connector switch C having access to the group of lines containing the called line B. When the selector line brushes 3 and 4 make connection with terminals 6 and 7, the following circuit is closed for the energization of the calling line relay 8 of connector C: battery, through the upper winding of said relay, terminal 6, brush 3, through the terminals and brushes of preceding switches (not shown), conductor 33, over the loop of substation A, conductor 34, through the brushes and terminals of switches preceding the selector 2, 3, 4, brush 4, terminal 7, lower winding of relay 8, to ground. The relay 8 by operating closes a circuit at its armature and front contact for the slow relay 35. Relay 35 places a ground on the test terminal 5 to render the appropriated connector switch busy to other selectors. The relay 35 at its lower armature and front contact also prepares a stepping circuit for the transmission of impulses to the operating magnets as will presently be seen. The calling subscriber having thus extended his line through selector switches to the connector C continues to operate the sender 1 in accordance with the tens digit of the called number. For each interruption produced in the line by sender 1 in the transmission of the tens impulses the line relay 8 retracts and attracts its armature. At the first retraction of the armature of relay 8, the following circuit is closed to send an operating impulse to the primary stepping magnet 9: grounded armature and back contact of relay 8, lower armature and front contact of slow relay 35, winding of slow relay 36, conductor 37, through the winding of magnet 9, side-switch arm 38 in position 1, to battery and ground. The magnet 9 energizes and steps the connector brushes 11, 12, 13 one step forward into operative relation to the first group of line terminals in the bank. For each succeeding impulse of the tens series, the primary magnet 9 operates to advance the brushes 11, 12, 13 forward one step, finally bringing them to rest in operative position relative to the tens group of line terminals including the terminals 14, 15, 16 of the line of the desired substation B. When the first impulse is sent over the above traced circuit by the line relay 8, the relay 36 energizes, and being slow to release, retains its armature in attracted position during the short interruptions produced by the stepping relay 8. Upon the energizatioin of slow relay 36, a circuit is established from battery, through the winding of escape magnet 39, contact 40, armature of relay 36, to ground. The escape magnet 39 being designed to move the side switch from position to position on deënergization, energizes preparatory to advancing said side switch into position 2. At the cessation of the impulses of the tens series, and the consequent maintained energization of the line relay 8, the circuit of slow relay 36 is held open for a sufficient period of time to permit said relay to retract its armature and open the circuit of escape magnet 39. Said escape magnet thereupon releases the side switch from first to second position. The connector switch is now in condition to receive the final or units series of impulses.

The calling subscriber by operating his sender 1 in accordance with the units digit of the desired number causes the relay 8 as before to retract and attract its armature in correspondence to the number of interruptions produced in the calling line. On the first retraction of the armature of relay 8, an impulse is transmitted over the following circuit to the secondary stepping magnet 10:

grounded armature and back contact of relay 8, lower armature and front contact of relay 35, winding of relay 36, conductor 37, uppermost armature and contact of relay 41, through the winding of magnet 10, side-switch arm 38 and its second position contact, to battery. The magnet 10 operates in response to the closure of this circuit and steps the brushes 11, 12, 13 onto the first set of line terminals in the selected group. At each succeeding vibration of the armature of the line relay 8 responsive to the units series of line interruptions, stepping magnet 10 operates to advance said brushes step by step over the line terminals, and finally at the cessation of said series brings them to rest in engagement with the terminals 14, 15 and 16 of the called line. The slow relay 36 energizes on the first deënergization of the relay 8 at the beginning of the secondary movement of the switch and remains energized during the following short interruptions produced by said relay 8 in the manner described in connection with the transmission of the primary series of impulses. Energization of relay 36 again closes a circuit for the operation of escape magnet 39 preparatory to releasing the side switch from second to third position. If the called line is busy, a ground potential is present on the test terminals 16, having been applied thereto either from a side-switch arm similar to arm 42 and its third position contact at some other connector switch, provided the line is busy as a called line, or from a finder or line switch provided the line is busy as a calling line. Under this assumption, when the connector C steps its brushes 11, 12 and 13 onto terminals 14, 15 and 16 at the end of the line selecting movement, and a sufficient period of time has elapsed to permit the deenergization of slow relay 36, a new holding circuit is completed for escape magnet 39 at the make-before-break contact 40 before said magnet can deënergize, due to the severance of its original circuit by the retraction of relay 36. This holding circuit may be traced from free pole of battery, through the winding of escape magnet 39, make-before-break contact 40, winding of relay 41, contact 43, side-switch arm 42 in its second position, test brush 13, to the grounded terminal 16. Escape magnet 39 therefore remains energized and prevents the release of the side switch into third position. Relay 41 energizes in the circuit just traced and at its lower armature and the make-before-break contact 43, closes a holding circuit for itself and escape magnet 39 from battery, through the winding of magnet 39, contact 40, winding of relay 41, contact 43 and lower armature of said relay, to ground at the off-normal contact 44. At its inner upper armature and contact, relay 41 applies current from the busy tone source 45 to conductor 64, which busy tone is inductively transmitted in the well-known manner to the substation apparatus of the calling line. The calling party being thus informed that the desired line is busy replaces his receiver on the switchhook, thereby causing the deënergization of the connector line relay 8. Relay 8 on retracting its armature permanently opens the circuit of slow relay 35, which in turn deënergizes and completes the following circuit for the connector release magnet 47: battery, through the winding of magnet 47, primary off-normal contact 48, back contact and lower armature of relay 35, back contact and armature of relay 8, to ground. The release magnet energizes and restores the connector switch C to its normal position. When the switch is completely restored the primary off-normal contact is again opened, thereby opening the circuit of magnet 47 to allow the same to deenergize. The slow relay 35 on releasing also removes at its upper armature the busy ground from the selector test terminal 5. The removal of this ground potential from terminal 5 may operate, as is well known, to cause the restoration of the selector switches preceding the connector C.

If, however, it be assumed that the called line is idle at the time the connector C steps its brushes, 11, 12 and 13 onto terminals 14, 15 and 16, no ground is present on the test terminal 16. Therefore, upon the deënergization of slow relay 36, the circuit of escape magnet 39 is opened, and no alternate circuit being provided therefor, said magnet deënergizes to release the side switch into third position. Side-switch arm 42, on reaching third position, places a busy ground on the test terminal 16 of the called line, and also closes a circuit for relay 49, which attracts its armatures to connect the talking conductors 50 and 51 through to brushes 11 and 12 respectively. The circuit for relay 49 is traceable from battery, through the winding of such relay, contact and outer armature of relay 52, armature and contact of escape magnet 39, inner armature and contact of relay 52, side-switch arm 42 in position 3, to ground. With the side switch in this position, a circuit is also closed as follows for the ringing relay 53: free pole of battery, side-switch arm 38, conductor 54, upper armature and contact of ringing cutoff relay 55, through the winding of relay 53, interrupter 56, to ground. The interrupter 56 operates to intermittently energize and deënergize the relay 53, which by a corresponding attraction and retraction of its armatures intermittently applies the ringing source of current indicated at 57 to the called line. The ringing circuit may be traced from source 57, front contact and outer armature of relay 53, conductor 51, inner armature and contact of relay 49,

brush 12, terminal 15, over the loop of called substation B, including the ringer thereof, terminal 14, brush 11, contact and upper armature of relay 49, conductor 50, to ground at the inner armature and front contact of relay 53. When the called subscriber removes his receiver, and during the period of operation of interrupter 56 that the armatures of relay 53 are retracted, a circuit is established as follows for the called line relay 58: battery, through the upper winding of relay 58, conductor 59, contact and left-hand armature of slow relay 60, left-hand armature and back contact of slow relay 61, closed contact 62 of solenoid magnet 24, conductor 63, back contact and outer armature of relay 53, conductor 51, inner armature and contact of relay 49, brush 12, terminal 15, over the loop of substation B, terminal 14, brush 11, contact and upper armature of relay 49, conductor 50, inner armature and back contact of relay 53, contact and right-hand armature of relay 60, conductor 64, through the lower winding of relay 58, to ground. The called line relay 58 on energizing closes a circuit for the ringing cutoff relay 55 from battery, side-switch arm 38, conductor 54, through the winding of relay 55, conductor 65, lower armature and contact of relay 58, to ground at the off-normal contact 66. Relay 55 at its upper armature opens the circuit of ringing relay 53 to discontinue the ringing operation, and at its lower armature closes a locking circuit for itself independent of relay 58. The lines of the calling substation A and called substation B are now connected through for conversation, talking battery current being fed to the calling line through the windings of relay 8, and to the called line through the windings of relay 58. Condensers 67 and 68 inserted in the talking conductors serve to conductively separate the calling and called lines. At the close of the conversation the calling party by replacing his receiver to the switch hook causes the restoration of the established connection as has been explained hereinbefore.

After a calling subscriber, as A, has completed the extension of a telephone connection between his line and that of a called subscriber, as B, in the manner above described, it may be desirable, due to the inability of the called subscriber to give the calling party the full information required, or for other reasons, to bring a third subscriber's line into talking relation to the already established connection. The case will now be assumed in which, after a talking connection has been built up between the lines A and B, it is desired to include the line D in the conversational circuit. To attain this end it is only necessary for the called subscriber at B, while holding his receiver off the hook, to manipulate the sender 69 to transmit to the connector C: first, a special series of impulses which are effective to operate the switch S to prepare the way for the extension of the desired connection over a second train of switches; and thereafter the proper series of selective impulses which are effective in controlling the operation of the switches of said train. The preliminary or special series of impulses may be sent by operating the sender 69 so as to produce ten interruptions, for example, in the line circuit of substation B. Since as above described the called line, relay 58 is now energized in series with the called line, each interruption in such line causes the relay 58 to retract and attract its armatures correspondingly. The upper armature of line relay 58 is arranged to coöperate with a make-before-break contact 70 in such manner that said contact 70 is in engagement with its grounded contact 71 for a brief interval during both the retracting and attracting movements of the armature of relay 58. Hence, as the relay 58 operates in response to the ten successive interruptions produced by sender 69, the ten successive deënergizations and energizations of said relay result in twenty momentary ground connections being applied to the conductor 72. The application of ground to conductor closes a circuit for the solenoid magnet 24 from battery, through the winding of said magnet, to the grounded conductor 72. Solenoid 24 is constructed such that the receipt of the twenty impulses produced by the operation of relay 58 is sufficient to attract its plunger 73 to a position where it becomes effective to open the contact 62.

It will be noted at this point that the winding of slow relay 61, and the path including the left-hand armature and back contact of relay 61 and contact 62, are in parallel with each other, both being in series with conductors 74 and 63, which conductors comprise a part of the above traced circuit for line relay 58. Normally then, the relay 61 remains inert, being shunted out by the low resistance path through contact 62. But when solenoid 24 attracts its plunger sufficiently to open contact 62, relay 61 energizes and completes the following circuit for slow relay 60: grounded outer right-hand armature and front contact of relay 61, through the winding of relay 60, inner right-hand armature and contact of relay 61, contact 75, conductor 76, winding of slow relay 77, to battery. Relays 60 and 77 both energize in this circuit. The attraction of the armatures of relay 60 opens the circuit of line relay 58 and slow relay 61. Relay 58 becomes deënergized, but the relay 61 is so adjusted as to retain its armatures attracted until the quick acting switch S has had time to step brushes 17, 18, 19 over the entire row of trunk terminals 21, 22, 23. The switch S

has no normal position, but is adapted when not busy to stand with its brushes 17, 18, 19 upon the terminals of the selector, such as the selector indicated at 78, 79, 80, last used in the extension of a connection. If then the selector upon the trunk terminals 21, 22, 23, of which the switch S is standing, is busy by reason of having been taken for use in the extension of a call by some other subscriber in the system, a ground will be present on the test terminal 23 of the switch S. This ground may either be derived from a front contact of the first slow relay of selector 78, 79, 80 as is well known or from the front contact of the first slow relay at the connector switch, as the relay 35 of connector C and relay 81 of connector C'. Therefore, on the energization of relay 77 as above described, a circuit is closed as follows for the stepping magnet 20 of special switch S: battery, side-switch arm 38 in third position, conductor 82, through the winding of magnet 20, armature and contact thereof, contact and lower armature of relay 77, back contact and inner lower armature of relay 83, test brush 19, to the grounded terminal 23. Magnet 20 energizes and opens its own circuit to rapidly advance the brushes 17, 18 and 19 over the terminals of trunks leading to busy first selectors, until the terminals 21, 22 and 23 of a trunk leading to an idle selector 78, 79, 80 are reached. When relay 77 operated to complete the circuit of magnet 20, a circuit in parallel therewith was also established through the winding of high resistance relay 83, inner armature and contact of relay 77 to ground. The resistance of relay 83 is sufficiently high to prevent the same from operating during the time that magnet 20 is stepping test brush 19 over grounded terminals. But when the non-grounded terminal 23 is reached, sufficient current flows to relay 83 to cause its energization. The stepping magnet 20 is included in series with relay 83, but the resistance of relay 83 being so high said magnet does not energize. The operation of relay 83 completes a circuit from battery, through the winding of the line relay (not shown) of the first selector 78, 79, 80, terminal 21, brush 17, contact and inner upper armature of relay 83, conductor 84, back contact and inner armature of relay 53, conductor 50, and thence over the called line B as before traced, returning by conductor 51, outer armature and back contact of relay 53, conductor 63, winding of slow relay 61, left-hand armature and front contact thereof, conductor 85, middle lower armature and contact of relay 83, brush 18, terminal 22, to ground through the other winding of the selector line relay (not shown). Relay 61, which held its armatures attracted during the hunting period of switch S, and while its circuit was maintained opened by relay 60, is again energized in the circuit above traced.

The attraction of the upper armature of relay 83 closes a substitute circuit for slow relay 60 to replace the one previously described. The attraction of the inner lower armature of relay 83 closes a holding circuit for said relay in place of its original circuit, which is severed by the deënergization of slow relay 77 shortly after the opening of contact 75. This circuit may be traced from battery, side-switch arm 38, conductor 82, winding, armature and contact of magnet 20, winding, front contact and inner lower armature of relay 83, test brush 19, to the test terminal 23 which has been grounded upon the seizure of selector 78, 79, 80 in the well-known manner.

The line of the first called substation B has now been extended by way of the hunting switch S to a first selector switch 78, 79, 80. The subscriber on operating his dial 69 causes said selector to move into engagement with terminals 86, 87, 88 leading to the connector C', which in turn has access to the desired line D. On the seizure of the connector C' a circuit is completed for line relay 89 as follows: battery, through the upper winding of relay 89, terminal 86, brush 78, terminal 21, brush 17, contact and inner upper armature of relay 83, conductor 84, contact and inner armature of relay 53, conductor 50, upper armature and contact of relay 49, brush 11, terminal 14, over the loop of substation B, terminal 15, brush 12, contact and lower armature of relay 49, conductor 51, outer armature and back contact of relay 53, conductor 63, winding of relay 61, left-hand armature and front contact of said relay 61, middle lower armature and contact of relay 83, brush 18, terminal 22, brush 79, terminal 87, lower winding of relay 89, to ground. Relay 89 thus becomes energized in series with the first called line B, and closes a circuit for slow relay 81, which places a ground at its lower armature on test wire 30 to render the switch C' busy, and also to hold the circuit closed for relay 83 as above explained. The subscriber now operates sender 69 to send the tens and units impulses to the connector C'.

In response to the tens series relay 89 vibrates its armature and at each retraction, a circuit is closed as follows for primary stepping magnet 90: grounded armature and back contact of relay 89, inner armature and front contact of relay 81, winding of slow relay 91, winding of magnet 90, side-switch arm 92, to battery. The escape magnet 93 is energized as is well understood and at the end of the tens impulse series releases the side switch into second position. In response to the units impulses the following circuit is closed for the secondary stepping magnet 94: grounded armature and back contact of relay 89, inner armature and front contact of relay 81, winding of relay 91, left-hand armature and contact of relay 95, through

the winding of magnet 94, side-switch arm 92 in second position, to battery. Magnet 94 operates in this circuit to advance brushes 25, 26, 27 over the group and into engagement with the terminals of the second called line D. Assuming line D to be idle, escape magnet 93 deënergizes at the end of the final series and steps the side switch into third position. In this position of the side switch the ringing relay 96 is intermittently actuated to apply ringing current to the called line in a manner similar to that described in connection with connector C. When the subscriber at substation D responds the called line relay 97 energizes, thereby causing the ringing operation to cease as already explained.

The telephone line of the third party at D has thus been included in the connection and all three subscribers may converse with one another. Talking battery current is fed to the substation A through the windings of the calling line relay 8 of connector C, as in the case when the established connection involved only the calling and first called subscribers. But the first called substation B is now supplied with talking current through the windings of the calling line relay 89 of the connector C′ instead of the called line relay 58 of connector C. The second called substation D receives battery current from relay 97 of connector switch C′. The conversational circuit between lines A and B is conductively separated by condensers 67, 98 and 68, 99; the conversational circuit between lines A and D by condensers 67, 98, 100 and 68, 99, 101; while that between lines B and D is separated by condensers 100 and 101.

At the completion of conversation, the calling party at A hangs up his receiver to effect a release of connector C and the remaining switches in the train interconnecting his line with that of substation B, as has already been set forth. When brushes 11, 12, 13 of connector C break engagement with the terminals of the called line B, the hereinbefore traced circuit of relay 89 is severed, thereby resulting in the release thereof. Retraction of relay 89 causes the deënergization of relay 81; which completes the following circuit for release magnet 102 of connector C′: battery, through the winding of magnet 102, primary off-normal contact 103, back contact and armatures of relays 81 and 89 to ground. The connector switch C′ is thereupon restored to its normal position. The selector switches preceeding connector C′ are likewise released at this time.

What is claimed is:

1. In a telephone system, a calling line, a called line, means for establishing a connection between said lines, a third line, an automatically operated hunting switch, means controlled by the called subscriber for initiating the hunting movement of said hunting switch to extend the established connection in the direction of the third line, and means controlled by the called subscriber for completing the extension of the established connection to said third line.

2. In a telephone system, a calling line, a called line, selector and connector switches for establishing a connection between said lines, a third line, an automatic step-by-step hunting switch individual to said connectors, means controlled by the called subscriber for initiating the hunting movement of said hunting switch to extend the established connection in the direction of the third line, and means controlled by the called subscriber for further extending the established connection to said third line.

3. In a telephone system a calling line, a called line, sending devices associated with said lines, means including selector and connector switches for establishing a connection between said lines, a third line, an automatically operated hunting switch, means controlled by the called subscriber's sending device for starting the hunting movement of said hunting switch to extend the established connection to an idle selector switch, and means controlled by the called subscriber's sending device for operating said selector and succeeding switches to further extend the established connection to said third line.

4. In a telephone system, a calling line, a called line, impulse senders associated with said lines, means including selector and connector switches for establishing a connection between said lines, a third line, an automatically operated hunting switch, an electromagnetic device operated under the control of the called subscriber's sender, means controlled by said device for initiating the hunting movement of said hunting switch to extend the established connection to a selector switch, and means under the control of the called subscriber's sender for operating said selector and succeeding switches to further extend the established connection to said third line.

5. In a telephone system, a calling line, a called line, an impulse sender associated with the called line, a train of automatic switches, means for operating said switches to establish a connection between said lines, a third line, an automatically operated hunting switch, a second train of automatic switches, an electromagnetic device and means including said sender for transmitting impulses thereto, said device responsive to a predetermined number of impulses to start the hunting movement of said hunting switch to extend the established connection to said second train of switches, and means

controlled by said sender for operating said second train of switches to further extend the established connection to said third line.

6. In a telephone system, a calling line, a called line, an impulse sender associated with the called line, a train of automatic switches, means for operating said switches to establish a talking connection between said lines, an automatically operated hunting switch associated with the last switch of said train, a third line, a second train of automatic switches, means controlled by said sender for initiating the hunting movement of said hunting switch to extend said talking connection to the second train of switches, and means controlled by said sender for operating said second train of switches to further extend the talking connection to said third line.

7. In a telephone system, a calling line, a called line, means for establishing a connection between said lines, a third line, a plurality of trains of automatic switches arranged to extend said established connection to the third line, an automatically operated auxiliary switch arranged to test the condition of the first switch in each of said trains of switches, means controlled by the called subscriber for starting the testing operation of said auxiliary switch to select a train of switches, and means for operating the switches of the selected train to include said third line in the established connection.

8. In a telephone system, a calling line, a called line, impulse senders associated with said lines, a train of automatic switches, means controlled by the calling subscriber's sender for operating said switches to establish a talking connection between said lines, a third line, a plurality of other trains of automatic switches adapted to extend said talking connection to the third line, an automatic auxiliary switch arranged to test and select the first switch in each of said plurality of trains of switches, an electromagnetic impulse device and circuits controlled thereby, means including the called subscriber's sender for transmitting impulses thereto, said device being responsive to a definite number of impulses only to control said circuits to initiate the testing movement of said auxiliary switch whereby a train of switches is selected, and means for setting the switches of the selected train to include said third line in the establishing talking connection.

In witness whereof I hereunto subscribe my name this 3rd day of April, A. D., 1918.

HENRY P. CLAUSEN.