Dec. 24, 1946. H. H. SCHNECKLOTH 2,413,001

COMMUNICATION SYSTEM

Filed Sept. 2, 1944 3 Sheets-Sheet 1

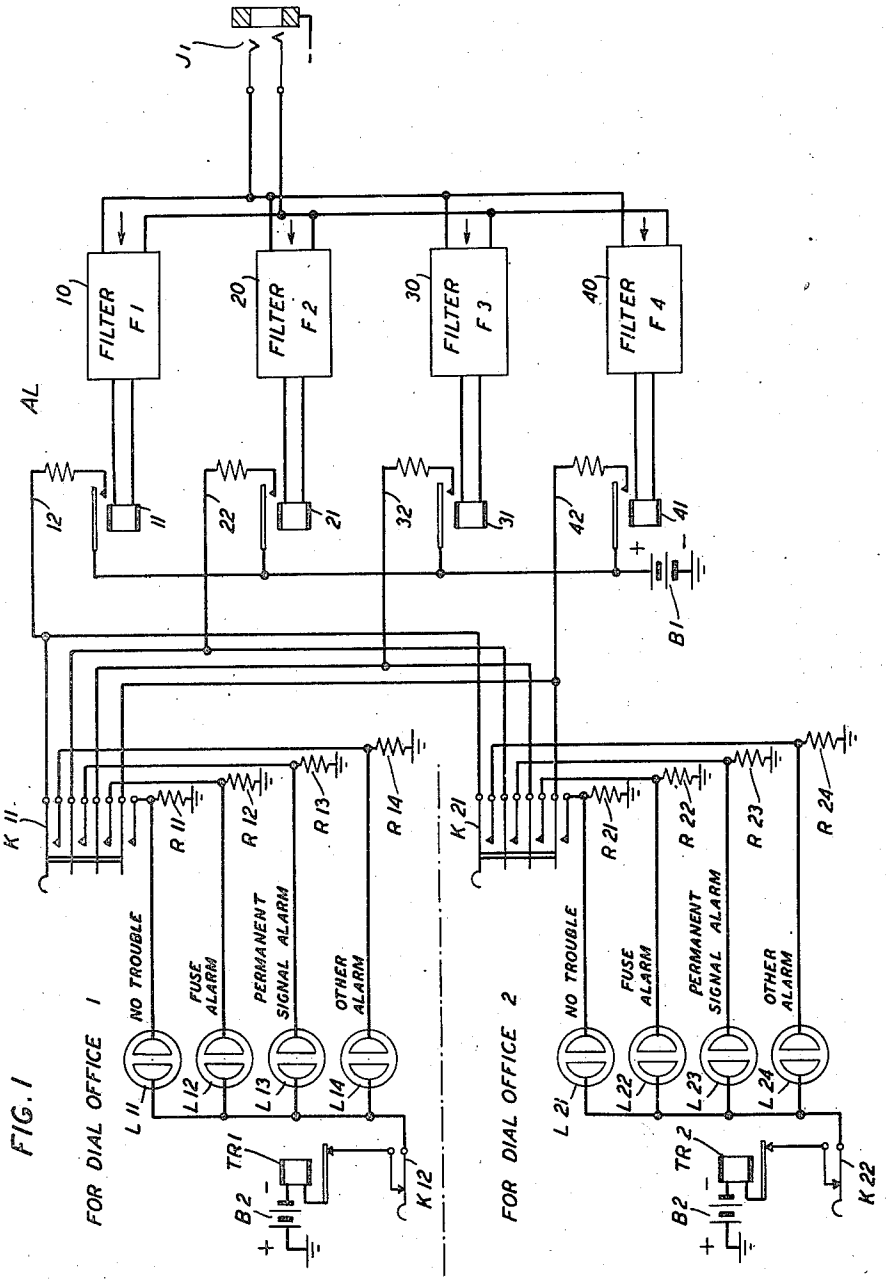


FIG. 1

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COMMUNICATION SYSTEM

Filed Sept. 2, 1944 3 Sheets-Sheet 2

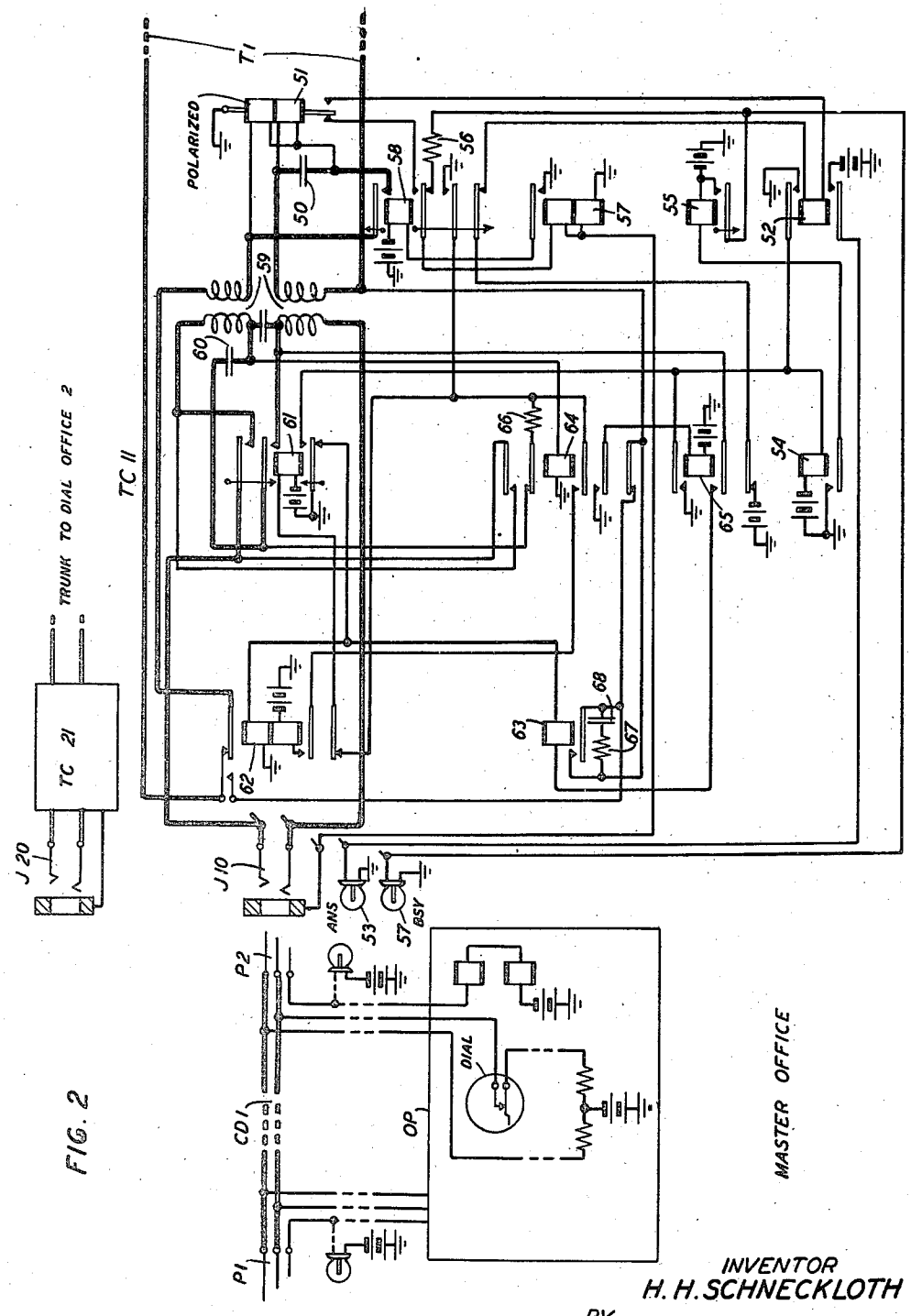


FIG. 2

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COMMUNICATION SYSTEM

Filed Sept. 2, 1944 3 Sheets-Sheet 3

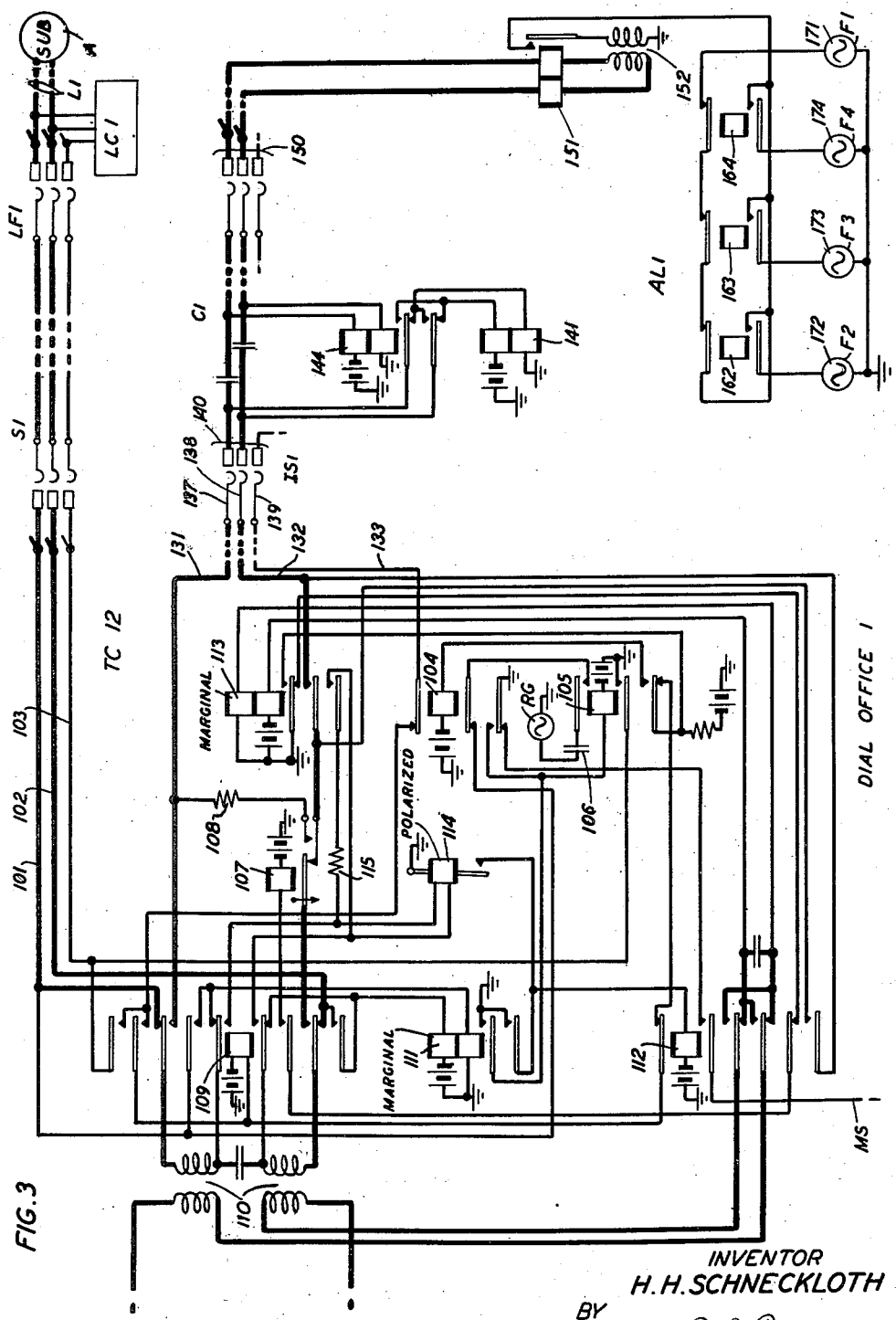


FIG. 3

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UNITED STATES PATENT OFFICE

2,413,001

COMMUNICATION SYSTEM

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Application September 2, 1944, Serial No. 552,418

22 Claims. (Cl. 179—175.2)

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This invention relates to telephone systems and particularly to systems comprising a master office and one or more unattended automatic offices.

It is the object of the invention to improve the arrangements for transmitting alarm signals from unattended automatic offices to a master office.

It is usual to provide alarm apparatus in an unattended dial office which is effective when a trouble condition exists to seize a trunk to a master office and upon answer of the call by an operator in the master office to transmit a tone signal to indicate that the call is a trouble alarm call from the unattended office. It is also known to provide a trouble checking line in the unattended office with which connection may be established on a call from an operator or maintenance test man in the master office to determine whether any trouble exists, and the character of the trouble, in the unattended office.

This invention is an improved alarm arrangement in a system comprising an attended master office and a plurality of unattended dial offices whereby on a trouble checking call initiated by an operator in the master office to any one of the unattended dial offices, signals are transmitted from the unattended office to operate a visual signal apparatus in the master office indicating that no trouble exists in the dial office or indicating the character of the trouble which does exist in the dial office, there being a set of such signals in the master office for each dial office from which alarm signals are received.

A feature of the invention is the provision of signal transmitting apparatus in an unattended dial office for transmitting to a master office voice frequency signals of different frequencies. One frequency is used to indicate that no trouble exists in the dial office, and each of the other frequencies indicates a different kind of trouble in the office.

Another feature of the invention is the provision of signal receiving means in the master office for receiving voice frequency signals of different frequencies for the different alarm conditions which may exist in a connected dial office and for indicating that no trouble exists in the dial office if such is the case.

Another feature of the invention is the provision in an attended office of signal means for indicating whether or not any trouble exists in an unattended automatic office, the operation of the signal means being maintained for a predetermined length of time after its operation, thereby

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to insure that a check of the unattended dial office is made periodically by an operator in the master office to determine the conditions existing in the unattended office.

The invention will be better understood by considering a system in which the invention and its features are embodied, one such system being shown schematically in the drawings which form a part of this specification and consists of three figures arranged in succession left to right. The invention is, however, not limited in its application to the specific arrangement and system shown but is generally applicable to alarm signaling systems between attended and unattended offices.

Referring to the drawings:

Fig. 1 shows the alarm signaling apparatus AL in a master office;

Fig. 2 shows an operator's position comprising the cord CD1, a trunk circuit TC11 associated with a trunk T1 extending to one unattended dial office, and a trunk circuit TC21 associated with a trunk extending to another unattended dial office; and

Fig. 3 shows, in an unattended dial office, a trunk circuit TC12, an incoming selector IS1 associated with the trunk circuit TC12, a connector C1 and alarm apparatus AL1. Fig. 3 also shows a subscriber's station A, line L1 and line circuit LC1, a line finder LF1 and a first selector S1 for use in establishing connections on calls originating in the dial office.

The subscriber stations in the unattended dial offices are of the type provided on lines terminating in common battery central offices and each includes a dial or other impulse sender for controlling the operation of automatic switches through which desired connections are established. The line circuit LC1 which comprises a line and a cut-off relay connects the line L1 to terminals in the banks of line finders for originating traffic and to terminals in the banks of connector switches similar to the connector C1 for terminating traffic. 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, 2d 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, No. 1,799,654, April 7, 1931, for a description of the operation of a step-by-step line finder. Each of the switches LF1, S1, IS1 and C1 is represented in the drawings by a set of brushes

and a single set of terminals, all omitted apparatus being represented by the broken lines connected to the brushes.

The alarm equipment AL1 comprises a line relay 151 connected to the tip and ring terminals of the terminal set 150 in the banks of a group of connectors including the connector C1, a transformer 152, alarm relays 162, 163 and 164 and sources 171, 172, 173 and 174 of alternating current of frequencies F1, F2, F3 and F4 respectively. If there is no trouble condition existing in the dial office shown in Fig. 3 none of relays 162, 163 or 164 is operated. Relay 162 is operated when any fuse in the dial office has burned out; relay 163 is operated when a permanent signal condition exists in the dial office; and relay 164 is operated when any other alarm condition exists in the dial office.

The trunk circuit TC11, terminating trunk T1 in the master office and the trunk circuit TC12 terminating the trunk T1 in dial office 1 are shown in detail and the operation of each of these trunk circuits is hereinafter described on calls in both directions. The trunk circuit TC21 terminating a trunk to a second dial office is similar to the trunk circuit TC11. The cord CD1 and the operator's dial and telephone are shown schematically and may be similar to the cord and position equipment disclosed in detail in the patent to King and Miller No. 2,208,765 granted July 23, 1940.

The alarm equipment AL in the master office comprises signal receiving relays 11, 21, 31 and 41 selectively connected by filters 10, 20, 30 and 40 to the jack J1. Each of the filters is tuned to pass current of a different one of the frequencies used for transmitting alarm signals from an unattended dial office to the master office. The alarm apparatus AL further comprises alarm apparatus individual to each unattended office from which alarm signals may be received. The alarm apparatus individual to dial office 1 comprises keys K11 and K12, gas-filled discharge lamps L11 to L14, and a timing relay TR1; the alarm apparatus for a second dial office comprises keys K21 and K22, gas-filled discharge lamps L21 to L24, and a timing relay TR2. The lamps L11 and L21 are provided for indicating that there is no trouble existing in the corresponding dial office; the lamps L12 and L22 are provided for indicating a fuse alarm condition in the corresponding office; the lamps L13 and L23 are provided for indicating a permanent signal condition in the corresponding dial office; and the lamps L14 and L24 are provided for indicating any other alarm condition which may exist in the corresponding dial office. The timing relays TR1 and TR2 are aranged to operate a predetermined interval, for instance, half an hour after the lighting of any of the associated lamps, so as to extinguish the lamp and thereby indicate that it is time to again check the alarm conditions existing in the corresponding unattended dial office.

The voltage of the battery B2 normally connected in series with the winding of each of the timing relays and the associated lamps is insufficient to effect breakdown of any lamp but is sufficient to maintain the energization of any lamp after breakdown until the associated timing relay opens the circuit therethrough. With key K11 or K21 actuated and with any one of relays 11, 21, 31 or 41 operated, the voltage of batteries B1 and B2 in series is sufficient to break down the lamp corresponding to the operated one of relays 11, 21, 31 and 41 in the set of lamps associated with the operated one of keys K11 and K21.

Assume now that a call is originated at station A, that the line finder LF1 is operated to extend the calling line to a first selector S1 and that the selector S1 is actuated in response to the dial impulses created by the dialing of the first digit of the called subscriber's number to select the terminals connecting to trunk circuit TC12. When the cut-through relay (not shown) of the selector S1 operates to extend the connection from the conductors of line L1 to conductors 101 and 102 of trunk circuit TC12, the line relay 111 of trunk circuit TC12 is operated by the curent in a circuit traced from battery through the upper winding of relay 111, a lower back contact of relay 109, lower right winding of repeating coil 110, another lower back contact of relay 109, conductor 102, middle brushes of selector S1 and line finder LF1, lower conductor of line L1, through the telephone at station A, the other conductor of line L1, top brushes of line finder LF1 and selector S1, conductor 101, an upper back contact of relay 109, upper right winding of repeating coil 110, another upper back contact of relay 109 and through the lower winding of relay 111 to ground. Relay 111 closes a circuit for operating relays 105 and 112. Relay 105 connects ground to conductor 103 to hold the switching relay (not shown) of selector S1 and to guard the trunk circuit TC12 against seizure by any other selector having access thereto. Relay 112 connects ground to conductor MS to start the ringing machine motor (not shown) and closes a connection from the ringing source RG through condenser 106 and a back contact of relay 104 to conductor 101 so as to transmit a ringing tone to the calling subscriber as an indication that the operator in the master office is being signaled. The operation of relay 112 interchanges the connections between the windings of relay 113 and the conductors of trunk T1 leading to the master office, thereby reversing the current through these conductors to effect the operative energization of both windings of the polarized relay 51 of trunk circuit TC11. Although the windings of relays 113 and 51 are normally connected in a closed circuit over trunk T1, the current in this circuit is not strong enough to operate the marginal relay 113 and is in the non-operate direction with respect to relay 51. The circuit for operating relay 51 may be traced from battery through the lower winding of relay 113, a front contact of relay 112, upper left winding of repeating coil 110, upper conductor of trunk T1, upper back contact of relay 62, upper right winding of repeating coil 59, both windings of relay 51, lower right winding of repeating coil 59, lower conductor of trunk T1, lower left winding of repeating coil 110, a front contact of relay 112, and through the upper winding of relay 113 to ground. The operation of relay 51 closes a circuit for operating relay 52. Relay 52 closes a circuit for lighting the multiple answering lamps 53 and a circuit for operating relay 54. Relay 54 closes a circuit for operating relay 55. Relay 55 closes a circuit for lighting the multiple busy lamps 57 and connects a busy potential through resistor 56 and the upper winding of relay 57 to the sleeve of jack J10.

When an operator answers the call by inserting the plug P2 of a cord CD1 in jack J10, a circuit is closed from battery in the operator's position circuit, through the sleeve conductors of plug P2 and jack J10 and the lower, high-resistance winding of relay 57 to ground. Relay 57 oper-

ates closing a circuit for operating relay 58. Relay 58 closes a circuit for operating relay 61; closes a short-circuit around the upper, high-resistance winding of relay 51 thereby causing the operation of relay 113 of trunk circuit TC12; opens the busy potential connection between resistor 56 and the sleeve of jack J10; and opens the circuit through the winding of relay 52 to release this relay and thus extinguish lamp 53. Relay 61 closes a holding circuit for relay 54 and completes the talking connection between the left windings of repeating coil 59 and the line conductors of jack J10.

The aforementioned operation of marginal relay 113 of trunk circuit TC12 when the call is answered by an operator in the master office, closes a circuit for operating relay 104. Relay 104 disconnects condenser 106 from conductor 101 to end the transmission of ringing tone to the calling subscriber, disconnects ground from the ringing-machine motor-start conductor MS, and closes a circuit for holding relay 105. The talking connection between the calling line and the operator in the master office includes the repeating coils 59 and 110 and the connection is under the joint control of the calling subscriber and the answering operator. When the calling subscriber releases the connection, relay 111 releases. The release of relay 111 causes the release of relay 112, thereby restoring the current over trunk T1 to its normal direction to effect the release of relay 51 of trunk circuit TC11 in the master office. After relay 111 releases, relay 105 is held under the joint control of relays 113 and 104. The release of relay 51 of trunk circuit TC11 connects ground to the upper, low-resistance winding of relay 57, thereby causing the lighting of the supervisory lamp in the operator's cord circuit as a disconnect signal. When the plug P2 of cord CD1 is disconnected from jack J10, relay 57 releases. The release of relay 57 causes the successive release of relays 58 and 61. Relay 52 reoperates if relay 51 has not yet released. The release of relay 58 opens the short-circuit around the upper, high-resistance winding of relay 51 thereby causing the release of relay 113 of trunk circuit TC12. The release of both of relays 111 and 113 in trunk circuit TC12 causes the release of relays 104 and 105. Relay 105 disconnects ground potential from conductor 103 to cause the release of the selector S1 and the return of the selector S1 and line finder LF1 to normal. The release of relay 104 reconnects conductors 131 and 132 to the line relay (not shown) of the incoming selector IS1, thereby preparing trunk T1 for seizure on another call in either direction.

Assume next that the operator in the master office connects the plug P1 of cord CD1 with jack J1 associated with the alarm equipment AL and connects the plug P2 with jack J10 to make a call to dial office 1. Relay 57 operates in a circuit including the sleeve conductors of jack J10 and plug P2 to battery in the operator's position circuit. Relay 57 closes a circuit for operating relay 58. Relay 58 closes a short-circuit around the upper winding of relay 51 to effect the operation of relay 113 of trunk circuit TC12, closes a circuit for operating relay 61, and connects ground to the upper winding of relay 57 to effect the lighting of the supervisory lamp in the cord circuit CD1. Relay 61 closes a circuit for operating relay 54; closes a connection from the winding of relay 64, through the upper left winding of repeating coil 59, to the tip conductor of jack J10; and closes a connection from ground at

the outer lower front contact of relay 58, through resistor 66, upper back contact of relay 64, inner upper front contact of relay 61 and lower right winding of repeating coil 59, to the ring conductor of jack J10. The operation of relay 54 closes a circuit for operating relay 55; and relay 55 lights the multiple busy lamps 57. The operation of relay 113 of trunk circuit TC12 closes a circuit, including back contacts of relays 105 and 112, through the winding of relay 109. Relay 109 operates thereby connecting its winding to sleeve conductor 133 of the associated incoming selector IS1 and extends ground potential to conductor 103 to mark the trunk circuit TC12 as busy in the banks of selectors having access thereto. Relay 109 closes a bridge comprising the winding of relay 114 and resistor 115 in parallel across conductors 131 and 132 of selector IS1 to operate the line relay (not shown) to prepare the selector for operation by dial impulses. The selector IS1 connects holding ground potential to sleeve conductor 133 in usual manner to hold relay 109.

When the calling operator operates the position dial key (not shown), a circuit for operating relay 64 is closed from battery in the position circuit OP through the tip conductors of plug P2 and jack J10, a front contact relay 61, upper left winding of repeating coil 59 and the winding of relay 64 to ground. Relay 64 operates, closing a circuit for operating relay 65 and connecting the tip of jack J10 through repeating coil 59 to the winding of relay 64, independent of the contact of relay 61. Relay 65 closes a circuit for holding relay 54 operated and closes a circuit from ground through the upper winding of relay 62, winding of relay 63, lower front contact of relay 65, lower left winding of repeating coil 59, ring conductors of jack J10 and plug P2, through the impulse contacts of the operator's dial, to battery. Relays 62 and 63 operate. Relay 62 locks under control of relays 64 and 58 and opens the circuit through the winding of relay 61. The release of relay 61 disconnects the ring conductor of jack J10 from condenser 60 and short-circuits the upper winding of relay 62 to prepare relay 63 for response to dial impulses. Relay 62 is held operated by the energization of its lower winding in a circuit including its lower front contact, a front contact of relay 64, and a front contact of relay 58. With relays 63 and 62 operated, the impulse repeating contacts of relay 63 are connected across the conductors of trunk T1 in place of the bridge comprising the lower winding of relay 51. When the operator dials the digits of a called subscriber's number, relay 63 is alternately released and reoperated responsive to the dial impulses of each train thereby created. Corresponding impulses are transmitted by the contacts of relay 63 over trunk T1 to relay 113 of trunk circuit TC12. When dialing is completed, the restoring of the operator's dial key disconnects battery from the tip of the cord, releasing relay 64. Relay 64 opens the connection between repeating coil 59 and the tip of jack J10, short-circuits the contacts of relay 63, and releases relays 65 and 62. The release of relay 65 disconnects the winding of relay 63 from the ring conductor of jack J10 and opens the holding circuit of relay 54. The release of relay 62 disconnects the contacts of relay 63 from the conductors of trunk T1 and reestablishes the bridge, comprising the lower winding of relay 51, across these conductors. The release of relay 62 causes the reoperation of relay 61 and the completion of the talking connection between jack J10 and re-

peating coil 59. The reoperation of relay 61 recloses the circuit for operating relay 54. Since relay 55 is slow in releasing, it remains operated during the transfer of the conductors of trunk T1 to and from dialing conditions.

In response to the dial impulses thus transmitted over trunk T1 by the contacts of relay 63, relay 113 of trunk circuit TC12 is alternately released and reoperated. When relay 113 releases in response to the first impulse of each train, it opens the bridge across conductors 131 and 132 and closes a circuit including a back contact of relay 112 and a front contact of relay 109 for operating the slow-to-release relay 107. With relay 107 operated, the reoperation of relay 113 closes a bridge comprising resistor 108 across conductors 131 and 132 in place of the bridge comprising the winding of relay 114. Relay 107 is slow to release and remains operated while a train of impulses is being repeated by relay 113. The release of relay 107, when relay 113 remains operated at the end of a train of impulses, reconnects the winding of relay 114 across conductors 131 and 132 for response to supervisory signals.

The first train of impulses repeated by relays 63 and 113 controls the operation of the incoming selector IS1 to select a corresponding group of terminals. The selector IS1 is thereupon operated automatically to select an idle set of terminals in the selected group, which terminals are connected to a connector C1. The impulses created by the dialing of the last two digits of the called number are repeated by relays 63 and 113 to the line relay 141 of a connector C1 to selectively operate the connector and thereby complete a connection with the called line terminals. If the called line is idle, the called station is signaled in usual manner; and, if the call is answered, relay 144 is operated to reverse the direction of current through conductors 131 and 132 to operate relay 114. Relay 114 closes a circuit for operating relay 112; and relay 112 effects the reversal of current through conductors of trunk T1 to operate relay 51 of trunk circuit TC11. The operation of relay 51 disconnects ground from the upper winding of relay 57 to extinguish the supervisory lamp in the operator's cord circuit. The talking connection between the operator and the called subscriber includes the repeating coils 59 and 119 and is under the sole control of the operator.

If the called subscriber restores the telephone to normal before the operator disconnects, relay 144 releases so as to restore the direction of current through conductors 131 and 132 and thereby cause the successive release of relays 114, 112 and 51, and the lighting of the supervisory lamp in the operator's cord circuit. When the operator disconnects, relays 57, 58, 61, 54 and 55 are released. The release of relay 58 opens the short-circuit around the upper winding of relay 51 thereby causing the release of marginal relay 113 in trunk circuit TC12. The release of relay 113 opens the operating circuit of relay 109 and opens the bridge across conductors 131 and 132 thereby causing the release of the incoming selector IS1 and the release of the connector C1. If the called subscriber has failed to disconnect, the connector is held operated but the incoming selector IS1 is restored to normal in the usual manner. When the called subscriber releases, the connector switch is also restored to normal in usual and well-known manner.

Assume next that the connector C1 has been selectively operated by dial impulses corresponding to the last two digits of the called number to select the trouble checking terminals 150 associated with the alarm equipment AL1. In this case the bridge consisting of the winding of relay 151 and left winding of transformer 152 effects the tripping of the ringing and closure of the talking circuit through the connector C1 in usual manner. If at the time relay 151 operates there is no trouble existing in this dial office, none of relays 162, 163 and 164 are operated; and a circuit is closed from the alternating current source 171 of frequency F1 through a back contact of each of relays 162, 163 and 164 in series, a front contact of relay 151, and the right winding of transformer 152 to transmit current of frequency F1 through transformer 152 and the talking conductors of connector C1, selector IS1, trunk circuit TC12, trunk T1, trunk circuit TC11 and cord CD1, to the alarm equipment AL in the master office. The current thus transmitted is transmitted through filter 10 to operate relay 11 without effecting the operation of any one of relays 21, 31 or 41. If fuse alarm relay 162 is operated, current of frequency F2 is transmitted from source 172 through transformer 152 and the talking connection to effect the operation of relay 21 of alarm apparatus AL in the master office, the filter 20 being tuned to pass current of frequency F2. If the permanent signal alarm relay 163 is operated, current of frequency F3 is transmitted from source 173, through transformer 152 and the talking connection to alarm apparatus AL to effect the operation of relay 31, filter 30 being tuned to pass current of frequency F3. And, if other trouble conditions exist in office 1 such as failure of the ringing equipment, relay 164 is operated and current of frequency F4 is transmitted from source 174, through transformer 152 and the talking connection to alarm apparatus AL to operate relay 41, the filter 40 being tuned to pass current of frequency F4. The operator now momentarily actuates key K11 to connect the signal lamps L11, L12, L13 and L14 to conductors 12, 22, 32, 42, respectively. The voltage thus applied across the lamp corresponding to the operated one of relays 11, 21, 31 and 41 is high enough to cause ionization of the gas in that lamp. The operator may then release key K11 and disconnect the cord CD1 from jacks J1 and J10, the voltage of battery B2 being sufficient to maintain the energization of any one of the signal lamps L11 to L14 which has been energized. Thus a continuing signal indicative of the maintenance conditions in the office 1 is given until the timing relay TR1 operates. This relay is designed to operate in series with any one of the signal lamps at the end of a desired interval, for instance half an hour. The operation of relay TR1 extinguishes the lighted lamp, thereby indicating to the operator that a check of the alarm conditions at the dial office has not been made within this interval. An energized signal lamp may be extinguished prior to the operation of relay TR1 by the operation of the release key K12.

A check of the conditions existing in dial office 2 may be made by connecting a cord CD1 to jacks J1 and J20, dialing the trouble checking number for dial office 2 and operating key K21, thereby effecting the lighting of that one of lamps L21 to L24 which corresponds to the condition existing in dial office 2 in similar manner to that in which the alarm lamps for dial office 1 are energized as above described.

What is claimed is:

1. In a telephone system, an unattended dial office, a master office, alarm apparatus in the unattended office responsive selectively to a plurality of trouble conditions, signal receiving means in the master office, means including an interoffice trunk for connecting said signal receiving means to said alarm apparatus, and a set of alarm signals in said master office controlled by said signal receiving means for visually indicating the existence of any of said plurality of trouble conditions in the unattended office.

2. In a telephone system, an unattended dial office, an attended office, signal sending means in said unattended office for selectively sending a signal of a first character when no trouble exists in the unattended office and for sending a signal of a second character when a trouble condition exists in the unattended office, signal receiving means in said attended office for selectively responding to signals of said first and second characters, means comprising a trunk between said offices connecting said signal receiving means to said signal sending means, and visual signal means selectively controlled by said signal receiving means.

3. In a telephone system, an unattended dial office, an attended office, signal sending means in said unattended office for selectively sending a signal of a first character when no trouble exists in the unattended office and for sending a signal of a second character when a trouble condition exists in the unattended office, signal receiving means in said attended office for selectively responding to signals of said first and second characters, means comprising a trunk between said offices connecting said signal receiving means to said signal sending means, signal means selectively energized by said signal receiving means to indicate the condition existing in the unattended office, and means for maintaining the energization of said signal means after the connection between said signal sending and signal receiving means is ended.

4. In a telephone system, an unattended dial office, an attended office, signal sending means in said unattended office for selectively sending a signal of a first character when no trouble exists in the unattended office and for sending a signal of a second character when a trouble condition exists in the unattended office, signal receiving means in said attended office for selectively responding to signals of said first and second characters, means comprising a trunk between said offices connecting said signal receiving means to said signal sending means, signal means selectively energized by said signal receiving means to indicate the condition existing in the unattended office, means for maintaining the energization of said signal means after the connection between said signal sending and signal receiving means is ended, and means for terminating the energization of said signal means a predetermined interval of time after the connection between said signal sending and signal receiving means is ended.

5. In a telephone system, an unattended dial office, an attended office, signal sending means in said unattended office for selectively sending a signal of a first character when no trouble exists in the unattended office and for sending a signal of a second character when a trouble condition exists in the unattended office, signal receiving means in said attended office for selectively responding to signals of said first and second characters, means comprising a trunk between said offices connecting said signal receiving means to said signal sending means, signal means selectively energized by said signal receiving means to indicate the condition existing in the unattended office, means for maintaining the energization of said signal means after the connection between said signal sending and signal receiving means is ended, means for terminating the energization of said signal means a predetermined interval of time after the connection between said signal sending and said signal receiving means is ended, and other means for ending the energization of said signal means.

6. In a telephone system, an unattended dial office, an attended office, a trunk between said offices for use in completing connections between calling and called lines, means in said unattended office for sending any one of a plurality of signals each of a different character, means in said unattended office preparing said signal sending means to send a signal of one character when no trouble condition exists in said unattended office and for selectively preparing said signal sending means to send a signal of a different character when a trouble exists in the unattended office, the character of the signal depending on the character of the trouble, signal receiving means in the attended office for selectively responding to a signal of any one of said characters, means comprising said trunk for connecting said signal receiving means to said signal sending means, and visual signal means in said attended office selectively controlled by said signal receiving means.

7. In a telephone system, an unattended dial office, an attended office, a trunk between said offices for use in completing connections between calling and called lines, means in said unattended office for sending any one of a plurality of signals each of a different character, means in said unattended office preparing said signal sending means to send a signal of one character when no trouble condition exists in said unattended office and for selectively preparing said signal sending means to send a signal of a different character when a trouble exists in the unattended office, the character of the signal depending on the character of the trouble, signal receiving means in the attended office for selectively responding to a signal of any one of said characters, means comprising said trunk for connecting said signal receiving means to said signal sending means, visual signal means in said attended office selectively controlled by said signal receiving means to indicate the condition existing in the unattended office, and means for maintaining the energization of said signal means after the connection between said signal sending and signal receiving means is ended.

8. In a telephone system, an unattended dial office, an attended office, a trunk between said offices for use in completing connections between calling and called lines, means in said unattended office for sending any one of a plurality of signals each of a different character, means in said unattended office preparing said signal sending means to send a signal of one character when no trouble condition exists in said unattended office and for selectively preparing said signal sending means to send a signal of a different character when a trouble exists in the unattended office, the character of the signal depending on the character of the trouble, signal receiving means in the attended office for selectively responding to a signal of any one of said characters, means com-

prising said trunk for connecting said signal receiving means to said signal sending means, visual signal means in said attended office selectively controlled by said signal receiving means, signal means selectively energized by said signal receiving means to indicate the condition existing in the unattended office after the connection between said signal receiving means is ended, and means for terminating the energization of said signal means a predetermined interval of time after the connection between said signal sending and signal receiving means is ended.

9. In a telephone system, an unattended dial office, an attended office, a trunk between said offices for use in completing connections between calling and called lines, means in said unattended office for sending any one of a plurality of signals each of a different character, means in said unattended office preparing said signal sending means to send a signal of one character when no trouble condition exists in said unattended office and for selectively preparing said signal sending means to send a signal of a different character when a trouble exists in the unattended office, the character of the signal depending on the character of the trouble, signal receiving means in the attended office for selectively responding to a signal of any one of said characters, means comprising said trunk for connecting said signal receiving means to said signal sending means, visual signal means in said attended office selectively controlled by said signal receiving means to indicate the condition existing in the unattended office, means for maintaining the energization of said signal means after the connection between said signal sending and signal receiving means is ended, means for terminating the energization of said signal means a predetermined interval of time after the connection between said signal sending and signal receiving means is ended, and other means for ending the energization of said signal means.

10. In a telephone system, a plurality of unattended offices, an attended office, trunks between said attended office and each of said unattended offices, like means in each of said unattended offices for sending a signal of one character when no trouble condition exists in the unattended office and a signal of a different character when a trouble condition exists in the unattended office, signal receiving means in the unattended office for selectively responding to a signal of either character, means comprising said trunks for connecting said signal receiving means to the signal sending means in any desired one of said unattended offices, like signal means in said attended office for each of said unattended offices arranged for selective control by said signal receiving means, and means for connecting the signal receiving means to the signal means corresponding to the unattended office the signal sending means of which is connected to said s'gnal receiving means, thereby to effect the selective energization of the signal means.

11. In a telephone system, a plurality of unattended offices, an attended office, trunks between said attended office and each of said unattended offices, like means in each of said unattended offices for sending a signal of one character when no trouble condition exists in the unattended office and a signal of a different character when a trouble condition exists in the unattended office, signal receiving means in the unattended office for selectively responding to a signal of either character, means comprising said trunks for connecting said signal receiving means to the signal sending means in any desired one of said unattended offices, like signal means in said attended office for each of said unattended offices arranged for selective control by said signal receiving means, means for connecting the signal receiving means to the signal means corresponding to the unattended office the signal sending means of which is connected to said signal receiving means, thereby to effect the selective energization of the signal means, and means in said attended office for each of said signal means for maintaining the energization of the associated signal means after the connection between the signal receiving means and the signal sending means of the corresponding unattended office is terminated.

12. In a telephone system, a plurality of unattended offices, an attended office, trunks between said attended office and each of said unattended offices, like means in each of said unattended offices for sending a signal of one character when no trouble condition exists in the unattended office and a signal of a different character when a trouble condition exists in the unattended office, signal receiving means in the unattended office for selectively responding to a signal of either character, means comprising said trunks for connecting said signal receiving means to the signal sending means in any desired one of said unattended offices, like signal means in said attended office for each of said unattended offices arranged for selective control by said signal receiving means, means for connecting the signal receiving means to the signal means corresponding to the unattended office the signal sending means of which is connected to said signal receiving means, thereby to effect the selective energization of the signal means, means in said attended office for each of said signal means for maintaining the energization of the associated signal means after the connection between the signal receiving means and the signal sending means of the corresponding unattended office is terminated, and like means in said attended office for each of said signal means for terminating the energization of the associated signal means a predetermined interval of time after the connection between said signal receiving means and the signal sending means of the corresponding unattended office is terminated.

13. In a telephone system, a plurality of unattended offices, an attended office, trunks between said attended office and each of said unattended offices, like means in each of said unattended offices for sending any one of a plurality of signals each of a different character, alarm means in each unattended office preparing the signal sending means to send a signal of one character when no trouble exists in the unattended office and for preparing the signal sending means to send a signal of a different character when a trouble exists in the unattended office, the character of the signal depending on the character of the trouble, signal receiving means in the attended office for selectively responding to a signal of any one of said characters, means comprising said trunks for connecting said signal receiving means to the signal sending means in any desired one of said unattended offices, sets of signal devices in said attended office, one set for each unattended office, and means for connecting said signal receiving means to the signal set corresponding to the unattended office the signal sending means of which

is connected to said signal receiving means, thereby to effect the selective energization of said set of signal devices.

14. In a telephone system, a plurality of unattended offices, an attended office, trunks between said attended office and each of said unattended offices, like means in each of said unattended offices for sending any one of a plurality of signals each of a different character, alarm means in each unattended office preparing the signal sending means to send a signal of one character when no trouble exists in the unattended office and for preparing the signal sending means to send a signal of a different character when a trouble exists in the unattended office, the character of the signal depending on the character of the trouble, signal receiving means in the attended office for selectively responding to a signal of any one of said characters, means comprising said trunks for connecting said signal receiving means to the signal sending means in any desired one of said unattended offices, sets of signal devices in said attended office, one set for each unattended office, means for connecting said signal receiving means to the signal set corresponding to the unattended office the signal sending means of which is connected to said signal receiving means, thereby to effect the selective energization of said set of signal devices, and means in said attended office for each of said sets of signal devices for maintaining the energization of the associated set of signal devices after the connection between the signal receiving means and the signal sending means of the corresponding unattended office is terminated.

15. In a telephone system, a plurality of unattended offices, an attended office, trunks between said attended office and each of said unattended offices, like means in each of said unattended offices for sending any one of a plurality of signals each of a different character, alarm means in each unattended office preparing the signal sending means to send a signal of one character when no trouble exists in the unattended office and for preparing the signal sending means to send a signal of a different character when a trouble exists in the unattended office, the character of the signal depending on the character of the trouble, signal receiving means in the attended office for selectively responding to a signal of any one of said characters, means comprising said trunks for connecting said signal receiving means to the signal sending means in any desired one of said unattended offices, sets of signal devices in said attended office, one set for each unattended office, means for connecting said signal receiving means to the signal set corresponding to the unattended office the signal sending means of which is connected to said signal receiving means, thereby to effect the selective energization of said set of signal devices, means in said attended office for each of said sets of signal devices for maintaining the energization of the associated set of signal devices after the connection between the signal receiving means and the signal sending means of the corresponding unattended office is terminated, and like means in said attended office for each of said sets of signal devices for terminating the energization of the associated signal devices a predetermined interval of time after the connection between said signal receiving means and the signal sending means of the corresponding unattended office is terminated.

16. In a telephone system, an attended office, an unattended office, a trunk between said offices for completing connections between calling and called lines in said offices, signal receiving means in said attended office, a trouble checking line in said unattended office, means including said trunk for connecting said signal receiving means to said trouble checking line, signal sending means associated with said line comprising a source of current of a first frequency and a source of current of a second frequency, means comprising a trouble alarm relay in said unattended office for connecting the source of the first frequency to said signal sending means when no trouble exists and for connecting the source of the second frequency to said signal sending means when trouble exists in said unattended office, said signal receiving means comprising two relays and filters for selectively transmitting current of a different one of said frequencies to each of said relays, a signal device for operation when no trouble exists in the unattended office and a signal device for operation when trouble exists in the unattended office, and means for connecting said devices to said signal receiving means thereby to effect the operation of the one or the other of said signal devices according to whether or not trouble exists in the unattended office.

17. In a telephone system, an attended office, an unattended office, a trunk between said offices for completing connections between calling and called lines in said offices, signal receiving means in said attended office, a trouble checking line in said unattended office, means including said trunk for connecting said signal receiving means to said trouble checking line, signal sending means associated with said line comprising a source of current of a first frequency and a source of current of a second frequency, means comprising a trouble alarm relay in said unattended office for connecting the source of the first frequency to said signal sending means when no trouble exists and for connecting the source of the second frequency to said signal sending means when trouble exists in said unattended office, said signal receiving means comprising two relays and filters for selectively transmitting current of a different one of said frequency to each of said relays, a signal device for operation when no trouble exists in the unattended office and a signal device for operation when trouble exists in the unattended office, means for connecting said devices to said signal receiving means thereby to effect the operation of the one or the other of said signal devices according to whether or not trouble exists in the unattended office, and means for maintaining the operation of either one of the signal devices for a predetermined interval after the connection between said signal receiving means and said trouble checking line is terminated.

18. In a telephone system, an attended office, a plurality of unattended offices, each comprising lines including a trouble checking line and switches for seizing called lines, trunks between said attended and each of said unattended offices, signal receiving means in said attended office, means including said trunks and switches for connecting said signal receiving means to said trouble checking lines, one at a time, like signal sending means in each of said unattended offices associated with said trouble checking lines respectively, each of said signal sending means comprising a transformer, a plurality of sources of alternating current each of a different frequency, a plurality of alarm relays each operated

when a different trouble condition exists in the office in which the alarm relays are located and means including said relays for connecting one of said sources to said transformer when no trouble condition exists in the office and for connecting another and different one of said sources to said transformer when each different trouble condition exists in the office, means rsponsive to seizure of said trouble checking line for completing a connection from said line through said transformer to one of said sources according to what if any trouble then exists in the office, thereby to selectively transmit to said signal receiving means a signal indicative of the condition existing in the office, said signal receiving means comprising a plurality of relays one for each different signal which may be transmitted from the signal sending means of a connected one of said trouble checking lines, filters for selectively transmitting current of a different one of said frequencies to each of said relays, respectively, sets of signal devices, one set for each of said unattended offices and each set including a device for each signal which may be received from the corresponding unattended office, means individual to each set of signal devices for operatively connecting said devices to said signal receiving means, thereby to effect the operation of the signal device corresponding to the condition existing in the unattended office to which the signal receiving means is then connected.

19. In a telephone system, an attended office, an unattended office, a trunk between said offices for completing connections between calling and called lines in said offices, signal receiving means in said attended office, a trouble checking line in said unattended office, means including said trunk for connecting said signal receiving means to said trouble checking line, signal sending means associated with said line comprising a source of current of a first frequency and a source of current of a second frequency, means comprising a trouble alarm relay in said unattended office for connecting the source of the first frequency to said signal sending means when no trouble exists in said unattended office and for connecting the source of the second frequency to said signal sending means when trouble exists in said unattended office, said signal receiving means comprising two relays and filters for selectively transmitting current of a different one of said frequencies to each of said relays, a gas-filled discharge lamp for operation when no trouble exists in the unattended office and a gas-filled discharge lamp for operation when trouble exists in the unattended office, and means for connecting said lamps to said signal receiving means thereby to effect the energization of one or the other of said lamps according to whether or not trouble exists in the unattended office.

20. In a telephone system, an attended office, an unattended office, a trunk between said offices for completing connections between calling and called lines in said offices, signal receiving means in said attended office, a trouble checking line in said unattended office, means including said trunk for connecting said signal receiving means to said trouble checking line, a signal sending means associated with said line comprising a source of current of a first frequency and a source of current of a second frequency, means comprising a trouble alarm relay in said unattended office for connecting the source of the first frequency to said signal sending means when no trouble exists in said unattended office and for connecting the source of the second frequency to said signal sending means when trouble exists in said unattended office, said signal receiving means comprising two relays and filters for selectively transmitting current of a different one of said frequencies to each of said relays, a gas-filled discharge lamp for operation when no trouble exists in the unattended office and a gas-filled discharge lamp for operation when trouble exists in the unattended office, means for connecting said lamps to said signal receiving means thereby to effect the energization of one or the other of said lamps according to whether or not trouble exists in the unattended office, and means for maintaining the energization of either one of said lamps for a predetermined interval after the connection between said signal receiving means and said trouble checking line is terminated.

21. In a telephone system, an attended office, a plurality of unattended offices, each comprising lines including a trouble checking line and switches for seizing called lines, trunks between said attended and each of said unattended offices, signal receiving means in said attended office, means including said trunks and switches for connecting said signal receiving means to said trouble checking lines, one at a time, like signal sending means in each of said unattended offices associated with said trouble checking lines respectively, each of said signal sending means comprising a transformer, a plurality of sources of alternating current each of a different frequency, a plurality of alarm relays each operated when a different trouble condition exists in the office in which the alarm relays are located and means including said relays for connecting one of said sources to said transformer when no trouble condition exists in the office and for connecting another and different one of said sources to said transformer when each different trouble condition exists in the office, means responsive to seizure of said trouble checking line for completing a connection from said line through said transformer to one of said sources according to what if any trouble then exists in the office, thereby to selectively transmit to said signal receiving means a signal indicative of the condition existing in the office, said signal receiving means comprising a plurality of relays one for each different signal which may be transmitted from the signal sending means of a connected one of said trouble checking lines, filters for selectively transmitting current of a different one of said frequencies to each of said relays respectively, sets of gas-filled discharge lamps, one set for each of said unattended offices and each set including a lamp for each signal which may be received from the corresponding unattended office, means individual to each set of gas-filled discharge lamps for operatively connecting said lamps to said signal receiving means, thereby to effect the energization of the lamp corresponding to the condition existing in the unattended office to which the signal receiving means is then connected.

22. In a telephone system, an attended office, a plurality of unattended offices, each comprising lines including a trouble checking line and switches for seizing called lines, trunks between said attended and each of said unattended offices, signal receiving means in said attended office, means including said trunks and switches for connecting said signal receiving means to said trouble checking lines, one at a time, like signal

sending means in each of said unattended offices associated with said trouble checking lines respectively, each of said signal sending means comprising a transformer, a plurality of sources of alternating current each of a different frequency, a plurality of alarm relays each operated when a different trouble condition exists in the office in which the alarm relays are located and means including said relays for connecting one of said sources to said transformer when no trouble condition exists in the office and for connecting another and different one of said sources to said transformer when each different trouble condition exists in the office, means responsive to seizure of said trouble checking line for completing a connection from said line through said transformer to one of said sources according to what if any trouble then exists in the office, thereby to selectively transmit to said signal receiving means a signal indicative of the condition existing in the office, said signal receiving means comprising a plurality of relays one for each different

signal which may be transmitted from the signal sending means of a connected one of said trouble checking lines, filters for selectively transmitting current of a different one of said frequencies to each of said relays respectively, sets of gas-filled discharge lamps, one set for each of said unattended offices and each set including a lamp for each signal which may be received from the corresponding unattended office, means individual to each set of gas-filled discharge lamps for operatively connecting said lamps to said signal receiving means, thereby to effect the energization of the lamp corresponding to the condition existing in the unattended office to which the signal receiving means is then connected, and means individual to each set of lamps for maintaining the energization of any lamp in the set for a predetermined interval after the connection of said signal receiving means to the trouble checking line in the corresponding unattended office is ended.

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