Aug. 16, 1949. R. TAYLOR ET AL 2,479,276

COMBINATION TOLL AND LOCAL CONNECTOR SWITCH USED IN TELEPHONE SYSTEMS

Filed April 26, 1945

3 Sheets-Sheet 1

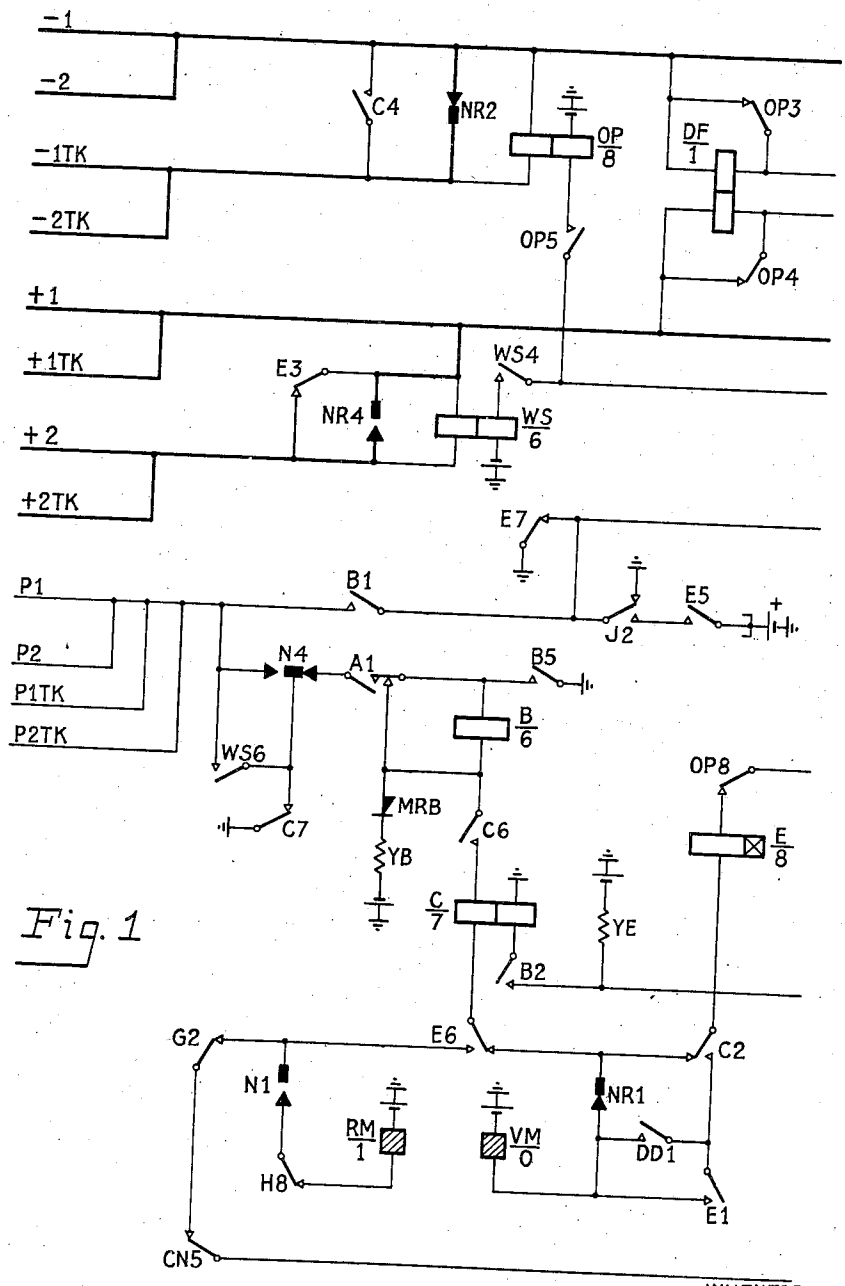


Fig. 1

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3 Sheets-Sheet 2

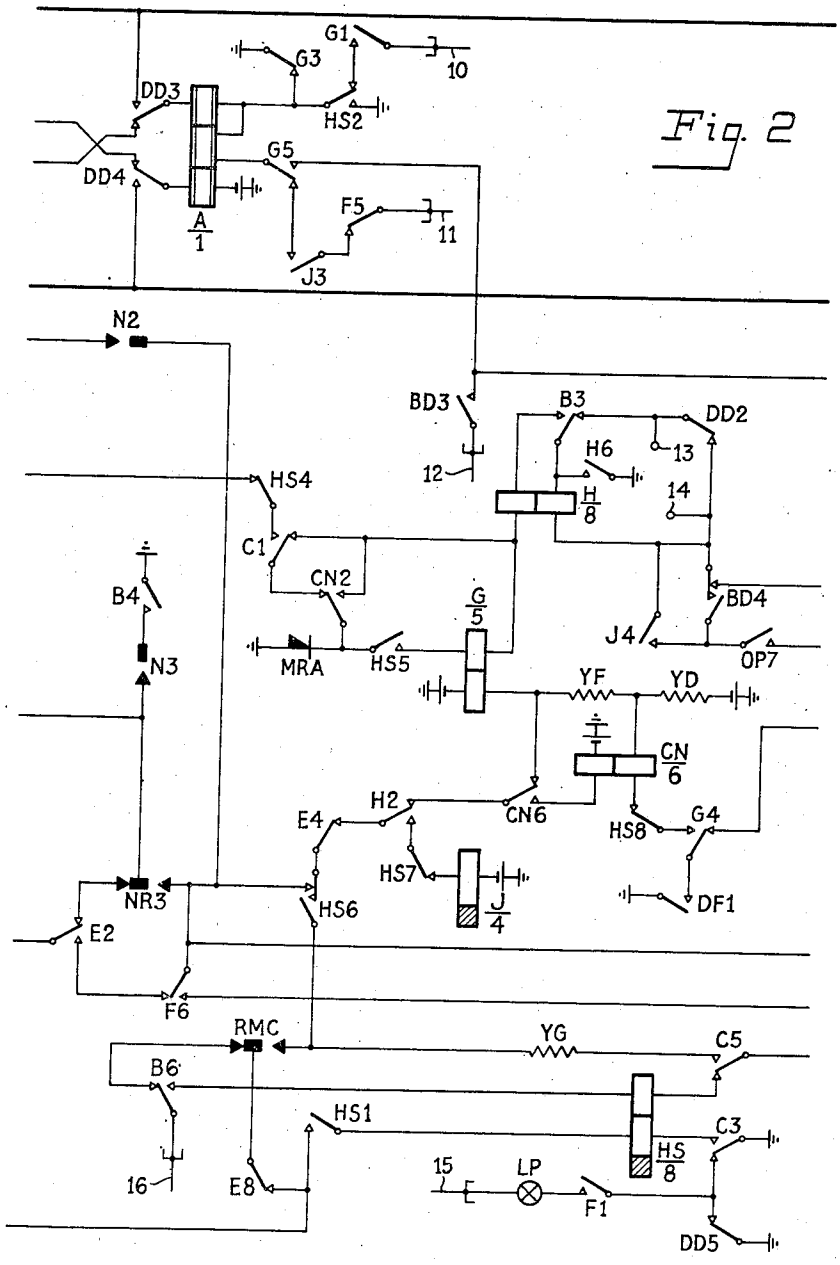


Fig. 2

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3 Sheets-Sheet 3

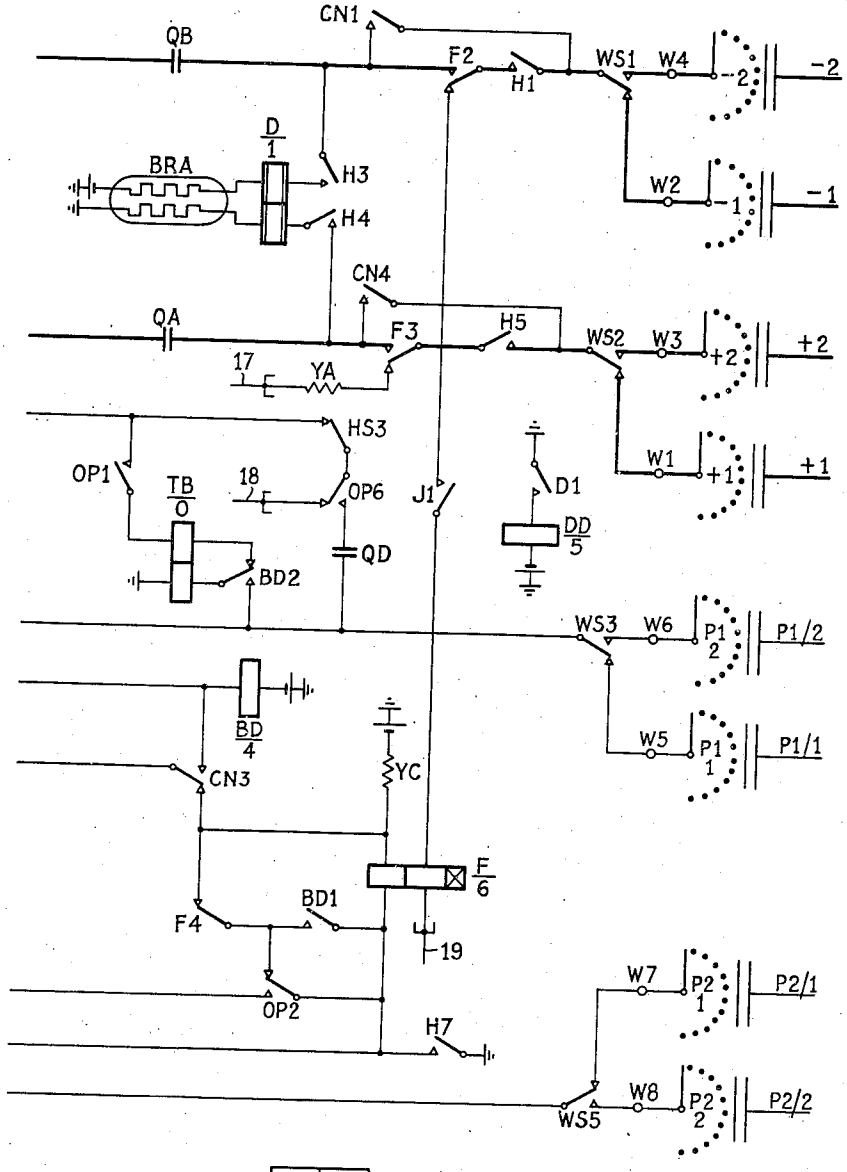


Fig. 3

N/4	NR/4

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UNITED STATES PATENT OFFICE

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COMBINATION TOLL AND LOCAL CONNECTOR SWITCH USED IN TELEPHONE SYSTEMS

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Application April 26, 1945, Serial No. 590,471
In Great Britain June 15, 1944

9 Claims. (Cl. 179—27)

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The present invention relates to automatic switches of the type used in telephone or like systems and is more particularly concerned with so-called final selectors by which access is gained to a wanted party's line. The general object of the invention is to provide an improved switch circuit giving additional facilities and particularly enabling an operator to control the setting up of long distance connections when this involves cutting in on and subsequently breaking down an existing connection.

According to one feature of the invention, in a final selector switch arranged to be accessible to both operators and subscribers over different means of access, equipment responsive to seizure of the switch over one means of access but not over the other is arranged to effect circuit changes such that when the switch is seized by an operator it is responsible to control signals transmitted from the operator's position to which it is otherwise unresponsive.

According to another feature of the invention, in a final selector switch arranged to permit an operator to cut in on and break down an existing connection, if the switch is positioned on to a busy line a signal suitable for flashing a supervisory lamp is transmitted back from the switch while in addition a tone signal is or is not sent back according to the nature of the existing connection.

A further feature of the invention is that in a final selecton switch arranged to be accessible to both operators and subscribers over different means of access, if the switch is positioned on to a busy line by a subscriber he receives the same signal whether the called party is engaged in a long distance or a local connection while if the switch is positioned on to a busy line by an operator she receives a different busy signal according to the nature of the existing connection.

The invention will be better understood from the following description of one method of carrying it into effect which should be taken in conjunction with the accompanying drawings comprising Figs. 1, 2 and 3. These when placed side by side in order with Fig. 1 on the left show the circuit of a 200-point P. B. X final selector with groups of from 2 to 10 lines but it will be understood that the main features of the invention are also applicable to regular final selectors and to P. B. X. final selectors arranged to cater for groups greater than 10. Moreover the features of the invention are not limited to final selectors provided with two sets of wipers.

The switch in question is of the well-known

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vertical and rotary type arranged to have so-called rectangular release, i. e. without a separate release magnet and is provided with two sets of wipers the selection of which is dependent upon the level of the preceding selector over which the switch is seized. The switch moreover is accessible to both subscribers and operators so that there are four different means of access corresponding respectively to subscriber seizure over two different levels and operator seizure over two different levels.

It will be assumed first that the switch is taken into use by a subscriber over a selector level such that the normal set of wipers is used, that is to say over the line conductors —1 and +1. When this occurs, relay A is operated over the line and at contacts A1 completes a circuit for relay B by way of contacts C7 and N4, rectifier MRB and resistor YB. Rectifier MRB is included in this circuit in accordance with known practice in order to prevent the low resistance battery connection having a slugging effect on the operating magnets during subsequent impulsing. Relay B on operating, at contacts B1 earths the incoming P conductor, at contacts B2 completes a circuit for the right-hand winding of relay C in series with resistor YE, at contacts B3, Fig. 2, prepares a circuit for relay H, at contacts B4 prepares a circuit for relay E and a shunt for relay C, at contacts B5 completes a locking circuit for itself, and at contacts B6 opens a point in the release circuit and prepares a circuit for relay HS. Relay C operates at this time and at contacts C1, Fig. 2, opens a point in the circuit of relay H and prepares for the subsequent metering operation, at contacts C2 changes over the circuit of relay E, at contacts C3 prepares a locking circuit for relay HS, at contacts C4 provides an additional shunt for the left-hand winding of relay OP, at contacts C5 prepares a locking circuit for relay G, at contacts C6 closes a point in the impulsing circuit and at contacts C7 opens a point in the circuit for guarding the switch during release conditions.

No further operations take place until the succeeding digit is transmitted, whereupon relay A deenergises in accordance with the impulses and on each de-energisation completes a circuit from earth over contacts B5, A1 and C6, left-hand low-resistance winding of relay C, contacts E6 and NR1, vertical magnet VM to battery. The switch wipers are thus raised to the appropriate level and on the first step the off-normal contacts close, whereupon at contacts N1 a circuit is prepared for the rotary magnet RM, at contacts

N2 a locking circuit is prepared for relays WS and OP, at contacts N3 the right-hand winding of relay C is short-circuited and at contacts N4 the initial circuit of relay B is opened and a guarding circuit is prepared. Relay C is rendered slow by the short-circuiting of its right-hand winding and remains energised as long as impulses are transmitted through its left-hand winding. At the end of the train it de-energises and thereupon at contacts C2 completes a circuit for relay E in series with the vertical magnet VM which is not now operative. Relay E at contacts E1 prepares a locking circuit for itself, at contacts E2 removes the short-circuit from relay C which therefore again energises, at contacts E3 removes the short-circuit from the left-hand winding of relay WS, at contacts E4, Fig. 2, opens a point in the circuit of relays G and J, at contacts E5 closes a point in the booster battery metering circuit, at contacts E6 changes over the impulsing circuit to the rotary magnet RM, at contacts E7 removes one of the multiple earths from the P conductor and at contacts E8 opens a point in the release circuit.

The switch is now ready for the final digit and when this is received, relay A responds as before. Corresponding impulses are therefore transmitted through the left-hand winding of relay C and over contacts E6, N1 and H8 to the rotary magnet RM which accordingly advances the wipers into engagement with the desired line. On the first rotary step the rotary off-normal contacts are operated, thereupon at contacts NR1 opening the initial circuit of relay E, at contacts NR2 removing one of the shunts round the left-hand winding of relay OP, at contacts NR3 again short-circuiting relay C and at contacts NR4 short-circuiting the left-hand winding of relay WS. Accordingly at the end of the train of impulses relay C again releases and at contacts C1 provides an operating earth for relay H and at contacts C2 opens the locking circuit of relay E which commences to release slowly.

If the line is busy, the P1 wiper will encounter earth and relay H will be short-circuited and therefore unable to operate. Hence, on the release of relay E a circuit is completed from earth over contacts B4, N3, NR3, HS6, E4, H2 and CN6 to battery through the lower winding of relay G. Relay G accordingly operates and at contacts G1 connects up flash battery from common lead 10, which will be ineffective in the present case since a subscriber is calling, at contacts G2, Fig. 1, opens a point in the release circuit, at contacts G3 removes the normal earth connection from the upper winding of relay A so that the flash battery may be effective, at contacts G4 prepares a circuit for relay CN and at contacts G5 connects up busy tone which extends to the middle winding of relay A by way of common lead 18 and contacts OP6 and HS3. The subscriber accordingly hears busy tone and realizes that he cannot obtain his connection.

When he subsequently replaces his receiver, relay A de-energises and at contacts A1 short-circuits relay B which accordingly releases after its slow period. Relay B brings down relays C and G and a release circuit for the switch is then completed over common lead 16 which extends to earth by way of delayed alarm equipment, contacts B6, RMC, E8, CN5, G2, N1 and H8, rotary magnet RM to battery. The rotary magnet therefor advances the wipers to the 12th position after which they fall and rotate back to normal underneath the bank by spring tension. The rotary magnet circuit is opened at contacts N1 when normal position is reached. During the release operation, guarding earth is applied to the P conductor by way of contacts C7 and N4.

If the wanted party is idle, however, wiper P1 will encounter battery and this will be extended over contacts WS3, BD4, right-hand winding of relay H, contacts B3, left-hand winding of relay H, contacts C1 and CN2, rectifier MRA to earth. It may be mentioned that the purpose of the rectifier MRA is to prevent the operation of relay H in case the line is busy but wiper P1 picks up booster battery because a metering operation is taking place. Relay H on operating, at contacts H1 and H5 connects up the line wipers, at contacts H2 prepares a circuit for relay J, at contacts H3 and H4 connects the back bridge relay D to the speaking conductors, at contacts H6 short-circuits its high resistance left-hand winding to busy the line, at contacts H7 prepares a locking circuit for relay F and at contacts H8 opens a point in the release circuit. The circuit of relay J is completed as soon as relay E releases and thereupon at contacts J1 is connects up ringing current by way of common lead 19 and the right-hand winding of ring trip relay F to the negative conductor, the ringing return being by way of resistor YA and common lead 17, at contacts J2 prepares the metering circuit, at contacts J3 connects ringing tone from common lead 11 to the middle winding of relay A and at contacts J4 prepares a circuit for relay BD.

The wanted party is now rung in the usual manner and when he replies, relay F operates and thereupon at contacts F1 prepares the circuit of the supervisory lamp LP which extends to battery over delayed alarm equipment by way of common lead 15, at contacts F2 and F3 disconnects the ringing circuit and switches the speaking leads through, at contacts F4 removes the short-circuit from its left-hand winding thereby providing an effective locking circuit in series with resistor YC, at contacts F5 opens the ringing tone circuit and at contacts F6 prepares an alternative locking circuit for relays WS and OP and prevents relay C being short-circuited on the subsequent re-operation of relay E. When the speaking conductors are switched through, relay D is operated over the called party's loop and at contacts D1 brings up its relief relay DD. This relay at contacts DD1 completes a circuit for relay E, at contacts DD2 opens a point in a short-circuit round the right-hand winding of relay H, at contacts DD3 and DD4 reverses the connections of relay A to the incoming line to give the usual supervision and at contacts DD5 opens a point in the circuit of the supervisory lamp LP. The operation of relay E at this time at contacts E5 connects booster battery to the P conductor to effect metering and also at contacts E4 opens the circuit of relay J. During the release time of relay J therefore, the booster battery metering condition is maintained and the call is accordingly charged against the calling party. Rectifier MIA at this stage serves to prevent release of the preceding switches while the metering contacts are changing over. The connection has now been fully set up and the parties may converse.

The circuit as shown is arranged for last party release. Assuming that the called party hangs up first, relay D then releases and brings down relay DD. Thereupon the current flow over the incoming conductors is reversed back to normal and at contacts DD5 a circuit is prepared for the supervisory lamp LP which is thus effective after

a predetermined interval to give a called subscriber hold alarm. When the calling party subsequently hangs up, relay A is released and brings down relay B which thereupon releases relay C which in turn brings down relay E. Moreover, owing to the release of relays B and DD, the right-hand winding of relay H is short-circuited and it therefore releases, bringing down relay F. Thereupon, the previously traced self-interrupted circuit for the rotary magnet RM is again completed and the switch is restored to normal as described earlier. If the calling subscriber hangs up first, relays A, B, C and E release and the supervisory lamp is lighted after a suitable interval over contacts C3. During the release time of relay C there is no earth on the incoming P conductor and this permits the release of the preceding switches but this earth is replaced at contacts C7 when relay C finally releases so as to maintain the switch guarded as long as it is off-normal. When the called party subsequently hangs up, relays D and DD release and the right-hand winding of relay H is then short-circuited so that it releases and brings down relay F and the usual release circuit is completed as above described. If the switch is to be arranged for calling party release, terminals 13 and 14, Fig. 2, are strapped so that on the release of relay B, relay H will be short-circuited at contacts B3 regardless of the condition of relay DD. It will be seen that on the release of relay H the circuits over the speaking conductors and the P conductors are opened simultaneously by contacts of relay H which gives a clean release operation and permits a greater margin of variation in relay adjustment.

If the switch is taken into use by a subscriber from the other selector level, i. e. over conductors −2 and +2, the left-hand winding of relay WS is included in the line circuit on the operation of contacts E3 at the end of the vertical movement. Accordingly, relay WS is operated in series with relay A and at its contacts WS4 prepares a locking circuit over its right-hand winding and at its contacts WS1, WS2, WS3 and WS5 changes over to the second set of wipers. The left-hand winding of relay WS is short-circuited by the rotary off-normal contacts NR4 as soon as the switch commences its rotary movement in response to the final digit, while the locking circuit is completed at contacts NR3. Relay WS remains locked up until the connection is released.

Consider now the case in which the calling party calls a P. B. X group instead of an individual line. P. B. X hunting is controlled over the P2 wiper in the bank of which battery is connected to the first line of a P. B. X group and earth to the last line, while intermediate lines and also ordinary subscribers' lines are unwired. When relay C releases at the end of the rotary digit, battery picked up by the P2 wiper from the first line of the group is extended over contacts WS5 and C5, upper winding of relay HS, contacts B6 and common lead 15 to the release alarm earth and relay HS is therefore operated. Thereupon at contacts HS1 it prepares a circuit for its lower winding and the rotary magnet RM in series, at contacts HS2 provides an alternative earth for the upper winding of relay A to maintain this relay operated while relay G is energised during the hunting operation, at contacts HS3 opens the busy tone circuit over common lead 18, at contacts HS4 disconnects the rectifier MRA from the incoming P conductor, at contacts HS5 prepares a circuit for relays G and H in series, at contacts HS6 prepares a holding circuit for relay G, at contacts HS7 opens a point in the circuit of relay J and at contacts HS8 opens a point in the circuit of relay CN.

If the first line of the group is busy, wiper P1 encounters earth and relay H is unable to operate and on the subsequent release of relay E and the re-operation of relay C, a circuit is completed from earth, contacts C3, lower winding of relay HS which is of low resistance, contacts HS1, CN5, G2, N1 and H8, rotary magnet RM to battery. The magnet is operated in this circuit and advances the wipers a further step while relay HS is maintained operated. The magnet interrupter contacts RMC are also operated and extend low resistance earth over contacts HS6, E4, H2 and CN6 to the lower winding of relay G. This relay thereupon operates and at contacts G2 opens the circuit of the rotary magnet which therefore de-energises. If the line now engaged is also busy, relay H and the upper winding of relay G will be short-circuited and consequently relay H will still fail to operate while relay G will be de-energised when the interrupter contacts RMC again open on the release of the rotary magnet. The magnet circuit is therefore again completed at contacts G2 and the switch wipers are advanced a further step. This operation continues until an idle line is encountered or the last line of the group is reached and is found busy. If there is an idle line, when it is reached relay G is held over its upper winding in series with relay H. Relay H then at contacts H6 short-circuits its own left-hand winding and the upper winding of relay G and also at contacts H8 opens another point in the rotary magnet circuit so that no further operation takes place when relay G releases. When impulses are no longer transmitted to the rotary magnet relay HS releases after its slow period. If all the lines of the group are busy, when the last line of the group is reached, earth on the P2 contact is extended over contacts C5, resistor YG, contacts HS6, E4, H2 and CN6 to maintain relay G. No further circuit is then completed for relay HS and it de-energises in turn, leaving relay G locked up over contacts NR3, N3 and B4 and permitting the busy signal to become effective so that the calling party is notified that he cannot obtain his connection.

The case will now be considered in which the switch is taken into use from an operator's position by way of leads −1TK and +1TK. The setting of the switch in response to the vertical and rotary digits takes place in the manner previously described but on the release of relay C at the end of the rotary digit, the left-hand winding of relay OP is momentarily included in the line circuit in series with relay A. Relay OP therefore operates and at contacts OP1 connects both windings of the retard TB to the tone signalling lead for a purpose which will be appreciated subsequently, at contacts OP2 operates relay F by way of its left-hand winding, at contacts OP3 and OP4 removes the normal short-circuit from the windings of the differential relay DF which is therefore included in the line circuit in series with relay A, at contacts OP5 completes a locking circuit for itself over its right-hand winding, at contacts OP6 connects the tone signalling lead to the outgoing P conductor by way of capacitor QD, at contacts OP7 prepares a circuit for relay BD and at contacts OP8 opens a point in the circuit of relay E. It will be appreciated that the arrangement whereby the windings of relay DF are normally short-

circuited ensures that the signalling operations proper to an operator cannot be performed by a subscriber either due to a fault on his line or with malicious intent. Moreover, the fact that the windings of this relay are not included in the line circuit during impulsing improves the response of relay A. The immediate operation of relay F ensures that ringing shall not be started automatically when connection is made with the wanted line and this feature is desirable to cater for the case in which the operator is completing a delayed call and does not wish to signal the called party until she has the calling party back on the line.

Assuming that the wanted party is idle, relay H operates in normal manner and brings up relay J whereupon a circuit is completed from earth, contacts H6, low resistance winding of relay H, contacts J4 and OP7, winding of relay BD to battery. Relay BD thereupon at contacts BD1 prepares a circuit for short-circuiting the left-hand winding of relay F, at contacts BD2 connects the low resistance lower winding of retard TB to the P conductor for guarding and holding purposes, at contacts BD3 extends busy tone from common lead 12 over contacts HS3 and OP6 and capacitor QD to the P conductor and at contacts BD4 disconnects relay H from this conductor and connects it in series with relay BD. The wanted line has therefore been seized and marked busy but no signalling has yet taken place. When the operator subsequently wishes to complete the connection, she throws her ringing key thereby earthing the line and thus unbalancing relay DF which accordingly operates and at contacts DF1 extends earth over contacts G4 and CN3 to short-circuit relay F. Relay F then deenergizes and connects up ringing current in the usual manner and owing to the operation of contacts BD1, relay F remains short-circuited after the operator releases the ringing key and is only re-operated over its right-hand winding when the wanted party replies. Relays D and DD are then energised but owing to the opening of contacts OP8 no circuit is completed for relay E and metering does not take place. In these circumstances relay J remains operated for the remainder of the connection.

If the operator finds the wanted line busy, earth will be picked up by the P1 wiper so that relay H cannot operate and relay B is energised by way of its lower winding in the usual manner on the release of relay E. Thereupon the operator receives a busy flash signal by the intermittent connection of earth and battery to common lead 10 but if the subscriber is busy in a local connection she does not receive tone since relay BD is not yet operated and the normal tone connection over lead 18 has been cut off at contacts OP6. It will be noted that during the flash periods, that is to say while battery is connected to lead 10, relay A is maintained operated over its middle winding in series with the two windings of retard TB. The operator, being thus notified that a local connection is concerned, may decide to cut in on the connection in which case she again operates her ringing key to earth the line and energises relay DF. In these circumstances a circuit is completed over contacts DF1, G4 and HS8 and the right-hand winding of relay CN to battery by way of resistor YD. Relay CN thereupon at contacts CN1 and CN4 connects the speaking leads through to the line wipers, at contacts CN2 provides an operating earth for relay H, at contacts CN3 prepares a circuit for relay BD, at contacts CN5 opens a point in the rotary magnet circuit and at contacts CN6 opens the circuit of relay G and locks up over its left-hand winding. Relay G holds in series with the right-hand winding of relay CN by way of resistor YF and thus does not fall away until the ringing key is released. The operator may now converse with the wanted party and may if necessary break down the existing connection by further operation of the ringing key. In this case contacts DF1 extend earth over contacts G4 and CN3 to operate relay BD. Relay BD thereupon by connecting the low resistance lower winding of the retard TB to the P conductor breaks down the existing connection. It will be understood that if the wanted party is the calling party in the existing connection this low resistance earth shunts down the cut-off relay in his line circuit, which may be of the type disclosed in our application Serial No. 567,551, filed December 11, 1944, now Patent No. 2,424,519 dated July 22, 1947, while if he is the called party, it shunts down the H relay in the final selector. When the key is released, relay H operates in series with relay BD and releases relay CN. Relay J now operates and the operator may initiate ringing by a further manipulation of her key as previously described.

If, on the other hand, the subscriber is engaged in a long distance connection, tone from common lead 12 applied to the P conductor in the existing connection will be extended over capacitor QD and contacts OP6, HS3 and G5 to the middle winding of relay A and the operator will therefore receive both busy flash and tone and will thus know that it is not desirable for her to disturb the existing connection.

It will be appreciated that if the operator seizes the switch by way of the other means of access, that is to say over the leads —2TK and +2TK, relay WS will be operated between the two digits and will connect up the second set of wipers. All the other operations take place as just described.

It will be understood that if desired the tones from the two sources, that is to say over leads 12 and 18 respectively might be of a different amplitude and/or different frequency or with a different code of interruption. This would be primarily for the benefit of a maintenance man or monitoring operation, since the regular operator always receives tone from one source only, namely over lead 12, while a calling subscriber always receives tone from the other source only, namely over lead 18.

It may be mentioned that if a P. B. X group is concerned it may be the practice for the operator to connect herself to the last line of the group by dialling the appropriate number on the assumption that this line is most likely to be free. If, however, she finds that a trunk connection is involved thereover, she will release the connection which she has set up and dial an intermediate line in the group in the hope of finding a line engaged in a local connection which she can then break down.

According to the invention, therefore, an improved final selector has been provided which without sacrificing reliability of operation or involving an appreciable increase in the amount of equipment required gives additional facilities which in some circumstances may be of considerable advantage.

We claim:

1. In a telephone system, a connector switch,

a path accessible to an operator over which the switch may be seized, a path accessible to subscribers over which the switch may be seized, means in the switch controllable by said operator for controlling the switch, means normally short-circuiting said first means thereby rendering said first means normally inoperative, said first means remaining short-circuited when the switch is seized and operated by a subscriber over said second path, and means in said first path operated after the switch has been seized over that path for causing the disablement of said short-circuiting means thereby to render said first means effective and subject to control by said operator.

2. A telephone system as claimed in claim 1 in which said means in said first path comprises a relay which is included only momentarily in said first path.

3. In a telephone system, a plurality of lines certain of which may be busy in toll calls or in local calls, a switch having access to said busy lines, said switch accessible to an operator and operable to seize one of said busy lines, means in said switch responsive to the seizure of one of said busy lines under control of said operator for giving said operator a busy flash signal whether said seized line is busy in a toll call or in a local call, and means responsive to said seizure of said one busy line for returning a tone signal to said operator only if said seized line is busy in a toll call.

4. In a telephone system, a combination toll and local connector operable by an operator over one path and by local subscribers over another path, said paths having talking conductors, a relay momentarily included in one of said talking conductors of said one path after said connector has been operated by said operator over said one path, means for operating said relay responsive to said momentary inclusion of said relay in said one talking conductor of said one path, said relay not included in a talking conductor of said other path when said connector is operated by a local subscriber over said other path.

5. In a telephone system, a connector switch, local lines accessible to said switch, different paths over which said switch may be seized by a local line or an operator, a relay in said switch normally short-circuited, means in said switch operated when said switch is seized and operated by said local line over one of said paths for selecting and signalling a called local line, another relay in said switch, means in said switch for causing the momentary inclusion of said other relay in said other path when said switch is seized and operated over said other path, said other relay operated responsive to said inclusion to remove said short-circuit from said first relay, and means controlled by said first relay when said short-circuit is removed for controlling the selecting and signalling operations of said switch in a different manner.

6. In a telephone system, a combination local and toll connector switch operable by local stations over one path and by an operator over another path, said other path having talking conductors, means in said connector for automatically signalling a called local station, said means effective when said switch is operated by one of said local stations over said one path, a relay momentarily included in one of said talking conductors of said other path when said switch is operated by said operator over said other path, means for operating said relay responsive to said momentary inclusion of said relay in said one talking conductor of said other path, said operation of said relay causing the disablement of said first means.

7. In a telephone system, a plurality of lines certain of which are busy in telephone connections, a switch having operating conductors and a line relay connected to said conductors, said busy lines accessible to said switch, said line relay of said switch operable by an operator over said conductors for causing said switch to seize one of said lines, an auxiliary holding circuit, another relay in said switch, means in said switch responsive to the operation of said switch by said operator for momentarily including said other relay in one of said conductors, said other relay operated responsive to its momentary inclusion in said one conductor to connect said auxiliary holding circuit to said operated line relay, means in said switch responsive to the seizure of one of said busy lines for giving said operator an interrupted signal to indicate to said operator that said seized line is busy in a telephone connection, said interrupted signal intermittently disabling said first connection of said line relay, said auxiliary holding circuit maintaining said line relay operated during the intermittent periods said interrupted signal disables said first connection of said line relay.

8. In a telephone system, a switch operable over a path having talking conductors, a relay in said switch normally short-circuited, means in said switch responsive to the operation of said switch over said path for momentarily removing said short-circuit from said relay thereby to momentarily include said relay in one of said talking conductors, said relay operating in response to said momentary inclusion in said one talking conductor, and means in said switch for retaining said relay in said operated position.

9. In a telephone system, a switch operable over a path having talking conductors, a relay in said switch having two windings, means in said switch short-circuiting one of said windings of said relay, means in said switch responsive to the operation of said switch over said path for disabling said short-circuiting means thereby to include said one winding of said relay in one of said talking conductors, means responsive to said inclusion of said one winding in said one talking conductor for causing said relay to operate, means in said switch including said other winding of said relay for causing said relay to lock in said operated position, and means in said switch for thereafter short-circuiting said one winding of said relay.

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