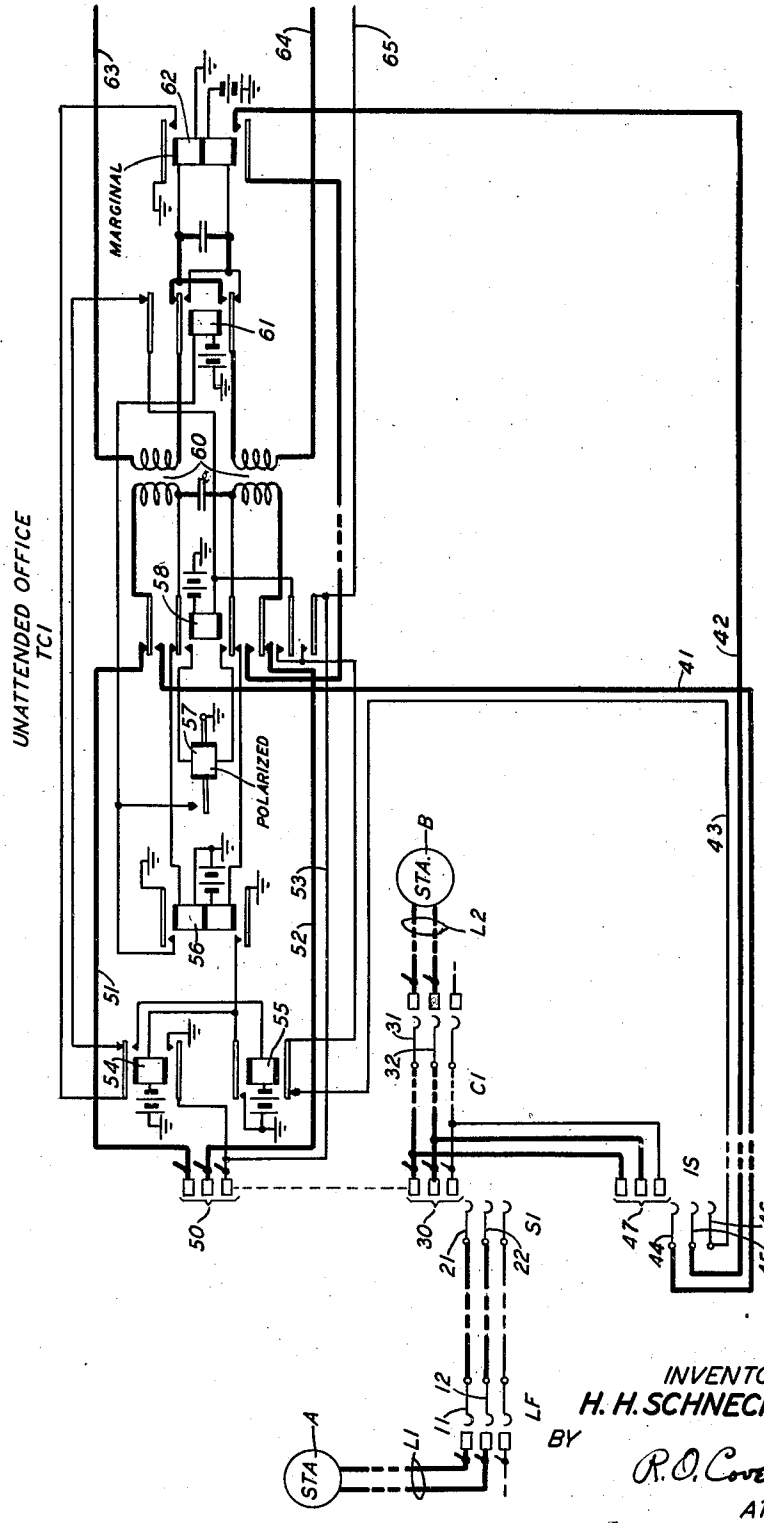
March 20, 1945. H. H. SCHNECKLOTH 2,372,022

SIGNALING SYSTEM

Filed July 3, 1943 2 Sheets-Sheet 1

FIG. 1



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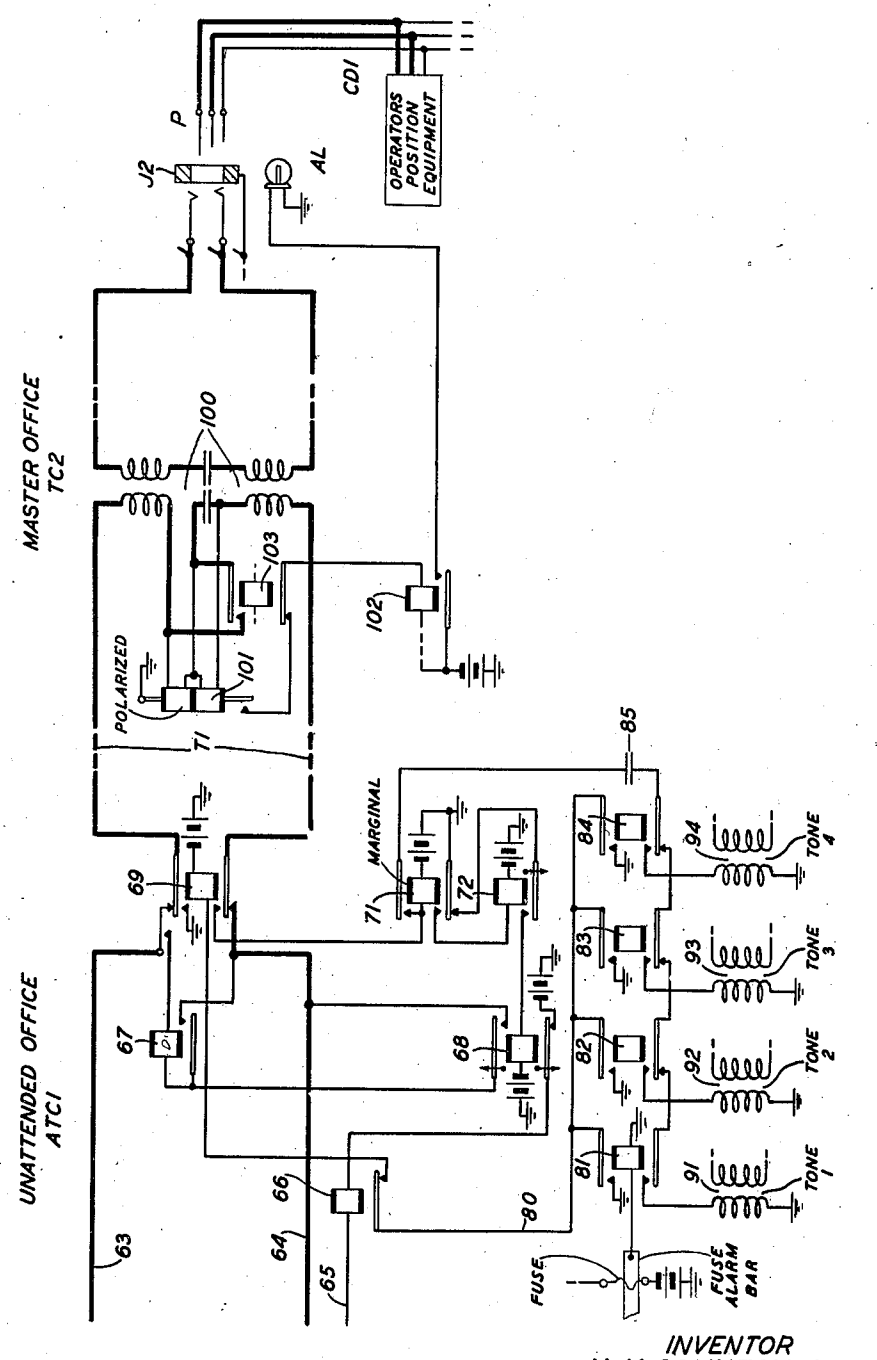

FIG. 2

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2,372,022

SIGNALING SYSTEM

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Application July 3, 1943, Serial No. 493,333

19 Claims. (Cl. 179—27)

This invention relates to telephone systems and particularly to systems comprising an unattended automatic office.

Objects of the invention are the improvement of the equipment provided in an unattended automatic office for the transmission of maintenance alarms to a master office and an increase in the efficiency of a system comprising an unattended automatic office.

This invention is an arrangement which enables the transmission of a maintenance alarm over a line without interfering with the use of the line on a regular call.

According to a feature of the invention, means are provided in an unattended office for selectively connecting to a particular line one of a plurality of tone sources responsive to the initiation of a call over said particular line, the particular tone thus transmitted being indicative of the character of the trouble condition then existing in the unattended office. According to a further feature of the invention means are provided in the unattended office for disconnecting the trouble tone from the line or trunk responsive to seizure of the line in the unattended office for use on a regular call.

These and other features of the invention will be further explained by considering the system in which the invention is embodied, one such system being shown in the drawings which are a part of this specification. The invention is not limited, however, to the particular system disclosed in the drawings or to a system comprising switches of any particular type, but is generally applicable to any automatic switching system comprising an unattended central office.

Referring to the drawings, Fig. 1 represents a part of an unattended automatic telephone office comprising a subscriber's station A and line L1, a line finder LF, a first selector S1, an incoming selector IS, a connector C1, a called subscriber's line L2 and station B, and a trunk circuit TC1 connected to a set of terminals in the bank of the selector S1; and

Fig. 2 shows in the same unattended office, alarm equipment comprising an auxiliary trunk circuit ATC1 connecting the trunk circuit TC1 of Fig. 1 to an outgoing trunk T1 extending to a master office; Fig. 2 further shows, in the master office, a trunk circuit TC2 terminating the trunk T1 and an operator's position comprising the cord CD1.

The line finder, selector and connector switches may be of the well-known two-motion step-by-step type. Reference may be had to "Automatic Telephony" by Smith and Campbell, second edition, pages 53 to 65 for a description of the structure of such switches and their operation when used as selectors and connectors. Reference may be had to the patent to R. L. Stokely 1,799,654, April 7, 1931, and the patent to T. L. Dimond 2,210,068, August 6, 1940, for a description of the operation of two-motion step-by-step switches when used as line finders.

The subscribers' stations A and B and the other stations of the unattended office are of the type usually provided on lines terminating in common battery central offices; and each includes a dial or other impulse sender for controlling the operation of the automatic switches through which desired connections are established. The line finder LF, selector S1, incoming selector IS and connector C1 are each represented by a set of brushes and one or two sets of terminals of the associated terminal bank, all other apparatus being omitted. Each of the line finders such as LF is individually associated with a first selector such as S1; and these selectors may have direct access to groups of outgoing trunks and connector switches as shown in the drawings. If, however, the number of subscribers in the office makes necessary the provision of one or more additional stages of selection, intermediate selectors will be provided.

The trunk T1, which represents a group of two-way trunks between the unattended office and an operator's position in the master office, is normally connected in the unattended office to the two-way trunk circuit TC1. In the attended office the trunk T1 terminates in a two-way trunk circuit TC2. The trunk circuits TC1 and TC2 are similar to the trunk circuits TC1 and TC3 disclosed in the patent to J. N. Walters 2,262,595, granted November 11, 1941. Reference may be had to the patent to King et al. 2,208,765, granted July 23, 1940, for a complete disclosure of the cord and operator's position circuits. Only so much of the trunk circuits TC1 and TC2 is shown as is necessary to afford a complete disclosure of applicant's invention.

An auxiliary trunk circuit ATC1 is associated with a particular one of the trunks T1 in the group between the unattended and master offices to enable the transmission of trouble signals to the master office. A similar trunk circuit may be associated with another of the trunks in this group to provide for the transmission of trouble tones to the master office in case the first trunk is disabled or temporarily removed. The trunk

circuit ATC1 enables the transmission of maintenance alarms over the trunk circuit T1 to the master office on trouble checking calls from the master office and the removal of the tone if a regular cell is being established. This trunk circuit comprises a line relay 71, a relay 69 for transferring the conductors of trunk T1 from relay 62 of trunk circuit TC1 to relay 71, a slow-to-release relay 72, a sleeve relay 66, and control relays 67 and 78.

The alarm equipment further comprises a plurality of alarm relays 81, 82, 83 and 84 and a corresponding plurality of tone sources 91, 92, 93 and 94. Each of relays 81, 82, 83 and 84 is operatively responsive to the occurrence of a different type or severity of trouble in the unattended office, the operation of any of these relays being effective to operate relay 69, providing the trunk T1 is not then engaged on a regular call, to prepare for the connection of the associated tone source to the trunk T1.

Assume first that no trouble condition exists in the unattended office when a call is initiated at station A. A line finder LF is operated to connect the line L1 to a first selector S1; and, when the calling subscriber dials the first digit of a called subscriber's number or special service code, the selector S1 is selectively operated to select the corresponding level of the terminal bank and to select therein the first idle set of terminals, which terminals are connected to a connector C1 in the case of a local call or to a trunk circuit associated with a trunk to the master office. If the call is a local call, the dialing of the succeeding digits of the called subscriber's number effects the completion of the call in usual and well-known manner. If the call is other than a local call and assuming the trunk circuit TC1 to be associated with the selected set of terminals in the level giving access to the group of trunks to the master office, relay 56 is operated in a circuit traced from battery through the lower winding of relay 56, inner lower back contact of relay 58, lower left winding of repeating coil 60, another back contact of relay 58, conductor 52, terminal of terminal set 50 which is engaged by brush 22 of selector S1, brush 12 and engaged terminal of line finder LF, over the conductors of line L1 and through the telephone at the calling station A, through the terminal engaged by brush 11 of line finder LF, brush 21 and engaged terminal of selector S1, conductor 51, outer upper back contact of relay 58, upper left winding of repeating coil 60, inner upper back contact of relay 58, and upper winding of relay 56, to ground. The operation of relay 56 closes a circuit for operating the slow-to-release relay 61 and closes a circuit for operating relay 54. The operation of relay 54 connects ground potential, through conductor 53, to the terminal engaged by brush 23 of selector S1 to hold the selector S1 and line finder LF in usual manner and to prevent the selection of trunk circuit TC1 by any other selector having access thereto. Normally there is a closed circuit over the conductors of trunk T1, which circuit is traced from the negative pole of battery through the lower winding of relay 62, lower back contact of relay 61, lower right winding of repeating coil 60, conductor 64, lower back contact of relay 69, lower conductor of trunk T1, lower left winding of repeating coil 100, both windings of relay 101, upper left winding of repeating coil 100, upper conductor of trunk T1, upper back contact of relay 69, conductor 63, upper right winding of repeating coil 60, inner upper back contact of relay 61, and upper winding of relay 62 to ground. Relay 62 is not operated by the current in this circuit because it is marginal and the upper winding of relay 101 is a high resistance winding; and relay 101 is not operated because it is polarized and the current is in the non-operative direction. The aforementioned operation of relay 61 interchanges the connections between the windings of marginal relay 62 and conductors 63 and 64, thereby to reverse the direction of the current over trunk T1 to effect the operation of polarized relay 101 of trunk circuit TC2 in the master office. The connection of ground to conductor 53 also completes a circuit, through conductor 65 and the winding of relay 66 to battery at a back contact of relay 68, for operating relay 66 to prevent the operation of relay 69 in case one of relays 81, 82, 83 and 84 should operate before the call from station A is terminated. The operation of relay 101 closes a circuit for operating relay 102; and the operation of relay 102 closes a circuit for lighting the answering lamp AL associated with the jack J2. When an operator inserts the plug P of a cord CD1 in jack J2 to answer the call, relay 103 is operated, in the manner described in the aforementioned patent to Walters, to release relay 102 and extinguish lamp AL. The operation of relay 103 also short-circuits the upper, high resistance winding of relay 101 thereby to increase the current in the circuit over trunk T1 to operate marginal relay 62. The operation of relay 62 closes a circuit, including the upper front contact of relay 54, for operating relay 55; and the operation of relay 55 closes a circuit for holding relay 54 operated independent of the continued operation of relay 56. When the calling subscriber releases the connection by restoring the telephone to normal, relay 56 releases. The release of relay 56 causes the release of relay 61; but relay 54 remains operated until relay 55 releases. The release of relay 61, reverses the current over conductors 63 and 64 and trunk T1 to release polarized relay 101 of trunk circuit TC2, whereby a cord supervisory lamp (not shown) is energized as described in the aforementioned King et al. patent. When the plug P is removed from jack J2, the release of relay 103 opens the short-circuit across the upper winding of relay 101 thereby causing the release of marginal relay 62 of trunk circuit TC1. The release of relay 62 causes the successive release of relays 55 and 54. The release of relay 54 disconnects the busy and holding ground potential from conductor 53 thereby causing the release of relay 66 of trunk circuit ATC1 and the return of selector S1 and line finder LF to normal in usual and well-known manner.

If an operator in the master office inserts the plug P of a cord CD1 in jack J2 to initiate a call over trunk T1 to the unattended office, relay 103 is operated in the manner described in the aforementioned patent to Walters. The operation of relay 103 short-circuits the upper winding of relay 101; and, if relay 69 of the auxiliary trunk circuit ATC1 is not operated, the increase in current through the conductors of trunk T1 effects the operation of marginal relay 62 of trunk circuit TC1. The operation of relay 62 closes a circuit including back contacts of relays 54 and 61 for operating relay 58. The operation of relay 58 connects the winding of polarized relay 57 in series with the left windings of repeating coil 60 across conductors 41 and 42 of incoming selector IS, thereby to prepare this selector for response to dial impulse transmitted over trunk

T1 to relay 62 when the operator in the master office dials the number of the called subscriber in the unattended office. The operation of relay 58 closes a connection from the ground at the front contact of relay 62, through back contacts of relays 54 and 61 and the two outer lower front contacts of relay 58 to conductors 53 and 65 to mark the trunk circuit TC1 busy in the banks of selectors S1 and to operate relay 66 to prevent the operation of relay 69 before this call is terminated. The preparation of selector IS effects the connection of ground to conductor 43 in usual manner, this ground being further connected through a back contact of relay 55 and front contact of relay 58, to conductors 53 and 65. When the called number is dialed by the calling operator, the selector IS is selectively operated to select an idle connector C1 having access to the called subscriber's line L2; and the connector is selectively operated to complete the connection with this line. If the called line is idle, the called station is signaled; and, when the call is answered, the current through conductors 41 and 42 is reversed to operate relay 57. The operation of relay 57 closes a circuit for operating relay 61, thereby reversing the current through conductors 63 and 64 and trunk T1 to operate polarized relay 101. While relay 61 is operated, relay 58 is held operated by ground connected through brush 46 to conductor 43. The operation of relay 101 is effective to extinguish a supervisory lamp (not shown) in the cord CD1 to indicate that the call has been answered. When the called subscriber restores the telephone to normal, relay 57 is released, relay 61 releases, relay 101 releases and the supervisory lamp is again lighted to indicate that the called subscriber has restored the telephone to normal. When the calling operator removes the plug from jack J2, relay 103 releases and relay 62 releases. The release of relay 62 releases relay 58 and disconnects ground from conductors 53 and 65 thereby to render trunk circuit TC1 selectable by selectors S1 and to release relay 66 to enable the operation of relay 69 if and when one of the trouble relays is operated.

When any one of relays 81, 82, 83 and 84 operates due to the occurrence of trouble in the unattended office, and if at this time trunk T1 is not in use, a circuit is closed through conductor 80 and the back contact of relay 66 for operating relay 69. Relay 81 operates as a result of the operation of a fuse and each of relays 82, 83 and 84 is operative due to the occurrence of more severe trouble conditions, relay 84 being operated responsive to the most serious of the various trouble conditions which may exist. The operation of relay 69 disconnects trunk circuit TC1 from trunk T1, connects marginal relay 71 to trunk T1, and connects the winding of relay 67 to conductor 63 of trunk circuit TC1. If an operator in the master office inserts a plug in jack J2, while relay 69 is operated, either for the purpose of initiating a call to a line in the unattended office or for the purpose of determining whether a trouble condition exists in the unattended office, the short-circuiting of the upper winding of relay 101 causes the operation of marginal relay 71, whereby the tone source corresponding to the operated one of relays 81, 82, 83 and 84 is connected through condenser 85 and front contacts of relays 71 and 69 to trunk T1 to transmit a trouble indicating tone to the operator. If after a tone source indicative of one type of trouble has been connected to condenser 85, a more severe type of trouble occurs, another one of the trouble relays is operated and the corresponding tone source is connected to condenser 85 in place of the tone source previously connected thereto. The aforementioned operation of relay 71 also closes a circuit for operating slow-to-release relay 72. If the operator is checking for the existence of trouble, removal of the plug from jack J2 causes the opening of the short-circuit across the upper winding of relay 101 thereby causing the release of relay 71. The release of relay 71 causes the operation of relay 68, the release of relay 72, and the release of relay 68 in the order named. The operation of relay 68 completes a bridge comprising the winding of relay 67 across conductors 63 and 64 to effect the operation of relays 62 and 58 of trunk circuit TC1, thereby to connect ground to conductors 53 and 65. Relay 67 operates in series with relay 62 and locks independently of relay 68. When relay 68 releases, relay 66 is operated in the circuit through conductor 65, outer lower front contacts of relay 58, and back contacts of relays 61 and 54 to ground at the upper front contact of relay 62, thereby causing the release of relay 69. The release of relay 69 causes the release of relays 67 and 62; and the release of relay 62 causes the release of relays 58 and 66. If one of relays 81, 82, 83 and 84 is operated when relay 66 releases, relay 69 is reoperated and relay 71 is again connected to trunk T1.

If an operator wishes to complete a connection to a called line in the unattended office, and a trouble tone is transmitted over trunk T1 to the calling operator responsive to insertion of the plug of a cord in jack J2, the operator may effect the disconnection of the tone by dialing a digit, for instance the digit 1. The momentary release of relay 71, responsive to the dial impulse thereby repeated over trunk T1, causes the operation of relays 68, 67, 62 and 58 in the manner above described. At the end of the impulse, relay 71 reoperates and relay 68 is released. Relay 72 remains operated during the response of relay 71 to dial impulses. The release of relay 68 causes the operation of relay 66 and release of relays 69 and 67 as above described. The release of relay 69 also causes the release of relays 71 and 72, and relay 62 is held operated over trunk T1 in series with the lower winding of relay 104. The operator may now dial the called subscriber's number and the call is completed as above described. Relay 66 remains operated thereby preventing the reoperation of relay 69 until the connection is released.

If a trouble condition exists and relay 69 is operated at a time when a selector S1 is hunting for an idle trunk to the master office, the trunk circuit TC1 does not test busy and may be selected. If trunk circuit TC1 is selected while relay 69 is operated, the connection of ground to conductors 53 and 65, when relay 54 operates, causes the operation of relay 66 thereby causing the release of relay 69 so that the call can be completed in the manner hereinbefore described.

The trunk circuit ATC1 may be associated with an incoming one-way trunk instead of a two-way trunk. In the case of some unattended offices, it may be desirable to transmit trouble tone indications over a particular subscriber's line rather than transmit such signals to an attended office. In such a case the trunk circuit ATC1 is connected between this particular subscriber's line and the associated line circuit. This subscriber may check for the existence of trouble

and may, of course, make regular calls. If a trouble condition exists at a time that the subscriber desires to make a regular call, the trouble tone may be disconnected by the dialing of a digit.

What is claimed is:

1. In a central office of a telephone system, lines including subscribers' lines, means responsive to the initiation of a call at the distant end of a particular one of said lines while a trouble condition exists in said office for transmitting over said line a distinctive tone to indicate the existence of said trouble condition.

2. In a central office of a telephone system, lines including subscribers' lines, means responsive to the initiation of a call at the distant end of a particular one of said lines while a trouble condition exists in said office for transmitting over said line a distinctive tone to indicate the existence of said trouble condition, and means controlled over said line for terminating the transmission of said tone over said line.

3. In a central office of a telephone system, lines including subscribers' lines, subscriber controled switching means for establishing connections between calling and called lines, means including means normally responsive to the initiation of a call at the distant end of a particular one of said lines for connecting said one line to said switching means, means responsive to the initiation of a call at the distant end of said one line while a trouble condition exists in said office for transmitting over said one line a distinctive tone to indicate the existence and character of the trouble condition, and means controlled over said one line for ending the transmisison of said tone over said line.

4. In a central office of a telephone system, lines including subscribers' lines, subscriber controlled switching means for establishing connections between calling and called lines, means including call responsive means normally connected to a particular one of said lines for connecting said one line to said switching means upon initiation of a call at the distant end of said one line, other call responsive means for responding to the initiation of a call at the distant end of said one line, means responsive to a trouble condition in said office for connecting said other call responsive means to said line in place of said normally connected call responsive means, and means rendered effective by the operation of said other call responsive means for transmitting over said line a distinctive tone indicative of the trouble condition which exists in said office.

5. In a central office of a telephone system, lines including subscribers' lines, subscriber controled switching means for establishing connections between calling and called lines, means including call responsive means normally connected to a particular one of said lines for connecting said one line to said switching means upon initiation of a call at the distant end of said one line, other call responsive means for responding to the initiation of a call at the distant end of said one line, means responsive to a trouble condition in said office for connecting said other call responsive means to said line in place of said normally connected call responsive means, means rendered effective by the operation of said other call responsive means for transmitting over said line a distinctive tone indicative of the trouble condition which exists in said office, and means controlled over said one line for ending the transmission of said tone over said line.

6. In a central office of a telephone system, lines including subscribers' lines, subscriber controlled switching means for establishing connections between calling and called lines, means including call responsive means normally connected to a particular one of said lines for connecting said one line to said switching means upon initiation of a call over said one line, other call responsive means for responding to the initiation of a call over said one line, means responsive to a trouble condition in said office for connecting said other call responsive means to said line in place of said normally connected call responsive means, means rendered effective by the operation of said other call responsive means for transmitting over said line a distinctive tone indicative of the trouble condition which exists in said office, and means controlled over said one line for effecting the reconnection of said one line to said normally responsive means.

7. In a central office of a telephone system, lines including subscribers' lines, subscriber controlled switching means for establishing connections between calling and called lines, means including call responsive means normally connected to a particular one of said lines for connecting said one line to said switching means upon initiation of a call over said one line, other call responsive means for responding to the initiation of a call over said one line, means responsive to a trouble condition in said office for connecting said other call responsive means to said line in place of said normally connected call responsive means, and means rendered effective by the operation of said other call responsive means for transmitting over said line a distinctive tone indicative of the trouble condition which exists in said office, and means controlled over said one line for disconnecting said one line from said other means to end the transmission of said tone and for connecting said one line to said normally responsive means to effect the connection of said one line to said switching means.

8. In a central office of a telephone system, lines including subscribers' lines, subscriber controlled switching means for establishing connections between calling and called lines, a plurality of tone sources each producing a tone of a different character and corresponding to a different trouble condition in said office, means including means individual to one of said lines rendered effective by the occurrence of trouble in said office and the initiation of a call at the distant end of said one line for connecting to said one line that one of said tone sources which identifies the trouble then existing in said office, and means controlled over said one line for disconnecting said tone source from said line.

9. In a central office of a telephone system, lines including subscribers' lines, subscriber controlled switching means for establishing connections between calling and called lines, means including call responsive means individual to one of said lines and normally connected thereto for connecting said line to said switching means responsive to the initiation of a call over said one line, a plurality of trouble tone sources, the tone from each of said sources being indicative of a different trouble condition in said office, a plurality of relays, one for each of said tone sources, means responsive to a trouble condition for operating the relay which is associated with the tone source which corresponds to the character of the trouble, other call responsive means individual to said one line, means responsive to the operation of any

one of said plurality of relays for transferring said one line from the normally connected one of said call responsive means to said other call responsive means, the operation of said other call responsive means being effective to connect the tone source which is associated with the operated one of said plurality of relays to said line, and means controlled over said one line for transferring said one line from said other call responsive means to said normally connected call responsive means.

10. In a central office of a telephone system, lines including subscribers' lines, subscriber controlled switching means for establishing connections between calling and called lines, means including call responsive means individually and normally connected to a particular one of said lines for effecting the connection of said one line to said switching means upon initiation of a call over said one line, other means individual to said one line responsive to the initiation of a call over said one line, means responsive to a trouble condition in said office for disconnecting said one line from said normally connected call responsive means and for connecting said one line to said other means, and means effective responsive to seizure of said one line by said switching means for disconnecting said one line from said other means and for connecting said one line to said normally connected call responsive means.

11. In a central office of a telephone system, lines including subscribers' lines, subscriber controlled switching means for establishing connections between calling and called lines, means including call responsive mans normally connected to a particular one of said lines for connecting said one line to said switching means upon initiation of a call over said one line, other call responsive means for responding to the initiation of a call over said one line, means responsive to a trouble condition in said office for connecting said other call responsive means to said line in place of said normally connected call responsive means, means rendered effective by the operation of said other call responsive means for transmitting over said line a distinctive tone indicative of the trouble condition which exists in said office, and means effective responsive to seizure of said one line by said switching means while said one line is connected to said other call responsive means for effecting the disconnection of said one line from said other call responsive means and the reconnection of said one line to said normally connected call responsive means.

12. In a central office of a telephone system, lines including subscribers' lines, subscriber controlled switching means for establishing connections between calling and called lines, means including call responsive means individually and normally connected to a particular one of said lines for effecting the connection of said one line to said switching means upon initiation of a call over said one line, other means individual to said one line responsive to the initiation of a call over said one line, means responsive to a trouble condition in said office for disconnecting said one line from said normally connected call responsive means and for connecting said one line to said other means, means rendered effective by the operation of said other means for transmitting over said one line a tone indicative of the trouble condition existing in said office, and means effective responsive to seizure of said one line by said switching means for disconnecting said one line from said other means and for connecting said one line to said normally connected call responsive means.

13. In a central office of a telephone system, lines including subscribers' lines, subscriber controlled switching means for establishing connections between calling and called lines, means including call responsive means individually and normally connected to a particular one of said lines for effecting the connection of said one line to said switching means upon initiation of a call over said one line, other means individual to said one line responsive to the initiation of a call over said one line, means responsive to a trouble condition in said office for disconnecting said one line from said normally connected call responsive means and for connecting said one line to said other means, means rendered effective by the operation of said other means for transmitting over said one line a tone indicative of the trouble condition existing in said office, and means controlled over said one line for effecting the disconnection of said one line from said other means and the reconnection of said one line to said normally connected call responsive means.

14. In a telephone system, an unattended office, an attended office, trunk lines between said offices, one of said lines being used for transmitting trouble signals from said unattended to said attended office, a relay in said unattended office normally connected to said one line for response to seizure of said one line in said attended office, another relay in said unattended office for response to seizure of said one line in said attended office, means responsive to a trouble condition in said unattended office for connecting said other relay to said one line in place of the normally connected relay, and means in said unattended office rendered effective by the operation of said other relay for transmitting a tone signal over said one line to said attended office to indicate the character of the trouble condition then existing in said unattended office.

15. In a telephone system, an unattended office, an attended office, trunk lines between said offices, one of said lines being used for transmitting trouble signals from said unattended to said attended office, a relay in said unattended office normally connected to said one line for response to seizure of said one line in said attended office, another relay in said unattended office for response to seizure of said one line in said attended office, means responsive to a trouble condition in said unattended office for conecting said other relay to said one line in place of the normally connected relay, means in said unattended office rendered effective by the operation of said other relay for transmitting a tone signal over said one line to said attended office to indicate the character of the trouble condition then existing in said unattended office, and means controlled over said one line for ending the transmission of said tone signal.

16. In a telephone system, an unattended office, an attended office, trunk lines between said offices, one of said lines being used for transmitting trouble signals from said unattended to said attended office, a relay in said unattended office normally connected to said one line for response to seizure of said one line in said attended office, another relay in said unattended office for response to seizure of said one line in said attended office, means responsive to a trouble condition in said unattended office for connecting

said other relay to said one line in place of the normally connected relay, means in said unattended office rendered effective by the operation of said other relay for transmitting a tone signal over said one line to said attended office to indicate the character of the trouble condition then existing in said unattended office, and means controlled over said one line for effecting the disconnection of said one line from said other relay and the reconnection of said one line to said normally connected relay.

17. In a telephone system, an unattended office comprising subscribers' lines, an attended office, trunk lines between said offices, automatic switching means in said unattended office for completing connections between calling and called lines, a particular one of said trunk lines being used for the transmission of trouble signals from said unattended office to said attended office, means in said unattended office for seizing any one of said trunk lines on a call to said attended office, a relay in said unattended office normally connected to said particular trunk line for response to seizure of said particular trunk line in said attended office, another call responsive relay in said unattended office for said particular trunk line, means responsive to a trouble condition in said unattended office for connecting said other relay to said particular trunk line in place of said normally connected relay, means rendered effective by the operation of said other relay responsive to seizure of said particular trunk line in said attended office for transmitting a tone over said particular trunk line to said attended office to indicate the character of the trouble condition then existing in said unattended office, and means responsive to seizure of said trunk line by the automatic switching means in said unattended office on a call to said attended office while a trouble condition exists in said unattended office for effecting the disconnection of said other relay from said particular trunk line and the reconnection of said normally connected relay to said particular trunk line.

18. In a telephone system, an unattended office comprising subscribers' lines, an attended office, trunk lines between said offices, automatic switching means in said unattended office for completing connection between calling and called lines, a particular one of said trunk lines being used for the transmission of trouble signals from said unattended office to said attended office, means in said unattended office for seizing any one of said trunk lines on a call to said attended office, a relay in said unattended office normally connected to said particular trunk line for response to seizure of said particular trunk line in said attended office, another call responsive relay in said unattended office for said particular trunk line, means responsive to a trouble condition in said unattended office for connecting said other relay to said particular trunk line in place of said normally connected relay, means rendered effective by the operation of said other relay responsive to seizure of said particular trunk line in said attended office for transmitting a tone over said particular trunk line to said attended office to indicate the character of the trouble condition then existing in said unattended office, means responsive to seizure of said trunk line by the automatic switching means in said unattended office on a call to said attended office while a trouble condition exists in said unattended office for effecting the disconnection of said other relay from said particular trunk line and the reconnection of said normally connected relay to said particular trunk line, and means in said unattended office controllable over said particular trunk line while said other relay is connected thereto for effecting the disconnection of said other relay from said particular trunk line and the reconnection of said normally connected relay to said particular trunk line.

19. In a telephone system, an unattended office comprising subscribers' lines, an attended office, trunk lines between said offices, automatic switching means in said unattended office for interconnecting calling and called lines, a particular one of said trunk lines being used for the transmission of trouble signals from said unattended office to said attended office, a trunk circuit in said unattended office normally connected to said particular trunk line, a call responsive relay in said unattended office normally disconnected from said particular trunk line, a transfer relay in said unattended office having normally closed contacts for connecting said particular trunk line to said trunk circuit and normally open contacts connecting said particular trunk line to said relay, a plurality of tone sources in said unattended office, each tone source producing a tone characterizing a different trouble condition, a plurality of trouble relays, one for each trouble condition, means responsive to a trouble condition in said unattended office for operating the corresponding one of said trouble relays, the operation of any one of said trouble relays being effective to operate said transfer relay to connect said call responsive relay to said particular trunk line, means including contacts of said transfer and call responsive relays and contacts of the operated one of said trouble relays and the associated one of said tone sources for transmitting a trouble tone over said particular trunk line to said attended office responsive to seizure of said particular trunk line in said attended office, means controlled over said particular trunk line for causing the release of said transfer relay to disconnect said one tone source from and reconnect said particular trunk line to said trunk circuit, and means responsive to seizure of said trunk circuit by said switching means on a call to said attended office for preventing the operation of said transfer relay if a trouble condition occurs after seizure of said particular trunk line and for causing the release of said transfer relay in case said transfer relay is operated at the time of seizure of said particular trunk line by said switching means.

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