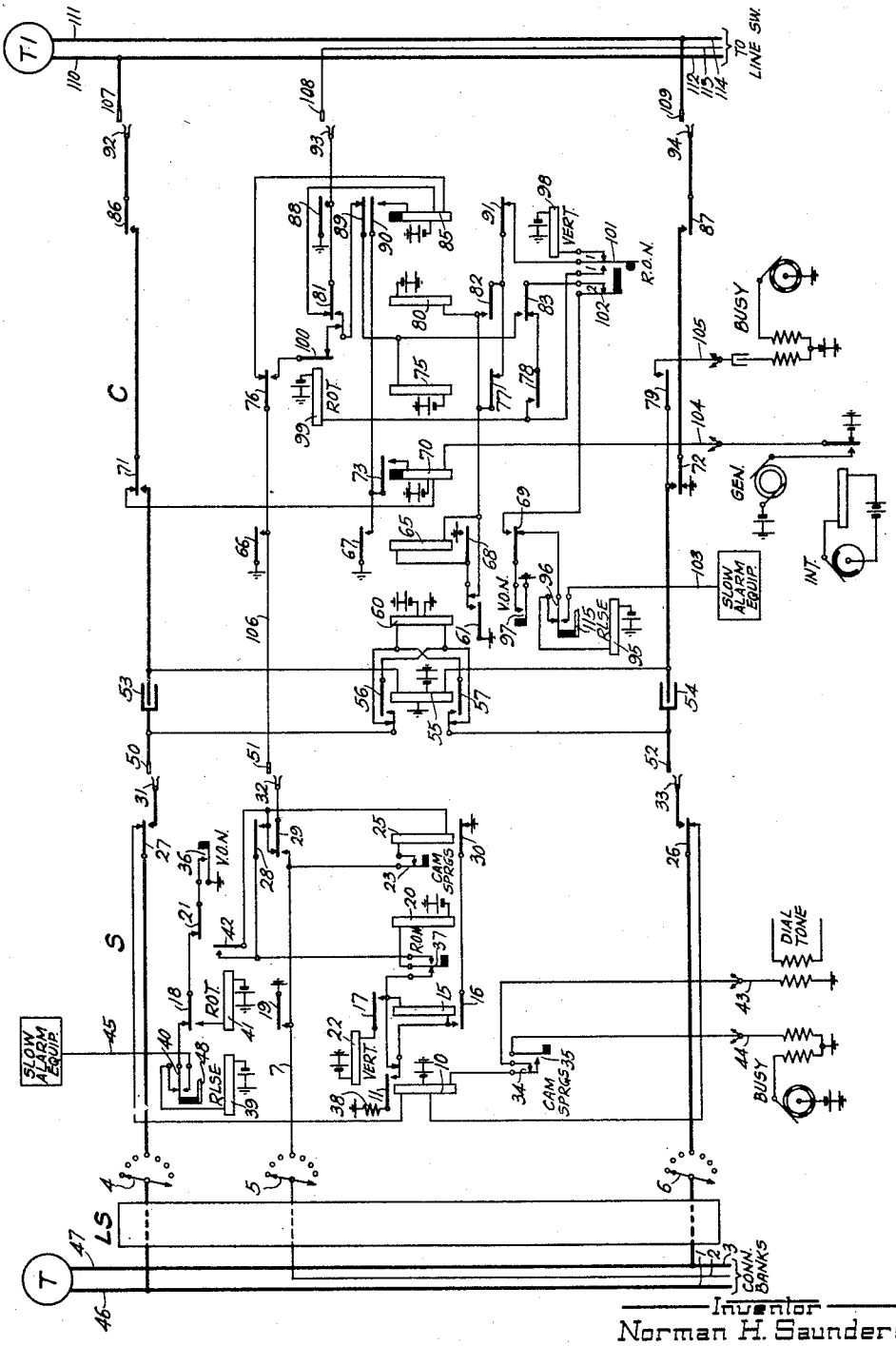
March 21, 1933. N. H. SAUNDERS 1,902,187

TELEPHONE SYSTEM

Original Filed Sept. 8, 1930



Inventor
Norman H. Saunders

Atty.

Patented Mar. 21, 1933 1,902,187

UNITED STATES PATENT OFFICE

NORMAN H. SAUNDERS, OF CHICAGO, ILLINOIS, ASSIGNOR, BY MESNE ASSIGNMENTS, TO ASSOCIATED ELECTRIC LABORATORIES, INC., OF CHICAGO, ILLINOIS, A CORPORATION OF DELAWARE

TELEPHONE SYSTEM

Original application filed September 8, 1930, Serial No. 480,313. Divided and this application filed June 29, 1931. Serial No. 547,500.

The present invention relates in general to telephone systems, but is concerned more particularly with automatic telephone systems employing automatic selector and connector switches of the step-by-step type. The main object of the invention is the provision of improved selector and connector switch circuits which perform all the required functions of such switches in an improved and more reliable manner.

A particular feature of the selector circuit is the novel testing and stepping arrangement for controlling the automatic rotary movement of the switch.

A particular feature of the connector circuit lies in the novel changeover scheme in which the switch is caused to take an automatic rotary step to perform the changeover from the directive vertical movement to the directive rotary movement.

This application is a division of my copending application Serial No. 480,313, filed September 8, 1930, for improvements in telephone systems. The features claimed in this divisional application relate to the new and improved connector switch.

A complete understanding of the above and other features of the invention may best be had from the following specification when read in connection with the accompanying drawing, comprising one figure only, which shows, by means of the usual schematic diagram, a telephone system employing the improved selector and connector switches of the present invention.

Referring to the drawing, T and T1 represent a calling and a called subscriber's station, respectively, of an automatic telephone system. The line comprising conductors 46 and 47 from station T terminates at the telephone exchange in a rotary lineswitch indicated by the rectangle designated LS, and having wipers 4, 5, and 6. The subscriber's line is accessible as a called station from contactor banks over conductors 1, 2, and 3. The selector S is the improved selector of the present invention and is accessible in the banks of rotary lineswitches such as LS, and in turn has access to the improved connector switch C over back contacts 50, 51, and 52. The connector C is one of a number of similar connectors and has access in its banks to subscribers' stations, such as T1, over bank contacts such as 107, 108, and 109. Conductors 112, 113, and 114 extend to a rotary lineswitch such as LS.

A detailed explanation of the operation of the improved selector and connector circuits will now be given. For this purpose it will be assumed that the subscriber at station T sets up a connection to the subscriber at station T1 whose telephone number is 567. Responsive to the removal of the receiver at station T, the rotary lineswitch LS is set in operation to select an idle trunk in the usual manner. It will be assumed that the trunk extending to the selector switch S is the first idle trunk available and has been seized by the lineswitch LS over wipers 4, 5, and 6.

As soon as the line is cut through to the selector switch S, line relay 10 of the selector operates over the calling loop in the following circuit: battery, upper winding of relay 10, resting contact of armature 27 and said armature, bank contact engaged by wiper 4 of lineswitch LS and said wiper, line conductor 46, calling loop at station T, line conductor 47, wiper 6 and bank contact of rotary lineswitch LS, armature 26 and its resting contact, lower winding of relay 10, normally-closed eleventh rotary-step contact 34, to ground through the dial tone equipment over conductor 43. Relay 10 operates, and at armature 11 and its front contact closes a circuit from ground, resistance 38, armature 11 and its front contact, winding of release relay 15, resting contact of rotary off-normal spring 37 and said spring, winding of relay 20, to battery. Relay 15 operates in this circuit, but relay 20 does not operate due to the high resistance of the release relay 15. A resistance 38 is provided so that relay 20 does not operate at the instant when the three springs of line relay 10 are all in contact during the energization of said relay.

Relay 15 in operating at armature 19 and its front contact grounds the release trunk conductor 7 to hold the lineswitch LS in operated condition, and also to busy the calling line in the banks of connector switches over

conductor 2. At armature 17 and its front contact, it prepares an impulsing circuit to the vertical magnet 22, and at armature 16 and its front contact it prepares a further point in the impulsing circuit of the vertical magnet 22 and prepares an operating circuit for the series relay 20. At armature 18 and its back contact, relay 15 opens a point in the circuit of release magnet 39, and at its working contact prepares a point in the circuit of the rotary magnet 41.

When the subscriber at station T hears the dial tone supplied over conductor 43 through the lower winding of line relay 10, he proceeds to dial the digits in the desired telephone number. Responsive to the dialling of the first digit "5", the circuit of line relay 10 is interrupted five times, causing this relay to release at each interruption and send an impulse to the vertical magnet 22 and to series relay 20. The impulsing circuit extends from ground at the resting contact of armature 30 and said armature, armature 16 and its working contact, normally closed springs controlled by armature 11 of line relay 10, working contact of armature 17 and said armature, through the winding of vertical magnet 22, to battery. A multiple circuit extends over the resting contact of rotary off-normal spring 37 and said spring, through the winding of series relay 20, to battery. Relay 20 operates at the first impulse, and at armature 21 and its resting contact opens a point in the circuit of rotary magnet 41.

Vertical magnet 22 responds to the impulses and raises the shaft and switch wipers of the selector to a point opposite the fifth level of the banks. At the first vertical step, vertical off-normal springs 36 are closed, preparing a circuit for the rotary magnet 41. Series relay 20 is slow to release due to the current through its winding in series with release relay 15. This current is not sufficient to hold relay 20 operated but is sufficient to make the relay slow to release so that it remains operated during the impulse series, maintaining the circuit of rotary magnet 41 open at armature 21 and its resting contact.

At the end of the series of impulses, line relay 10 remains energized, and, after an interval, series relay 20 releases and closes the circuit of rotary magnet 41 at armature 21 and its resting contact. The rotary magnet energizes and steps the switch wipers 31, 32, and 33 into engagement with the first set of bank contacts in the fifth level of the selector bank. At the first rotary step, rotary off-normal spring 37 is operated and engages its working contact, thereby completing a circuit from battery, winding of relay 20, rotary off-normal spring 37 and its working contact, interrupter contacts 42 of the rotary magnet, resting contact of armature 29 and said armature, to test wiper 32 of the selector switch. The operation now depends upon whether or not the connector accessible in the first set of bank contacts is idle. In case such connector is busy, there will be a ground potential on test contact 51 which energizes relay 20 in the above-traced circuit. Relay 20, at armature 21 and its resting contact, opens the circuit of the rotary magnet 41 which de-energizes and at its interrupter contacts 42 again opens the circuit of relay 20. Relay 20 releases, and at armature 21 and its resting contact again completes the energizing circuit of rotary magnet 41 which operates and steps the switch wipers into engagement with the second set of bank contacts. This interaction between the rotary magnet 41 and the stepping relay 20 continues as long as a ground potential is encountered on the bank contacts engaged by the test wiper 32.

Each time the rotary magnet energizes and closes its interrupter contacts 42, a circuit is completed from ground, armature 19 and its working contact, eleventh rotary-step springs 23, winding of switching relay 25, interrupter contacts 42 of the rotary magnet, working contact of rotary off-normal spring 37 and said spring, winding of relay 20, to battery. As long as the test wiper 32 is engaging a grounded bank contact, switching relay 25 is short circuited by ground over wiper 32, armature 29 and its resting contact, to the lower terminal of switching relay 25. The switching relay 25 is thereby prevented from operating, and the ground on the test wiper brings about the operation of relay 20 to again cause the switch to take another rotary step.

In case all of the trunks accessible in the fifth level of the selector banks are busy, the switch is automatically rotated to its eleventh rotary position and the eleventh rotary step springs are operated. At spring 23 and its resting contact, the circuit of switching relay 25 is opened so that this relay cannot operate. At contacts 35, busy tone over conductor 44 is connected to the lower winding of relay A to replace the dial tone. When the calling subscriber hears the busy tone, he knows that the connection cannot be completed at this time, and he replaces his receiver to release the connection as will be described later.

It will now be assumed that the connector C, accessible over bank contacts 50, 51, and 52, is idle when tested by the selector switch S. In this case, there is no ground on test wiper 32 and the switching relay 25 and the stepping relay 20 energizes in series over the following circuit: from ground, armature 19 and its working contact, eleventh rotary-step spring 23, winding of switching relay 25, interrupter contacts 42 of the rotary magnet 41, working contact of rotary off-normal spring 37 and said spring, winding of relay 20, to battery. Relay 25, at armature 28 and its working contact, closes a locking circuit for itself in series with relay 20 independent

of the interrupter contacts 42 of the rotary magnet. At armature 29 and its working contact it connects ground from release trunk conductor 7 to bank contact 51 to guard the connector switch C against seizure until such time as ground is sent back over release trunk conductor 106 from the connector switch C. At armature 30 and its resting contact, relay 25 opens a point in the impulsing circuit to prevent an impulse being sent to the vertical magnet when line relay 10 releases after the line conductors have been switched through to the connector. At armatures 27 and 26 and their resting contacts, relay 25 disconnects line relay 10 from the incoming line conductors, and at the working contacts of these armatures it connects the subscriber's loop through to the connector switch over wipers 31 and 33 and bank contacts 50 and 52. Line relay 10 releases, and at armature 11 and its working contact, opens the circuit of release relay 15. Relay 15 releases and at armature 16 and its working contact opens a further point in the impulsing circuit, at armature 17 and its working contact it opens a point in the circuit of vertical magnet 22, at armature 19 and its working contact it removes ground from release trunk conductor 7, which conductor has now been grounded from the connector switch C, as will be explained later, and at armature 18 and its resting contact it prepares a circuit for the release magnet 39.

When the connection is switched through to the connector switch C, line relay 60 of the connector energizes in a circuit extending from battery, upper winding of relay 60, normally closed springs controlled by armature 56 of relay 55, bank contact 50, wiper 31 of selector switch S, working contact of armature 27 and said armature, bank contact and wiper 4 of lineswitch LS, over the calling subscriber's loop, wiper 6 and bank contact of lineswitch LS, armature 26 and its working contact, wiper 33, bank contact 52, normally closed springs controlled by armature 57 of relay 55, lower winding of relay 60 to ground. Relay 60 energizes, and at armature 61 and its working contact completes a circuit from ground, armature 61 and its working contact, winding of release relay 65, to battery through the winding of relay 80, and over armature 77 and its resting contact, armature 91 and its resting contact, rotary off-normal spring 101 and its resting contact, to battery through the winding of vertical magnet 98. Release relay 65 energizes in this circuit, but due to its high resistance, relay 80 and vertical magnet 98 are not operated. At armature 66 and its working contact, relay 65 grounds the release trunk conductor 106 which extends over bank contact 51 and wiper 32 of the selector switch to release trunk conductor 7 to replace the ground removed at armature 19 of release relay 15 of the selector switch. At armature 68 and its working contact relay 65 prepares a point in the impulsing circuit and at armature 69 and its resting contact opens a point in the circuit of release magnet 95.

When the calling subscriber dials the next digit, "6", line relay 60 of the connector switch deenergizes a corresponding number of times and sends six impulses to the vertical magnet 98 and to the series relay 80 over the following circuit: from ground at the working contact of armature 68 and said armature, normally closed springs controlled by armature 61, winding of relay 80, to battery, and over a multiple circuit including armature 77 and its resting contact, armature 91 and its resting contact, rotary off-normal spring 101 and its resting contact, winding of vertical magnet 98, to battery. The vertical magnet 98 responds to this series of impulses and raises the switch shaft and wipers six steps to a point opposite the sixth level of the connector bank. Relay 80 energizes at the first impulse of the series, and remains operated throughout the series, being made slow-to-release due to the current through its winding in series with the release relay 65 each time relay 60 energizes. This current is not sufficient to hold relay 80 operated, but is sufficient to make it slow to release so that it will not deenergize between impulses of an impulse train.

At armature 81 and its resting contact, relay 80 disconnects the test wiper 93 from the winding of switching relay 85, and at its working contact connects the test wiper to the winding of busy relay 75. At armature 82 and its working contact, an impulsing circuit for the vertical magnet 98 is completed independent of armature 77 of relay 75, and at armature 83 and its working contact an energizing circuit is prepared for relay 75 which is completed at the first vertical step of the connector. The circuit for relay 75 extends from ground, vertical off-normal spring 97 and its working contact, armature 69 and its working contact, rotary off-normal spring 102 and its resting contact, armature 83 and its working contact, winding of relay 75, to battery. Relay 75, upon operating, at armature 76 and its working contact prepares a locking circuit for itself, at armature 77 and its resting contact it opens the original impulsing circuit to the vertical magnet, and at armature 78 and its working contact prepares a circuit for the rotary magnet 99.

It should be pointed out at this time that the wipers of the connector switch C are normally set two steps to the left of the connector bank, that is, two rotary steps of the switch are required in order to bring the wipers into engagement with the first set of bank contacts in any level. A short time after the cessation of the train of impulses which has

operated the connector vertically to a position opposite the sixth level of bank contacts, relay 80 deenergizes and at the normally-closed springs controlled by armature 81 completes a locking circuit for relay 75 extending from ground on release trunk conductor 106, armature 76 and its working contact, interrupter contacts 100 of rotary magnet 99, normally-closed springs controlled by armature 81, resting contact of armature 89 and said armature, winding of relay 75, to battery. At armature 82 and its working contact, relay 80 opens the impulsing circuit to the vertical magnet, and at armature 83 and its working contact opens the original energizing circuit of relay 75, and at its resting contact completes a circuit for the rotary magnet 99 extending from ground, vertical off-normal spring 97 and its working contact, armature 69 and its working contact, rotary off-normal spring 102 and its resting contact, armature 83 and its resting contact, armature 78 and its working contact, winding of rotary magnet 99, to battery. The rotary magnet energizes and advances the switch wipers one step toward the bank contacts. The rotary off-normal spring 101 is operated by the first rotary step of the switch, but the rotary off-normal spring 102 is not operated until the wipers are brought into engagement with the first set of bank contacts when the switch takes its second rotary step.

Rotary magnet 99, upon energizing, opens its interrupter contacts 100, thereby opening the locking circuit of relay 75. Relay 75 releases, and at armature 76 and its working contact opens a further point in its locking circuit, at armature 77 and its resting contact it closes a point in the impulsing circuit to the rotary magnet 99, and at armature 78 and its working contact it opens a point in the original energizing circuit of the rotary magnet. Rotary off-normal spring 101, upon operating in response to the first rotary step of the switch, transfers the impulsing circuit from the vertical magnet 98 to the rotary magnet 99.

In response to the dialling of the final digit "7" of the called telephone number, line relay 60 releases seven times, thereby sending seven impulses to the rotary magnet 99 over the following circuit: from ground at the working contact of armature 68 and said armature, normally-closed springs controlled by armature 61, armature 77 and its resting contact, armature 91 and its resting contact, rotary off-normal spring 101 and its working contact, winding of rotary magnet 99 to battery. The rotary magnet accordingly energizes at each impulse and steps the switch wipers 92, 93, and 94 into engagement with the seventh set of bank contacts in the sixth level. At the first step of the directive rotary movement, rotary off-normal spring 102 operates and opens the original energizing circuit of relay 75 and of rotary magnet 99.

Series relay 80 energizes at the first impulse and remains operated throughout the impulse train in the manner previously described. At armature 83 and its working contact it again closes a point in the energizing circuit of relay 75, but this circuit is now open at the rotary off-normal spring 102. At armature 82 and its working contact, relay 80 closes a point in the impulsing circuit independent of armature 77 to prevent the opening of the impulsing circuit in case the busy relay 75 should energize while the switch wipers are passing over busy contacts. At armature 81 and its working contact, relay 80 completes the testing circuit extending from test wiper 93, armature 81 and its working contact, resting contact of armature 89 and said armature, winding of busy relay 75, to battery.

It will first be assumed that the subscriber at station T1 is engaged in another connection when the connector C is operated into engagement with bank contacts 107, 108, and 109. In this case, there will be ground potential on the test bank contact 108 and the busy relay 75 will energize in a circuit from ground, bank contact 108, test wiper 93, armature 81 and its working contact, resting contact of armature 89 and said armature, winding of relay 75, to battery. At armature 77 and its resting contact, relay 75 opens a point in the impulsing circuit, and at armature 76 and its working contact prepares a point in its locking circuit which is completed upon the release of relay 80. A short time after the cessation of the impulse train, relay 80 releases and at the normally-closed springs controlled by armature 81 completes the previously-traced locking circuit for the busy test relay 75. At armature 82 and its working contact, relay 80 opens a second point in the impulsing circuit. Relay 75 at armature 79 and its working contact connects the busy tone to the lower talking conductor, thereby informing the calling subscriber that the desired called station is not available at this time. The calling subscriber thereupon hangs up his receiver and releases the established connection in a manner to be hereinafter pointed out.

It will now be assumed that the called line is idle when the connector switch wipers are brought into engagement with bank contacts 107, 108, and 109. In this case, there is no ground potential present upon the bank contact 108, and busy relay 75 will not energize. When relay 80 releases a short time after the cessation of the impulse train, it completes an energizing circuit for the switching relay 85 extending from ground on release trunk conductor 106, armature 76 and its resting contact, lower winding of switching relay 85, resting contact of armature 81

and said armature, test wiper 93, bank contact 108, and thence over conductor 113, to battery through the winding of the cut-off relay of the called lineswitch.

Switching relay 85 energizes in this circuit in series with the cut-off relay of the called lineswitch, and at armature 90 and its working contact closes a locking circuit for itself extending from ground through armature 67 and its working contact. At armature 91 and its resting contact, relay 85 opens a point in the impulsing circuit, at armature 89 and its resting contact it opens a point in the energizing circuit of busy relay 75, at armature 88 and its working contact it connects ground to test wiper 93 to busy the line to other connectors such as C, and at armatures 86 and 87 and their working contacts it completes the ringing circuit extending from interrupter generator over conductor 104, lower winding of ring-cut-off relay 70, resting contact of armature 71 and said armature, working contact of armature 86 and said armature, wiper 92, bank contact 107, conductor 110 of the called line, through the bridged condenser and ringer at the substation T1, conductor 111 of the called line, bank contact 109, wiper 94, armature 87 and its working contact, armature 72 and its resting contact, to ground.

Ringing current is sent out over this circuit to signal the called line, and, when the called subscriber removes his receiver, a direct current bridge is closed across conductors 110 and 111 of the called line and ring-cut-off relay 70 operates over the above-traced ringing circuit. At armature 73 and its working contact, it completes a locking circuit for itself extending from ground at armature 67 of relay 65. At armatures 71 and 72 and their resting contacts, it disconnects the ringing circuit, and at the working contacts of these armatures it completes the talking circuit to the called line. Back bridge relay 55 energizes over the called loop responsive to the energization of ring-cut-off relay 70, and at armatures 56 and 57 and their working contacts reverses the battery connection of line relay 60 to the calling line to operate the calling subscriber's meter in the usual manner.

When the conversation is completed and the called subscriber at station T1 hangs up his receiver, the bridge across the called line is opened and back bridge relay 55 releases and restores the normal battery connections to the calling line. When the calling subscriber at station T replaces his receiver, the circuit of line relay 60 is opened and this relay accordingly deenergizes. At armature 61 and its working contact, it opens the circuit of release relay 65, and at the normally-closed springs controlled by this armature it short circuits the winding of the release relay to make it slow to release. After an interval, relay 65 releases and at armature 67 and its working contact opens the locking circuits of the ring-cut-off relay 70 and switching relay 85. At armature 66 and its working contact it removes ground from release trunk conductor 106 to bring about the release of the selector switch S. At armature 69 and its back contact, release relay 65 closes a circuit for the release magnet 95 extending from ground, vertical off-normal spring 97 and its working contact, armature 69 and its resting contact, release link spring 96 and its resting contact, winding of release magnet 95, to battery.

The release link 115 and the manner in which it controls spring 96 is the same as disclosed in Patent No. 1,612,767, issued December 28, 1926, to Clarence E. Lomax. When release magnet 95 energizes and brings about the release of the switch, the release link 115 locks the double dog (not shown) in an operated position until the switch shaft has returned to its normal position, and at the same time operates spring 96. With spring 96 in its operated position, the circuit of release magnet 95 is opened and the release ground is transferred to the slow alarm equipment over conductor 103. In case the switch does not completely restore to normal, the slow alarm equipment (not shown) brings in an alarm to call attention to the fact that one of the connector switches has not properly released. When the connector shaft reaches its normal position, the vertical off-normal spring 97 is opened, thereby removing ground from conductor 103 and from the slow-acting alarm equipment. The release link is forced out of engagement with the double dog as soon as the connector has returned to normal and returns the spring 96 to its normal position, thereby again preparing the release circuit to the winding of release magnet 95. This special releasing arrangement does away with the continued energization of the release magnet in case the switch sticks off-normal and does not completely restore to its normal position.

The removal of ground from release trunk conductor 106 upon the release of relay 65 opens the circuit of relays 20 and 25 of the selector switch S. Relay 20 in releasing at armature 21 and its resting contact closes a circuit to the release magnet 39 extending from ground, vertical off-normal spring 36 and its working contact, armature 21 and its resting contact, armature 18 and its resting contact, release link spring 40 and its resting contact, winding of release magnet 39, to battery. Release magnet 39 energizes to bring about the release of the selector switch and the release link 48 operates spring 40 to transfer the release ground from the winding of the release magnet to the slow-acting alarm equipment over conductor 45 in the same

manner as pointed out in connection with the release of the connector switch C. As soon as selector switch S has returned to normal vertical off-normal spring 36 is operated, thereby removing ground from the slow-acting alarm equipment and release link spring 40 is returned to normal, thereby again preparing a circuit for release magnet 39. All apparatus used in the connection has now been restored to its normal condition.

Having described the invention, what is thought to be new and is desired to have protected by Letters Patent will be pointed out in the appended claims.

What is claimed is:

1. In an automatic switch having directive primary and secondary movements, a control circuit over which the primary operation of said switch is effected, a second control circuit over which the secondary operation of said switch is effected, and means automatically operative at the end of the primary movement for causing said switch to take one secondary step, and means responsive to said secondary step for effecting the change-over from the primary to the secondary control circuit.

2. In an automatic switch having vertical and rotary movements, an impulsing circuit for controlling said switch in its vertical movement, a second impulsing circuit for controlling said switch in its rotary movement, means responsive to the cessation of the vertical movement for operating said switch one step in its rotary movement, and rotary off-normal springs operated by said rotary step and effective to effect the change-over from said first to said second impulsing circuit.

3. In a switch control circuit for automatic switching devices having primary and secondary movements, an impulsing circuit over which impulses are transmitted to control the switch in its two movements, said circuit terminating in two branches, means for operating said switch in its primary movement over the first of said branches, means responsive to the cessation of said primary movement for causing said switch to take one step in its secondary movement, and means responsive to said last means for transferring said impulsing circuit to the second of said branches.

4. In a two-motion automatic switch, a primary magnet and a secondary magnet, an impulsing circuit extending to said primary magnet, means for sending impulses over said circuit to control said switch in its primary movement, means responsive to the cessation of said primary movement for operating said switch one step in its secondary movement, and means responsive to said operation for transferring said impulsing circuit to said secondary magnet.

5. In a step-by-step connector switch having primary and secondary movements, means for directively operating said switch in its primary movement, a secondary magnet, means responsive to the cessation of said primary movement for sending a single impulse to said secondary magnet to cause said switch to take one secondary step, and means for thereafter directively controlling said switch in its secondary movement.

6. In a connector switch having vertical and rotary movements, means for directively operating said switch in its vertical movement, a first and a second relay energized throughout said vertical movement, a locking circuit for said first relay closed by the deenergization of said second relay at the termination of said vertical movement, a rotary magnet, and a circuit for said rotary magnet including make contacts on said first relay and back contacts on said second relay.

7. In a connector switch having vertical and rotary movements, means for directively operating said switch in its vertical movement, a first and a second relay energized throughout said vertical movement, a locking circuit for said first relay closed by the deenergization of said second relay at the termination of said vertical movement, a rotary magnet, a circuit for said rotary magnet including make contacts on said first relay and back contacts on said second relay, and interrupter contacts on said rotary magnet for opening the locking circuit of said first relay.

8. In an automatic switch having directive primary and secondary movements, means for operating said switch in its primary movement, means responsive to the cessation of said primary movement for automatically operating said switch in its secondary movement, and means responsive to said automatic secondary operation for effecting the change-over from the directive primary to the directive secondary movement.

9. In an automatic switch having directive primary and secondary movements, means for directively moving said switch in its primary movement, means responsive to the cessation of said primary movement for causing an automatic movement of said switch, and means responsive to said automatic movement for preparing said switch for its directive secondary movement.

10. In an automatic switch having primary and secondary movements, a control circuit over which said switch is directively controlled in its primary movement, a second control circuit over which said switch is directively controlled in its secondary movement, means for causing an automatic movement of said switch at the end of the directive primary movement, and means responsive to said automatic movement for effect-

ing the changeover from said first to said second control circuit.

11. In combination, an automatic switch, said switch having a progressively movable selecting element, a control circuit, primary operating means for said selecting element directively responsive to a selective control exercised over said circuit, automatic means for moving said selecting element responsive to the cessation of said selective control, and secondary operating means for said selecting element rendered responsive by the automatic movement of said selecting element to a second selective control exercised over said circuit.

In witness whereof, I hereunto subscribe my name this 26th day of June, A. D. 1931.

NORMAN H. SAUNDERS.