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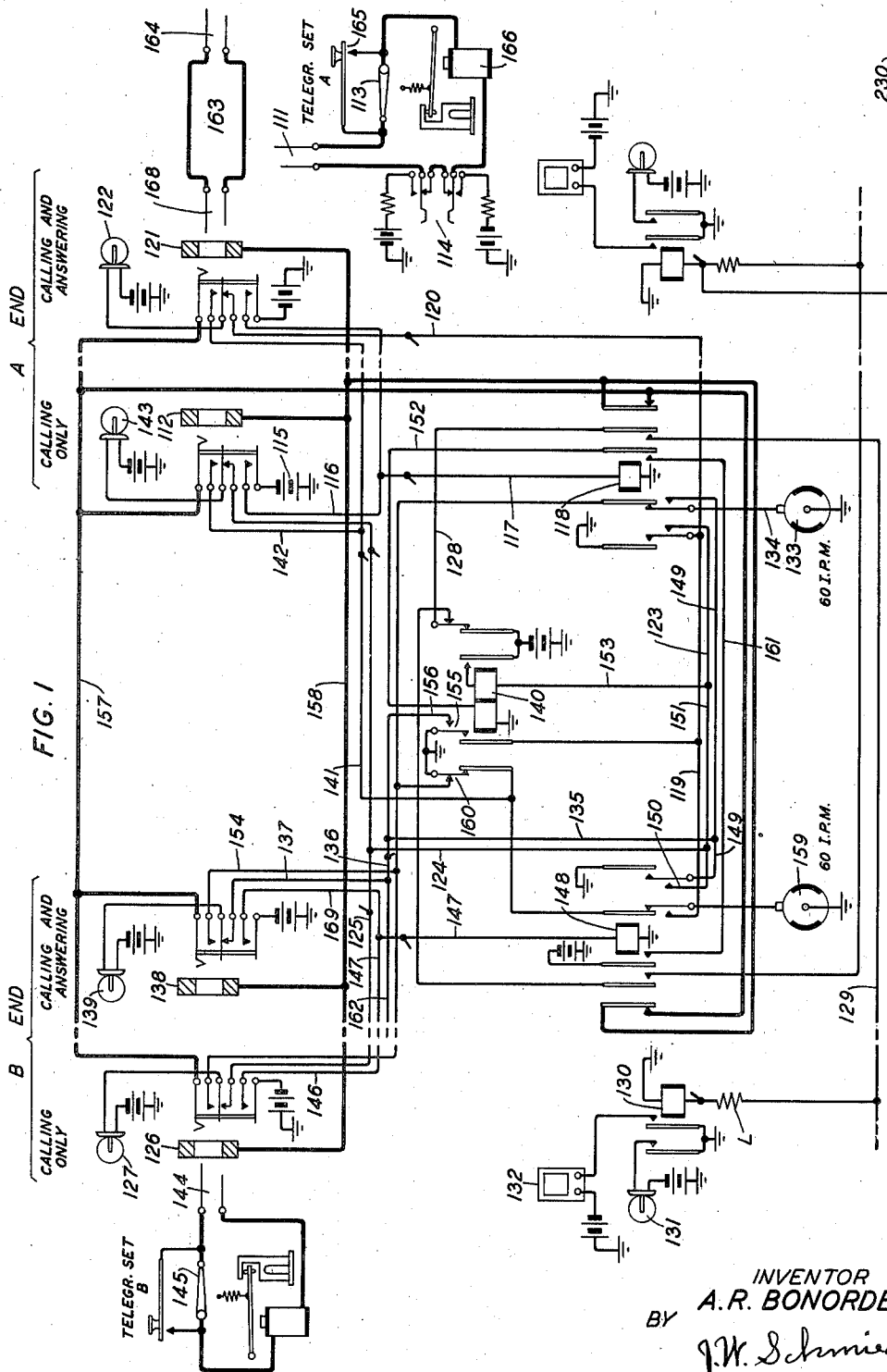
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2,206,659

COMMUNICATION SYSTEM

Filed Jan. 10, 1939

2 Sheets-Sheet 1



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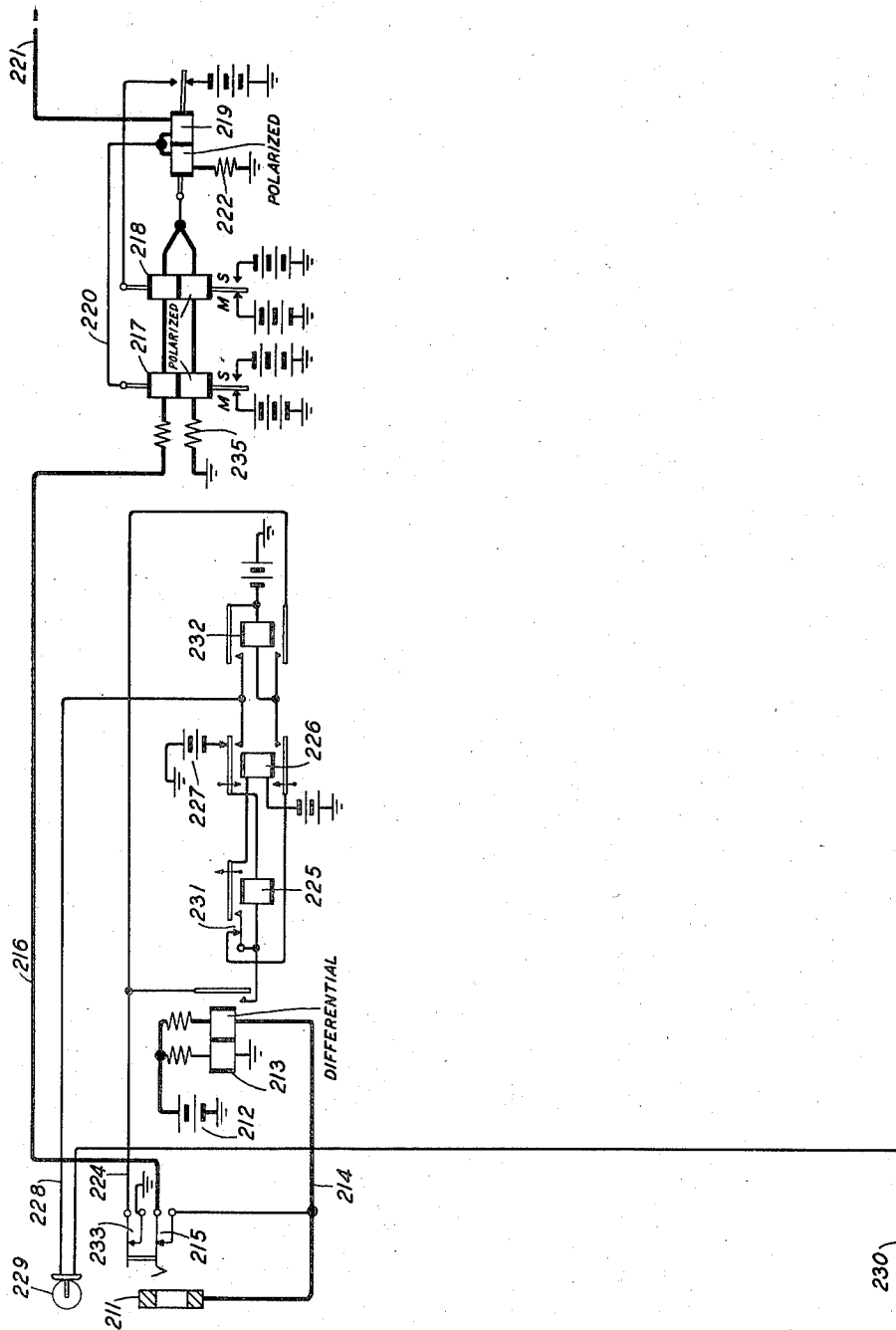
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FIG. 2



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COMMUNICATION SYSTEM

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6 Claims. (Cl. 178-2)

This invention relates to telephone and telegraph systems and more particularly to supervising and maintaining private wire and switching service over intra-office trunks between test board positions at the same or at different boards and between test board positions and repeater aisles all of which are in the same telephone or telegraph office.

An object of the invention is to simplify signaling and supervisory facilities in telephone and telegraph systems wherein an attendant at a switchboard may be connected with any one of a plurality of attendants at the same or at another switchboard or at repeater aisles in one office.

Another object is to use signaling lamps in an intra-office trunk whereby each lamp may be arranged to give a busy indication, a call indication, recall and disconnect supervision as desired. With the adaptation of the test board answering method of operation, greater use is being made of intra-office communication facilities both of the telephone and telegraph type, between positions at the same and at different test boards and between the test boards and the repeater aisles. Due to the fact that communication cords and patching cords in test boards are of the two-conductor type, the provision of supervisory features in the cord circuits themselves become complicated and expensive. It is highly desirable therefore that there be incorporated in such intra-office trunks a visual busy indication and supervisory signals in order to obtain the desired operating efficiency.

According to the present invention the complicated and expensive cord circuits are eliminated by incorporating the busy, signaling and supervisory features in the trunk circuit without increasing the space required in the jack field of the switchboard and the test board.

A feature of the invention is the incorporation in each intra-office trunk of a visual busy indication and supervisory signal, whereby economy and the desired operating efficiency are obtained.

Another feature is the provision whereby there is combined in one lamp a busy indication, a call indication, recall and disconnection supervision.

Still another feature is that the various signals combined in one lamp may be arranged to produce (1) a steadily lighted lamp at an idle trunk jack to indicate a busy condition for the trunk, (2) a rapidly flashing lamp at an idle trunk jack to indicate an incoming call, (3) intermittent periods of flashing of the lamp at a jack engaged in an established connection to

indicate that an attendant at the opposite end of the established connection is recalling, and (4) a rapidly flashing lamp at a jack engaged in the established connection to indicate that the attendant at the opposite end of the established connection has disconnected.

A better understanding of the scope and purpose of the invention can be obtained from the following description taken in connection with the attached drawings in which:

Fig. 1 shows a schematic arrangement of an intra-office trunk equipped at each end with one or more "calling only" appearances and a provision for a plurality of combined "calling and answering" appearances. Also shown at the left of the trunk in schematic arrangement is an attendant's telegraph set, and shown at the right of the trunk and in engageable relation therewith are alternative connecting means comprising a patching cord arrangement and another attendant's telegraph set arranged to furnish local battery.

Fig. 2 shows in schematic arrangement a terminating differential duplex repeater in an inter-office trunk arranged for engagement, by means of a patching cord, with the intra-office trunk, said interoffice trunk extending to a distant office.

The invention resides in the intra-office trunk shown in Fig. 1 wherein the busy indication and supervision are obtained on a single lamp provided at each appearance of the trunk at a switchboard or test board position, or at the repeater aisle. A detailed description of the operation of an intra-office trunk circuit such as shown in Fig. 1 of the drawings will now be given. The invention will be described for telegraph operation, it being understood that a telephone set may be readily substituted for the telegraph set by anyone skilled in the art.

First the invention will be described by establishing a connection between a test board position at the "A" end of the intra-office trunk shown in Fig. 1 and a test board position and/or aisle stations at the "B" end. Calls may be originated at either end and the procedure is substantially the same for both ends, except that the "A" end may and usually does include means for extending calls to and from interoffice trunks to test boards in other cities.

Originating a call from the "A" end

Assume that for the sake of illustration that the call originates at the right, or "A", end. The attendant inserts plug 111 into, say, "calling 55

only" jack 112, opens switch 113 and operates key 114 for connecting local battery to the attendant's telegraph set. The insertion of plug 111 closes a circuit extending from grounded battery 115, associated spring of jack 112, conductors 116 and 117, through the winding of relay 118 to ground. Relay 118 operates and thereby opens at its outermost right armature and contact a short circuit across the transmission circuit 157—158 and closes at its outer left armature and outer front contact, a circuit extending from ground, conductor 119, then in parallel over each of conductors 120, to each of all the combined calling and answering jacks 121 at the originating, or "A" end; the parallel path of each jack being completed over the contact in engagement with the middle spring, in normal position, of a jack such as that designated 121, through a lamp such as that designated 122, to grounded battery. Lamp 122 at each of the combined calling and answering jacks lights steadily to indicate a busy condition for the trunk circuit shown. Relay 118, in operating, also connects at its outer left armature and inner front contact, a circuit extending from ground, conductors 123, 151, 124 and 125 to the other "calling only" jacks, in parallel, such as that designated 126; the parallel path of each being completed over the contact in engagement with the middle spring, in normal position, of a jack, such as that designated 126, through a lamp such as that designated 127, to grounded battery. Lamp 127 lights steadily to indicate a busy condition. Relay 118, in operating, also closes at its middle right armature and front contact, a circuit extending from grounded battery, outer right armature and inner back contact of relay 140, conductor 128, front contact and right middle armature of relay 118, conductor 129, resistance L, through the winding of auxiliary signal relay 130 to ground. Relay 130 operates and thereby closes at its left armatures and contacts, circuits for respectively operating pilot lamp 131 and buzzer 132 at the repeater aisles or other convenient points near the called end of the trunk, in order to attract attention should the called position be unattended. The resistance of the auxiliary signal relay such as that designated 130, is small, being of the order of one ohm, and for that reason, because it is connected in multiple to all interoffice trunks terminating in one position, there is included in the circuit comprising a conductor such as that designated 129, a resistance L which has a value of about 240 ohms, or that equivalent to that of a lamp. Relay 118, in operating, also closes at its make-before-break contact in engageable relation with its inner left armature, a circuit extending from the grounded interrupter 133, conductor 134, make-before-break contacts of relay 118, conductors 149, 135, 136 and 137, contact in engagement with the middle spring, in normal position, of the calling and answering jack 138, through lamp 139 to grounded battery. The circuit just traced also extends over conductor 162 to parallel paths extending similarly to other lamps such as that designated 139 at the other calling and answering jacks (not shown) at the "B" end. Lamps, such as that designated 139, give at this time a rapidly flashing signal indicating that an incoming call is waiting on calling and answering jacks at the "B" end. Lamp 143 at jack 112 whereat the call originated lights steadily in a circuit extending from ground at the inner back contact and outer left armature of relay 140, conductors 141 and 142, contact

in engagement with the middle spring in operated position of jack 112, through lamp 143 to grounded battery. Lamp 143 will operate steadily to indicate that the called attendant has not yet answered.

Answering the call

An attendant at one of the calling and answering positions at the "B" end upon observing that the lamp associated with an idle jack at his position is flashing rapidly, answers by inserting plug 144 into the jack such as that designated 138 associated with flashing lamp 139. Switch 145 at this time is permitted to remain in a closed position as shown. The insertion of plug 144 closes a circuit extending from grounded battery associated with jack 138, conductors 169 and 147, through the winding of relay 148 to ground. Relay 148 operates and thereby opens at its outermost left armature and contact the other short circuit across the transmission path 157—158, and closes at its outer right armature and outer front contact a circuit extending from ground over conductor 149 and then over conductors 135, 136 and 162, as hereinbefore traced, to change the rapid flashing of all of the other combined calling and answering lamps, or appearances, at the "B" end to steady lights to indicate at such appearances that the trunk circuit is busy. Relay 148, in operating, also closes at its outer right armature and inner front contact a circuit extending from ground, conductor 159, then over conductor 124 as hereinbefore traced to add another ground for maintaining steadily lighted lamps at all the "calling only" appearances at both the "A" and "B" ends. Up to this time lamp 143 associated with the "calling only" jack 112 at which the call originated is maintained steadily lighted in a circuit extending over conductors 142 and 141 to ground at the outermost left armature and back contact of relay 140. Relay 148, in operating, also closes at its innermost left armature and contact a circuit extending from grounded battery, conductor 161, innermost right armature and contact of relay 118, conductor 152, through the left, or primary, winding of relay 140 to ground. Relay 140 operates and thereby locks in a circuit extending from grounded battery, innermost right armature and contact, through the right, or secondary, winding of the relay, conductor 153 to the junction of conductors 150 and 123; which are grounded respectively, at the inner front contact of the outer right armature of relay 148 and at the inner front contact of the outer left armature of relay 118 as previously described. Relay 140, in operating, opens at its outer right armature and contact, the circuit hereinbefore traced for operating the auxiliary signal relay 130. Relay 140, in operating, also disconnects ground at its outer left armature and inner back contact, from the two circuits respectively extending over conductors 154 and 141 to extinguish lamps 139 and 143, respectively associated with jacks 138 and 112 which are engaged in the established connection. Relay 140, in operating, supplements ground at its outer front contact and inner left armature to maintain a steady light at lamps such as 122 at all the calling and answering appearances of the trunk at end "A" and connects ground at contacts 155 to conductors 156 and 135 to supplement the short circuit on interrupter 133 provided by the outer front contact of the outer right armature of relay 148 and maintains the lamps such as lamp 139 at each of the other calling and answering appearances of the trunk at end "B" 75

in a steadily lighted condition. Therefore, for normal operation, all lamps are lighted steadily as busy indication, except those lamps associated with the jacks where the calling and answering cords at the "A" and "B" ends respectively, are connected. The last-mentioned lamps are extinguished, the extinguishing of the lamp at the calling end "A" indicates that the called party at end "B" has answered.

The trunk is now arranged for communication in either direction over the transmission trunk conductors 157 and 158. The trunk, as stated hereinbefore, is adaptable for either telephone or telegraph transmission. In the case of telegraph transmission as herein described in detail, transmission conductors 157 and 158 are short-circuited at the outermost right armature and contact of either relay 118 or 148, depending on the end of the trunk at which the call originates, until the called party answers thus holding the calling telegraph line in a marking, or closed condition.

Disconnecting at the called end after communication

Assuming that the attendant at the called, or "B" end of the trunk circuit disconnects by removing plug 144 from jack 138, relay 148 releases thereby replacing at its outermost left armature and contact the short circuit across the transmission conductors 157 and 158 to hold the calling line in a marking or closed, condition. Relay 148, in releasing, opens at its innermost left armature and contact the operating circuit for relay 140 which circuit extends through the left, or primary, winding of the latter relay. Relay 148, in releasing, also closes at its inner right armature and back contact, a circuit extending from grounded interrupter 159, conductor 141, operated contact in engagement with the middle spring of jack 112, through lamp 143 at the calling position to grounded battery. Lamp 143 therefore flashes rapidly indicating to the attendant at jack 112 which is still engaged by plug 111, that the attendant at the called position has disconnected. Lamp 139 which is associated with jack 138 from which plug 144 has just been removed now lights steadily in a circuit traceable from grounded battery, lamp 139, the middle spring, in normal position, engaged with its lower contact, conductors 137, 136 and 156, closed contacts 155 to ground at relay 140. The attendant at end "A" upon observing the rapid flashing of lamp 143 at this time removes plug 111 from jack 112 and thereby causes the release of relay 118. Relay 118, in releasing, supplements at its outermost right armature and contact the short circuit across transmission trunk conductors 157 and 158 and at its outer left armature and inner front contact disconnects ground from the circuit extending over conductors 123, 151 and 124 to the parallel paths, such as that designated 125, the middle spring, in normal position, engaged to the lower contact of the jack, such as that designated 126 through lamp 127 to grounded battery. The lamps such as that designated 127 become extinguished. Relay 118, in releasing, also opens the locking circuit for relay 140 which now releases.

Relay 140, in releasing, removes at its contact 155 the ground connection from the circuit extending over conductors 156 and 136, then over parallel paths such as those designated 137 and 162 respectively, the middle springs in normal

position, engaged to their respective lower contacts, through the lamps such as that designated 139 to grounded battery. Likewise at the inner left armature but at the outer front contact of relay 140, the circuit for effecting a steady light on the "calling and answering" appearance lamps at the "A" end is opened and lamps such as lamp 122 become extinguished. Relay 140, in releasing, also closed at its outer left armature and back contact, parallel circuits for short-circuiting the interrupters 133 and 159 and the trunk is now restored to normal.

Disconnecting at the calling end after communication

Assuming that the attendant at the calling, or "A", end of the trunk circuit disconnects first by removing plug 111 from jack 112, relay 118 releases instead of relay 148 which released prior to relay 118 when the disconnection was effected first at the called or "B" end. A further description is not deemed necessary in view of the description hereinbefore given for a disconnection at the called, or "B", end.

Originating a call from the "B" end

Assume that the call originates at the left, or "B" end. Having in mind the description of the establishment of a call originating at the "A" end, it is believed that a brief description only of the establishment of a call originating at the "B" end will be sufficient. The attendant inserts a plug 144 into a jack such as that designated 126 or 138, to close an operating circuit for relay 148. Relay 148 operates and thereby closes a circuit at its outer right armature and outer front contact, conductor 149 to produce a steady light on the lamps at all the calling and answering appearances, except the one into which plug 144 is inserted, assuming that one of the calling and answering jacks is selected. Also at the same armature, but in engagement with the associated inner front contact, relay 148 closes a circuit including conductors 150, 124 and 125 to produce a steady light on the lamps associated with the "calling only" appearances at both ends except the one into which plug 144 is inserted assuming that the connection be originated at one of the "calling only" appearances. The circuit normally closed at the outer back contact and outer left armature of the relay 140 furnishes ground over conductor 154 to light the lamp associated with the jack at which the call originated.

Relay 148, in operating, closes at its make-before-break contact at its inner right armature, a circuit extending from grounded interrupter 159 and over conductor 119 to cause a rapid flashing of the lamps at all the calling and answering appearances at the "A" end and at its middle left armature and contact closes an obvious path for operating the auxiliary signal relay which in turn controls the audible signal and pilot lamp at the called end. An attendant at any one of the calling and answering positions at the "A" end, upon observing the flashing of the lamps, inserts plug 111 into a jack associated with a flashing lamp to close a circuit over conductor 117 to operate relay 118. The insertion of plug 111 first transfers the middle spring of the jack into which the plug is inserted from a lower to an upper contact and thereby changes the associated lamp from the flashing to a steady light condition and secondly closes at the lowermost spring and contact of the jack the circuit for operating relay 118.

Relay 118, in operating, short-circuits at its outer left armature and outer front contact, interrupter 159, changes the lamps at all the other "calling and answering" appearances from a flashing to a steady light condition and at its outer left armature and inner front contact closes a circuit for producing a steady light on the lamps in all the "calling only" appearances at both the "A" and "B" ends, it being kept in mind that should jacks at one of the "calling only" appearances at the "B" end be selected for originating a call, its associated lamp will produce a steady light by means of the circuit extending to ground at contact 169.

Relay 140 in operating, completes the same circuits as hereinbefore described in connection with a call originating at the "A" end. Likewise a disconnect and a recall signal may be had as hereinbefore described.

Originating a call to an outside line including a repeater

Assume that a call originates at the "B" end for termination at an office in another city. The call is first established to the "A" end in the manner as hereinbefore described for a call originating at the "B" end. The attendant at the "A" end upon receiving the request from the attendant at the "B" end removes plug 111 from jack 121 and inserts plug 164 into jack 211 of the interoffice trunk circuit. He then inserts plug 168 into jack 121 after waiting approximately two seconds. The interoffice trunk circuit is normally closed at contact 215, the circuit extending from grounded positive battery 212, through the right-hand winding of biased relay 213, conductor 214, contact 215, conductor 216, through the upper windings, in series, of send relay 217 and differentially connected relay 218, armature and normally engaged contact of receiving relay 219 to grounded negative battery. Current flows through the left-hand winding of relay 213 in one direction and in parallel through the right-hand winding in the opposite direction so that relay 213 normally is in a released position, the current through the left-hand winding being continuous to effect a bias condition. Relay 213 is shown in Fig. 2 of the drawings, as being in a released position.

The insertion of plug 164 into jack 211 opens contacts 215 to send an open signal of comparatively long duration through the upper windings in series, of relays 217 and 218. The bias current normally flowing from the grounded negative source at the contact normally engaged to the armature of relay 219 through the lower windings, in series, of relays 218 and 217, artificial line 235 to ground now causes relays 218 and 217 to operate to their released positions. Relay 217, in operating to its released position, closes a circuit extending from its negatively poled contact and armature, conductor 220, then over parallel paths one extending through the right-hand winding of relay 219 to the trunk conductor 221, and the other through the left-hand winding, artificial line 222 to ground. Relay 219, being of a type having a differential characteristic, does not operate in response to the current from the grounded battery sources that are in engageable relation with the armature of relay 217.

At the opposite end of the trunk circuit 221, not shown, is an arrangement, similar to that shown in Fig. 2 of the drawings, as constituting the interoffice trunk terminal equipment corresponding to receiving relay 219, differentially

connected relay 218, send relay 217, jack 211, relay 213, and the signaling equipment controlled thereby. The equipment parts at the opposite end will hereinafter be referred to by reference characters similar to those designating their respective corresponding parts at the local end, except that to such corresponding characters will be added prime marks. It will be assumed therefore, for the sake of illustration, that the current that was stated hereinabove as flowing from the negatively poled contacts of relay 217 is being received by a receiving relay 219'. Relay 219' operates and thereby disconnects its armature from its negatively poled contact and closes a circuit extending from the grounded positive battery 212', through the right-hand winding of relay 213', conductor 214', contacts 215', conductor 216', through the upper windings, in series, of relays 217' and 218', armature and contacts normally disengaged from the armature of relay 219', armature and positively poled contact of relay 218'. Since the opposite ends of the circuit just traced are now positively poled, relay 213' operates under the influence of the continuous current in its left-hand winding. Relay 213', in operating, closes at its armature and contact, a circuit extending from ground at jack contacts 233', conductor 224', armature and contact of relay 213', through the winding of slow-to-release relay 225', upper armature and back contact of relay 226', to grounded negative battery 227'. Relay 225' operates to thereby close at its armature and contact, a path through the winding of relay 226' to grounded negative battery. Relay 225' is of the slow-to-operate type to guard against any short open periods in the line circuit just as those used for communication purposes. As hereinbefore stated an open period for calling purposes is comparatively long and is of sufficient duration to cause relay 226' to operate. Also relay 225' being of the slow-to-release type does not release in response to the open period ordinarily employed for the message impulses. Relay 226', in operating, closes at its upper armature and front contact, a circuit extending from grounded negative battery through the winding of relay 226', armature and contact of relay 225', through the winding of relay 225', upper armature and front contact of relay 226', conductor 228', through lamp 229', conductor 230', through the winding of pilot relay 130' to ground. Lamp 229' does not light nor will relay 225 hold in this circuit. Relay 226', in operating, also prepares at its lower armature and contact a path for operating relay 232'. When relay 225' eventually releases, relay 232' will operate provided relay 213' is still in the operated position. Relay 232' locks to ground at jack contact 233' and causes lamp 229' to light to indicate to the attendant at the distant office that a call is being made. The above operations occur during the interval elapsing between the insertion of plug 164 in jack 211 and plug 168 in jack 121.

When the attendant at the local office completes the patch, the right-hand winding of relay 213' again becomes energized and the relay having the characteristic of a differential type again releases and thereby opens at its armature and contact the operating circuit for relays 225' and 226' which release. Lamp 229' remains lighted until the attendant at the distant office inserts plug 111' into jack 211' at which time grounded connection 233' is disconnected to thereby open the locking circuit for relay 232'.

Relay 232' releases and removes grounded battery from the operating circuit for lamp 229'. Lamp 229' is extinguished. The interoffice trunk is now in condition for communication between the "B" attendant in the local office and the attendant in the distant office.

Recall signal

A recall signal may be initiated by the attendant at either end after the other attendant has answered. This is accomplished by momentarily disconnecting the plug from the jack and by reinserting the plug. These operations are repeated slowly to reproduce intermittent periods of flashing of the lamp at the opposite end each time the plug is removed as described for a disconnect. The attendant at the opposite end upon observing the short periods of rapid flashing of the lamp associated with the jack to which the plug is connected will challenge with his set if connected or will replace the patch cord 163 with the plug attached to his set in the jack associated with the flashing lamp and the connection is thereby reestablished.

Originating a call at the distant end to the attendant at the "A" end

When an incoming call is received over line 221 to operate receiving relay 219 at the local office, the armature of relay 219 engages its positively poled contact and thereby closes a circuit extending from grounded positive battery 212, through the right-hand winding of relay 213, conductor 214, contact 215, conductor 216, through the upper windings, in series, of relays 217 and 218, armature and normally disengaged contact of relay 219, armature and positively poled contact of relay 218. Inasmuch as both ends of the circuit, just traced are positively poled, relay 213 operates under the influence of the current flowing through its left-hand winding. Relay 213, in operating, closes at its armature and contact, a circuit extending from grounded battery 227, armature and back contact of relay 226, through the winding of relay 225, contact and armature of relay 213, conductor 224, to ground at contact 233. Relay 225 operates to close a circuit extending from grounded conductor 224, armature and contact of relay 213, armature and contact of relay 225, through the winding of relay 226 to grounded battery. Relay 226 being of the slow-to-operate type operates slowly to open at its upper armature and front contact, the operating circuit of relay 225. Relay 226 also prepares at its lower front contact a path which includes the winding of relay 232.

Relay 225 after a short interval releases and completes at its make-before-break contact 231 the circuit previously prepared, which extends from grounded conductor 224, armature and contact of relay 213, contacts 231, contacts and lower armature of relay 226, through the winding of relay 232 to grounded battery. Relay 232 operates to close a locking circuit for itself extending from grounded battery through its winding and lower contact and lower armature to grounded conductor 224. At its upper armature and contact relay 232, in operating, closes a circuit for lighting lamp 229 and operating the auxiliary relay at the "B" and over lead 230. The release of relay 225 releases relay 226.

The attendant at the "A" end observing the lighting of lamp 229 inserts plug 111 into jack 211 and communicates with the calling attendant at the distant office. The insertion of the plug

into jack 211 opens contact 215 and the ground connection 233. Relay 232, upon having its locking circuit opened at contact 233 releases and at its upper armature and contact, removes grounded battery from the lighted circuit of lamp 229. Lamp 229 is thereby extinguished.

The attendant at the "A" end in response to the request of the distant calling attendant may complete the call over an intra-office trunk to the desired point in the office. The attendant at the "A" end inserts plug 168 into a jack, say jack 121 of the desired intra-office trunk such as shown in Fig. 1, removes plug 111 from jack 211 and connects the other end of the patch cord 163 to the interoffice trunk by inserting plug 164 into jack 211. When the attendant at the "B" end answers the call signal as hereinbefore described, he will be connected for communication purposes with the attendant at the distant office over the intra-office trunk shown in Fig. 1 and the interoffice trunk which interconnect the "A" end and the office in the distant city.

The release of the connection established between a telegraph set at the "B" end and a telegraph set at the office of the distant city must be originated at the "B" end and the attendant at the "A" end upon observing the disconnect signal, at say lamp 122, will remove patching cord 163 from the jack from which it is engaged.

Résumé

In accordance with the above it will be noted that the following signaling and supervisory conditions are among those afforded on a single signal lamp associated with an intra-office trunk: dark lamp—no plug inserted at associated jack—trunk is idle; flashing lamp—no plug inserted at associated jack—calling; steadily lighted lamp extinguished—plug inserted at associated jack—called party answered; steadily light lamp—no plug inserted at associated jack—trunk is busy; flashing lamp—plug inserted at associated jack—disconnect; and intermittent periods of flashing lamp—plug inserted at associated jack—recall.

What is claimed is:

1. A switching system for communication purposes comprising a plurality of connecting terminals, a circuit interconnecting said terminals, signals for said circuit respectively mounted in proximity to said terminals, transmitting and receiving sets respectively comprising plugs arranged for connection to said terminals, and means included in said circuit and controlled by each of said plugs for transmitting current for effecting at each of said signals a plurality of different signaling and supervisory indications of no current, steady current, rapidly pulsating current and intermittent flashing current flowing in said circuit.

2. A switching system for communication purposes according to Claim 1 wherein said means comprises a source of steady current, an interrupter device connected with said source, and a relay arrangement controlled by said plugs for effecting at each of said signals at least six different signaling and supervisory conditions.

3. A switching system for communication purposes according to Claim 1, wherein said means comprises a plurality of relays arranged to operate in various orders under the control of either of said sets to effect in each of said signals a busy, a calling, a recall and a disconnect indication.

4. A switching system for communication pur-

poses according to Claim 1, wherein said connecting terminals are spring jacks for respectively terminating opposite ends of said circuit, said signals are lamps respectively associated with said spring jacks, and said means comprises a current source, a plurality of interrupting devices and a relay arrangement for connecting, as desired, said current source and said interrupting devices to each of said signals.

5. In a manually operated switching system, a plurality of switchboards, a plurality of aisle stations, trunk circuits interconnecting said switchboards and for connecting said switchboards with said aisle stations, connecting elements for each end of said trunk circuits at each of said switchboards, link circuits for interconnecting any two of said connecting elements at a switchboard, a signal associated with each of said connecting elements and said aisle stations, and means in each of said trunk circuits for giving, as desired, in each of said signals a busy indication, a call indication and recall and disconnect supervision.

6. In a manually operated switching system, a

plurality of switchboards, trunk circuits interconnecting said switchboards, connecting elements terminating each of said trunk circuits at each of said switchboards, other circuits terminating in each of said switchboards, other connecting elements terminating each of said other circuits at said switchboard, link circuits for interconnecting any one of said trunk circuits and any one of said other circuits at any one of said switchboards, supervisory signals associated with each of the first-mentioned connecting elements, means in each of said trunk circuits for effecting, when said trunk circuits are respectively connected through said link circuit to anyone of said other circuits in each of said signals associated with an engaged trunk circuit indication of a call initiated, an incoming call, a call answered, a busy condition, a recall and a disconnection as desired, and means for adapting said connecting elements for use as a combined answering and calling appearance or as a calling only appearance.

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