

June 15, 1926.

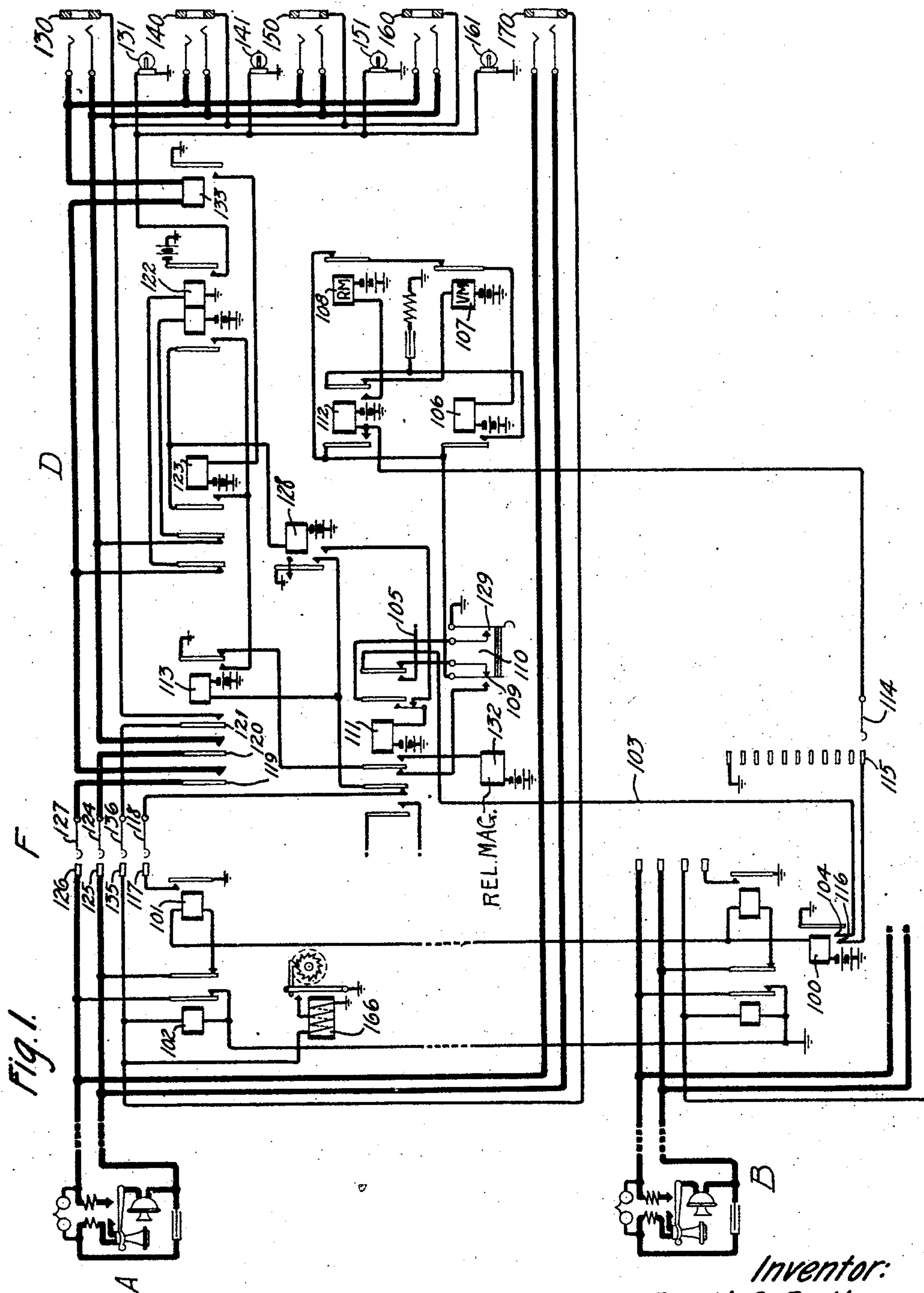
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R. S. BAILEY

TELEPHONE SYSTEM

Filed Nov. 23, 1923

2 Sheets-Sheet 1



Inventor:
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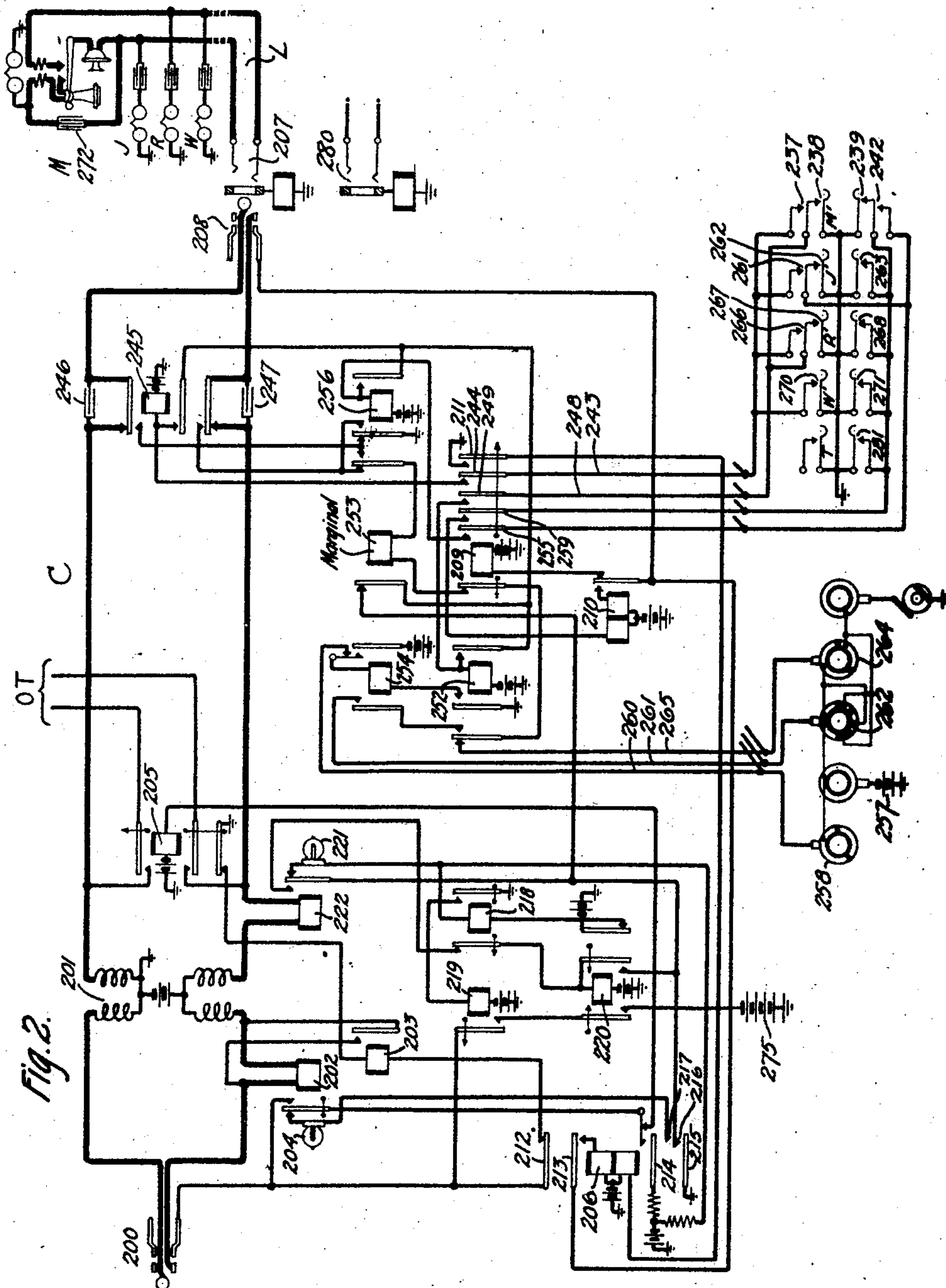
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2 Sheets-Sheet 2



Inventor:
Rand S. Bailey
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UNITED STATES PATENT OFFICE.

RAND S. BAILEY, OF MONTCLAIR, NEW JERSEY, ASSIGNOR TO AMERICAN TELEPHONE AND TELEGRAPH COMPANY, A CORPORATION OF NEW YORK.

TELEPHONE SYSTEM.

Application filed November 23, 1923. Serial No. 676,610.

This invention relates to telephone systems and more particularly to systems wherein calls incoming to an exchange may be handled by any one of a plurality of operators.

Among the objects of this invention is to provide improved means for concentrating traffic incoming to a telephone exchange.

This object is attained in accordance with a feature of the invention by the provision of a two-movement line finder having permanently associated therewith a connecting link terminating at an exchange in a plurality of multiple answering jacks. By this arrangement a call originating at any one of a plurality of lines accessible to the line finder comes into the exchange over the connecting link and is displayed at a plurality of operators' positions by means of multiple line lamps.

Another feature of the invention resides in the provision of a slow releasing relay associated with the line finder which permits an operator to disconnect her connecting circuit from association with the line finder without releasing the line finder.

A still further feature resides in the provision of a testing relay in an operator's connecting circuit which operates in response to the connection of the connecting circuit to a busy line to short-circuit the answering supervisory relay of the connecting circuit, thereby preventing its operation to effect the connection of the operator's telephone set with the connecting circuit.

A still further feature resides in the provision of a group of keys common to a plurality of connecting circuits, the actuation of one of said keys causing the application of ringing current to the calling end of the connecting circuit, and the actuation of another of said keys preventing the application of ringing current to the connecting circuit. Heretofore expensive and complicated arrangements have been provided by means of which the connecting circuit automatically differentiated between an ordinary line and a trunk and whereby the application of ringing current to the trunk was prevented. By means of the present arrangement a standard method operation is achieved whereby a key of some nature is always operated whether the line connected to be a regular subscriber's line or a trunk

line and at the same time the circuits are greatly simplified and economy in apparatus is achieved.

Still another feature of this invention resides in the provision of means in a manual cord or connecting circuit for automatically registering a call.

The invention will be readily understood from the following detailed description made with reference to the accompanying drawings.

In the drawings:

Figure 1 shows two substations A and B in a group having access to a line finder F, and a link circuit D, terminating in a plurality of multiple answering jacks at a telephone exchange. The structure of the switch or line finder is of the general type disclosed in the Patent No. 972,874—B. Kugelman—October 18, 1910, and is adapted in its present disclosure to accommodate a group of one hundred subscribers' lines. The switch is a two-movement switch, its first movement (vertical) selecting a group of ten lines in which the calling line is located, and its second movement (rotary) selecting the specific line in the selected group.

Fig. 2 shows the operator's connecting or link circuit C which is adapted to complete connections between the calling subscribers' lines such as A and B and a station on the four-party line L. The common ringing equipment employed in signaling the various subscribers on the party line L is also shown in this figure.

In the following description, the subscriber at station A will be considered the calling subscriber and any one of the four parties on the line L the called subscriber.

The subscriber at station A to initiate a call removes the receiver from the switch-hook, whereupon a circuit is established extending from grounded battery through the winding of the start relay 100, winding of the line relay 101, back contact and right-hand armature of cut-off relay 102, over the subscriber's closed line loop, inner armature and back contact of relay 102 to ground. The start relay 100 is common to a group of ten lines.

Upon operating, the start relay 100 connects, at its contacts 104, ground to the in-start lead 103 of the regular first choice selector or line finder F, provided that this

switch is available for use. As indicated on the drawing by the lead 105, the in-start lead 103 is adapted to be cut through to the next succeeding switch if the first switch is busy.

Assuming the switch F to be free to handle the incoming call, the stepping relay 106 now operates in a circuit extending from grounded battery through the winding of relay 106, armature and back contact of the vertical magnet 107, armature and back contact of the rotary magnet 108, contacts 109 of the off-normal switch 110, back contact and outer right-hand armature of the off-normal relay 111, in-start lead 103 to ground at the contacts 104 and armature of the start relay 100. As soon as the stepping relay 106 operates, the vertical magnet 107 operates in a circuit extending from grounded battery through the winding of the vertical magnet 107, back contact and right-hand armature of the transfer relay 112, front contact and armature of stepping relay 106, and thence to ground on the in-start lead 103 over the circuit hereinbefore traced. The vertical magnet 107 in operating raises the brushes of the switch F one level, and in addition opens the circuit for the stepping relay 106. The stepping relay 106 in releasing opens the circuit for the vertical magnet 107, whereupon this magnet releases. Upon the rise of the switch brushes to the first level due to the operation of the vertical magnet 107, the off-normal switch 110 is actuated, whereupon the circuit for the stepping relay 106 is transferred from ground on the in-start lead 103 to ground at the back contact and right-hand armature of the hunting relay 113.

The winding of the transfer relay 112 is now connected through the commutator brush 114 to the first commutator segment 115. If the called line is located on the first level of the switch or line finder F, the transfer relay 112 will operate through the commutator segment 115 to ground at the contacts 116 and armature of the start relay 100. In the event that the calling line is not located on the first level of the switch, the stepping relay 106 and the vertical magnet 107 will continue to operate alternately, to the ground at the back contact and armature of the hunting relay 113, until the vertical magnet 107 has raised the brushes to the level in which the calling line is located, at which time the transfer relay 112 will operate through the grounded commutator segment, and lock to the back contact ground on the hunting relay 113.

Upon operating, the transfer relay 112 substitutes the rotary magnet 108 for the vertical magnet 107 in the stepping circuit with the stepping relay 106. The stepping relay 106 and rotary magnet 108 will then operate alternately to cause the switch F to

rotate its brushes in the particular level in search of the calling line.

When the line relay 101 operated, it connected ground to the terminal 117 on the multiple bank, and as the rotary magnet 108 advances the brushes to this line, the hunting relay 113 operates in a circuit extending from grounded battery, through the winding of relay 113, outer left-hand armature and back contact of off-normal relay 111, brush 118, terminal 117 to ground over the front contact and armature of the line relay 101.

Relay 113 in operating removes ground from the rotary stepping circuit to prevent further rotation of the brushes at switch F. At its armatures 119 and 120, relay 113 connects the tip and ring conductors of the calling line to corresponding terminals of the multiple jacks 130, 140, 150 and 160. In attracting its armature 121, relay 113 closes through the sleeve conductor of the calling line.

Relay 122 now operates in a circuit extending from grounded battery through the left-hand winding of relay 122, middle armature and back contact of cut-off relay 123, front contact and armature 120 of relay 113, brush 124 and terminal 125 of switch F, over the closed subscriber's line loop, terminal 126 and brush 127 of switch F, armature 119 and front contact of relay 113, back contact and outer armature of relay 123 to ground through the right-hand winding of relay 122. The windings of relay 122 are of low resistance and therefore, when this relay is connected to the calling line, the line relay 101 and the start relay 100 are shunted, whereupon these relays release. Relay 122 in attracting its right-hand armature establishes obvious circuits for the line lamps 131, 141, 151 and 161 causing these lamps to be illuminated. At its left-hand armature relay 122 causes the slow releasing relay 128 to operate in a circuit extending from grounded battery through the winding of relay 128, left-hand armature and front contact of relay 122, to ground at the front contact and right-hand armature of relay 113.

Slow releasing relay 128 in operating provides an auxiliary holding circuit for relay 113 and an energizing circuit for the off-normal relay 111, both of which circuits are obvious. Relay 111 in operating locks to ground at the contacts 129 of the off-normal switch 110, and will not release until the switch F is restored to normal. In attracting its outer right-hand armature relay 111 transfers the in-start relay 103 to the conductor 105 leading to the next switch so that should another subscriber such as B initiate a call, the second line finder would function to extend the call. At its inner left-hand armature relay 111 prepares a circuit for the release magnet 132, the completion of

which is effected when the hunting relay 113 restores. At its outer left-hand armature relay 111 opens the hunting lead, it now being noted that the hunting relay 113 is held operated under the control of the calling subscriber.

An operator at the telephone exchange, upon noting the illumination of one of the line lamps 131, 141, 151 and 161, and who is free to answer the call, inserts the plug 200 associated with one of her connecting circuits into the jack, such as 130, located at her position, whereupon a circuit is established extending from grounded battery, through the lower left-hand winding of repeating coil 201, winding of supervisory relay 202, ring contacts of plug 200 and jack 130, front contact and armature 120 of relay 113, brush 124, terminal 125, over the closed subscriber's line loop, terminal 126, brush 127, armature 119 and front contact of relay 113, winding of supervisory relay 133, tip contacts of jack 130 and plug 200, to ground through the upper left-hand winding of repeating coil 201. Relay 133 operates in this circuit and establishes an obvious circuit for the cut-off relay 123. Relay 123 at its two outer armatures disconnects the switch line relay 122 from the talking conductors, and at its inner armature substitutes a new holding circuit for slow relay 128, it being noted that the original holding circuit for relay 128 is opened by the release of relay 122. Relay 122 in retracting its right-hand armature causes the multiple line lamps 131, 141, 151 and 161 to be extinguished.

Relay 202 also operates in the above traced circuit, preventing the illumination of lamp 204 at this time and connecting the listening relay 205 to the sleeve conductor of the cord, whereupon this relay operates in a circuit extending from grounded battery, through the winding of relay 205, normal make-before-break contacts of relay 206, armature and front contact of relay 202, sleeve contacts of plug 200 and jack 130, front contact and armature 121 of relay 113, brush 136 and terminal 135 of switch F, winding of the line cut-off relay 102 to ground. Relay 205 in attracting its lower armature disconnects ground from the winding of the test relay 203 and in attracting its other armatures connects the operator's telephone set, indicated at O. T. to the talking conductors of the connecting circuit C. The cut-off relay 102 operates in the circuit above traced to cut off the subscriber's line relay 101 from the calling subscriber's line. Although there is an apparent tendency for a race at this time, between the listening relay 205 and test relay 203 (it being obvious that with relay 202 operated the test relay 203 may operate from grounded battery through the winding of relay 205, normal make-before-break contacts of relay 206, armature

and front contact of relay 202, armature 212 and back contact of relay 206, winding of test relay 203 to ground at the back contact and lower armature of relay 205) relay 202 is made slow-to-release so that should relay 203 operate at this time and momentarily short circuit relay 202, relay 202 will hold up until relay 205 operates to open the circuit for relay 203.

The operator now ascertains the details of the call from the calling subscriber, and upon learning that a subscriber on the line L is desired, she makes the usual busy test on the line L, and finding the same idle, inserts plug 208 into the jack 207 of the desired line. As a result of the insertion of plug 208 into jack 207, relay 209 operates in a circuit extending from grounded battery through the winding of relay 209, back contact and right-hand armature of relay 210, sleeve contacts of plug 208 and jack 207 to ground. Relay 209 in attracting its armature 211 establishes an obvious circuit for relay 206, which relay thereupon operates. In attracting its armature 212, relay 206 removes the winding of the test relay 203 from the sleeve conductor of the answering end of the connecting circuit C. At its armature 213, relay 206 locks up to the sleeve of the calling end of the connecting circuit and at its armature 214 it opens the circuit for the listening relay 205, whereupon this relay releases, disconnecting the operator's telephone set from the connecting circuit, and also connects battery to the answering sleeve circuit to hold the subscriber's cut-off relay 102 operated. The current from this battery is not sufficient to operate the message register magnet 166. In attracting its armature 215, relay 206 closes its contacts 216 and 217 for purposes which will hereinafter appear.

Relay 218 now operates in a circuit extending from grounded battery, over the back contact and outer right-hand armature of relay 220, winding of relay 218, filament of lamp 221, back contact and armature of relay 222 to ground at the contacts 216 and armature 215 of relay 206. The lamp 221 is illuminated in this circuit. Relay 218 in operating causes the charge relay 219 to operate over an obvious circuit, in order to prepare the message register magnet 166 for operation. The magnet 166 automatically operates when a called subscriber answers, as will hereinafter appear.

Should the calling subscribers request a "party M" connection, the operator actuates the key M', thereupon connecting ground to its contacts 237, 238, 239 and 242. At the contacts 237 a circuit is established from ground on the contacts 237, over the conductor 243, armature 244 and front contact of relay 209, winding of relay 245 to battery and ground. Relay 245 operates in this

circuit and in attracting its two outer armatures removes the short circuit from the ring-back tone condensers 246 and 247. At its inner lower armature relay 245 locks in a circuit which may be traced from grounded battery, through the winding, front contact and inner lower armature of relay 245, armature and back contact of marginal relay 253 to ground at the contacts 216 and armature 215 of relay 206. At the contacts 238 of key M' a circuit is established which may be traced from ground at the contacts 238, armature 249 and front contact of relay 209, winding of relay 252 to battery and ground. Relay 252 operates in this circuit and in attracting its right-hand armature locks itself in a circuit extending from grounded battery, through the winding of relay 252, front contact and right-hand armature of relay 252, armature and back contact of marginal relay 253 to ground at the contact 216 and armature 215 of relay 206. At its inner left-hand armature relay 252 prepares a circuit for relay 254, which will be completed in the following description. At its outer left-hand armature relay 252 prepares a circuit for the transmission of a special code of ringing current, as will hereinafter appear. At the contacts 242 of key M' a circuit is established from ground at the contacts 242 of key M', armature 255 and front contact of relay 209, through the winding of relay 256 to battery and ground. Relay 256 operates in this circuit and at its right-hand armature locks itself in the same locking circuit as hereinbefore traced for relay 245. At its inner left-hand armature relay 256 connects ground to the ring conductor of the calling end of the connecting circuit C, and at its outer left-hand armature it prepares the tip side of the connection for the transmission of ringing current. At the contacts 239 of key M' a circuit is established for the left-hand winding of relay 210 by way of the armature 259 and front contact of relay 209. Relay 210 operates in this circuit and locks through its right-hand winding to ground on the sleeve of the calling end of the connecting circuit C. Relay 210 in operating opens the circuit for the start relay 209, which relay thereupon releases, it being now understood that the relays 245, 256 and 252 are locked to ground at the contact 216 of armature 215 of relay 206.

While the brush of interrupter 258 is on a conducting segment, current from battery 257 flows over the conductor 260, over the normal make-before-break contacts and winding of relay 254 to ground at the front contact and inner left-hand armature of relay 252. In attracting its right-hand armature relay 254 locks under the control of relay 252. A special code of ringing current now traverses a path extending from the ringing

current supply through the interrupter 262, conductor 261, front contact and left-hand armature of relay 254, front contact and outer left-hand armature of relay 252, left-hand armature and back contact of relay 209, winding of marginal relay 253, outer left-hand armature and front contact of relay 256, front contact and upper armature of relay 245, tip contacts of plug 208 and jack 207 to ground through the bells at stations M and J. The current in the circuit just traced is not sufficient to cause the operation of marginal relay 253 at this time. Both subscribers at stations M and J hear the ringing signal, but the subscriber at station M recognizes the code and answers the call, whereas the subscriber at J does not recognize the signal as his, and does not answer the call.

Should the calling subscriber ask for a connection with the subscriber at station J, the operator actuates key J', thereby connecting ground to contacts 261, 262 and 263. The closure of the contacts 261 causes relay 245 to operate in the same manner as described in connection with the operation of key M'. The closure of the contacts 262 causes relay 256 to operate in a manner similar to that described in the previous connection. The closure of the contacts 263 causes the sleeve relay 210 to operate and lock. It will be noted that when key J' is actuated, relays 252 and 254 do not enter into the ringing operation. Relays 245, 256 and 210 in operating perform the same functions as hereinbefore described in connection with the previous signaling operation. A circuit for a special code of ringing current now traverses a path which may be traced from the ringing current supply through the interrupter 264, conductor 265, back contact and outer left-hand armature of relay 252, left-hand armature and back contact of relay 209, through the winding of marginal relay 253, outer left-hand armature and front contact of relay 256, front contact and upper armature of relay 245, tip contacts of plug 208 and jack 207 to ground through the bells at the subscribers' stations M and J. The subscriber at station J responds to the signaling current at this time, whereas the subscriber M does not heed the signal.

Upon a request for a "party R" connection, the operator actuates the key R', thereby connecting ground to the contacts 266, 267 and 268. The same relays which were operated in response to the actuation of key M', with the exception of relay 256, are now operated so that the path for the ringing current may be traced from the ringing current supply through the interrupter 262, conductor 261, front contact and left-hand armature of relay 254, front contact and outer left-hand armature of relay 252, left-hand armature and back contact

of relay 209, winding of marginal relay 253, outer left-hand armature and back contact of relay 256, front contact and lower armature of relay 245, ring contacts of plug 208 and jack 207 to ground through the subscribers' bells at stations R and W. Though the bells at both stations R and W are actuated in response to this signaling current the subscriber at station R recognizes the code as his signal and answers the call, whereas the subscriber at W does not heed the signal.

Should the calling subscriber request a "party W" connection, the operator actuates key W', thereupon connecting ground to the contacts 270 and 271 so that only relays 245 and 210 of the ringing relays operate, the circuits for these relays now being obvious. The ringing current path may now be traced from the ringing current supply through the interrupter 264, conductor 265, back contact and outer left-hand armature of relay 252, left-hand armature and back contact of relay 209, winding of marginal relay 253, outer left-hand armature and back contact of relay 256, front contact and lower armature of relay 245, ring contacts of plug 208 and jack 207 to ground through the subscribers' bells at stations R and W. The subscriber at W only, recognizes this code and proceeds to answer the call in the usual manner.

When the desired party at a station, such as M, in response to the incoming signal removes the receiver from the switchhook, the condenser 272 is short circuited and a new circuit for the ringing current is established which may be traced over the original ringing current circuit as far as the subscriber's line and then through the transmitter and receiver switchhook contacts to ground on either the ring or tip conductors of the connecting circuit, depending upon whether or not relay 256 was operated. This circuit includes the winding of marginal relay 253, and due to the fact that the condenser 272 is short circuited, the resistance of this circuit is sufficiently reduced so as to permit this relay to operate. Relay 253 in operating opens the locking circuit for relays 245, 256 and 252, releasing them if operated, thereby restoring the ringing equipment to normal. When the called subscriber responds, a circuit for relay 222 is established which may be traced from grounded battery, through the lower right-hand winding of repeating coil 201, winding of relay 222, back contact and lower armature of relay 245, ring contacts of plug 208 and jack 207, over the closed subscriber's line loop, tip contacts of jack 207 and plug 208, upper armature and back contact of relay 245 to ground through the upper right-hand winding of repeating coil 201. Relay 222 in operating opens the

circuit for the supervisory lamp 221, which thereupon is extinguished, and establishes a circuit for the slow operating relay 220, which circuit may be traced from grounded battery, through the winding of relay 220, left-hand armature and back contact of slow releasing relay 218, front contact and armature of relay 222 to ground over the contact 216 and armature 215 of relay 206. Relay 218 released when relay 222 operated. Relay 220, operating in the circuit just traced, connects the high voltage battery 275 to its front contact and left-hand armature, whereupon current therefrom flows momentarily over the front contact and armature of the slow to release charge relay 219, sleeve contacts of plug 200 and jack 130, front contacts and armature 121 of relay 113, brush 136 and terminal 135 of switch F to ground through the winding of the message register magnet 166. The magnet 166 in operating on this momentary pulse causes the message registering device to operate to register the call. Relay 220 in operating locks to ground on the contact 216 and armature 215 of relay 206 in order to prevent further registration on this connection. Magnet 166 in operating shunts out part of its winding and thereby increases the flow of current in the other part so that hereafter such magnet will remain energized on the cord circuit battery. It should be noted that relay 219 is so adjusted as to hold operated until relay 220 has closed its contacts.

It will now be assumed that the conversation between the calling and called subscribers has terminated and the subscribers have replaced their receivers on their respective switchhooks.

When the calling subscriber hangs up the receiver at the termination of the conversation, the circuit for the supervisory relay 133 is opened whereupon this relay releases and opens the circuit for the cut-off relay 123. Relay 123 in retracting its two outer armatures reconnects the switch line relay 122 to the switch. At its inner armature, relay 123 opens the holding circuit for slow releasing relay 128, which relay after an interval, restores to normal. Relay 128 in retracting its armature, opens the holding circuit for relay 113 which relay releases and also opens the original energizing circuit for the off-normal relay 111, which relay, however, is held operated to ground at the contacts 129 of the off-normal switch 110.

Relay 113 in releasing its left-hand armatures, disconnects the tip, ring and sleeve brushes 127, 124 and 136 of the line finder F from the multiple answering jacks. At its right-hand armature, relay 113 connects ground to the winding of the release magnet 132 by way of the inner left-hand armature

and front contact of relay 111, whereupon the release magnet 132 operates to restore the line finder to normal position. When the line finder returns to normal, the off-normal contacts 129 are opened, whereupon relay 111 releases disconnecting the release magnet from ground at the right-hand armature of relay 113. The switch apparatus and all equipment shown in Fig. 1 are now in normal position.

When the calling subscriber hangs up, the circuit for the answering cord supervisory relay 202 is also opened so that the lamp 202 is lighted over a circuit extending from grounded battery, armature 214 and front contact of relay 206, armature and back contact of relay 202, filament of lamp 204, contacts 217 and 216 and armature 215 of relay 206. The illumination of lamp 204 at this time serves as a disconnect signal to the operator.

When the called party restores the receiver to normal, the circuit for the calling supervisory relay 222 is opened, whereupon lamp 221 is lighted over a circuit extending from grounded battery through the filament of lamp 221, back contact and armature of relay 222, to ground over the contacts 216 and armature 215 of relay 206.

Upon receipt of a disconnect signal, the operator may proceed to take down the connection. Upon withdrawing plug 200 from jack 130 no cord circuit equipment is affected, since the sleeve conductor of the answering end of the cord is opened by the release of relays 202 and 219 and by the operation of relay 206. The withdrawal of plug 208 from jack 207 causes the opening of the locking circuits for relays 210 and 206. Relay 206 in releasing its armatures, opens the circuits for the lamps 204 and 221 whereupon these lamps are extinguished and also opens the locking circuit for relay 220, whereupon this relay releases. The cord circuit equipment is now in normal condition.

Relay 128 associated with the line finder F is made slow releasing so as to enable an operator to remove the answering plug 200 from the jack 130 without causing the release of the line finder. When the plug 200 is withdrawn from jack 130 and when the subscriber at station A is on the line, relay 133 releases and opens the circuit for the cut-off relay 123, which relay thereupon retracts its armatures. In retracting its inner armature, relay 123 opens the holding circuit for relay 128, but at its two outer armatures, relay 123 reconnects the switch line relay 122 to the calling line and this relay immediately operates over the closed subscriber's line loop, and at its left-hand armature establishes another holding circuit for relay 128, which relay therefore remains operated and prevents the release of relay

113 and the subsequent operation of the release magnet 132. At its right-hand armature, relay 122 again causes the illumination of the multiple line lamps. Should the calling subscriber flash under this condition, relay 122 will follow the switchhook actuations and cause the flashing of the line lamps. Relay 128, however, will remain operated to prevent the release of the line finder.

If the calling subscriber in the previous descriptions requested a connection which necessitated the employment of a trunk circuit wherein no application of ringing current is required, the operator would insert plug 208 into the trunk jack 280 of the selected trunk and actuate the trunk key T. The same relays which were operated when plug 208 was inserted into jack 207 operate upon the insertion of the plug 208 into the trunk jack 280. The closure of contacts 281 of key T causes relay 210 to operate and lock to the sleeve of the calling end of the connecting circuit, and the disconnection of the common ringing keys as in the preceding descriptions without causing ringing current to be applied, since no other ringing relays are operated.

Should a second operator such as an operator at the position at which lamp 141 is located attempt to answer the incoming call, after the operator at the position at which the line 131 is located, has inserted the plug 200 into the jack 130, she would be prevented from doing so in the following manner. Upon the insertion of plug 200 of the first cord into the jack 130, the sleeves of the jack 130 and all the multiple jacks became a busy potential by reason of the current flow through the winding of relay 205 of the first cord in series with the winding of relay 102 in the line circuit. When a second operator inserts one of her answering plugs into the jack 140 of the calling line, the battery on the sleeve thereof causes the test relay 203 of the second cord circuit to operate in a circuit extending from battery on the sleeve of jack 140, sleeve of the answering plug of the second cord, armature 212 and back contact of relay 206 of the second cord, winding of test relay 203 of the second cord to ground at the back contact and lower armature of the listening relay 205 of the second cord. The second cord test relay 203 thereupon operates to short circuit the second cord supervisory relay 202 and prevent its operation. Since relay 202 of the second cord cannot operate, the circuit for the second cord listening relay 205 is held opened at the front contact of the second cord relay 202. Therefore, this relay cannot operate and the second operator's headset cannot be connected to the calling line. Under such a condition, the operator upon receiving no communica-

tion from the calling subscriber and noting the dead condition of her headset, realizes that the call has already been answered and removes her answering plug from the multiple jack 140.

The jack 170 is employed in establishing a connection to the subscriber's line A.

What is claimed is:

1. In a telephone system, a telephone exchange, a link circuit terminating therein in a plurality of multiple jacks, a plurality of telephone lines, a two-movement line finder actuated in response to the initiation of a call on one of said lines to connect the calling line to said link circuit, a relay operated in response to the connection of the calling line to said link circuit for maintaining said line finder in its operated position, and means responsive to the seizure of said link circuit at said telephone exchange for deenergizing said relay and maintaining said line finder in its operated position.

2. In a telephone system, a telephone exchange, a link circuit terminating therein in a plurality of multiple jacks, a two-movement line finder, a plurality of telephone lines, means responsive to the initiation of a call on one of said lines for operating said line finder to connect the calling line to said link circuit, a relay actuated in response to the connection of the calling line to said link circuit, a slow releasing relay controlled thereby, a cut-off relay actuated in response to the seizure of said link circuit at said telephone exchange for deenergizing said first relay and controlling said slow releasing relay, and means controlled by said slow releasing relay for restoring said line finder to normal position.

3. In a telephone system, a telephone exchange, a link circuit terminating therein in a plurality of multiple terminals, a two-movement line finder, a group of lines ac-

cessible to said line finder, means responsive to the initiation of a call on one of said lines for operating said line finder to connect the calling line to said multiple jacks and for placing said line finder under the control of the calling line, means responsive to the seizure of said link circuit at said telephone exchange for placing said line finder under the control of both the subscribers on the calling line and the answering operator at said exchange, and a slow releasing relay controlled by said last mentioned means for maintaining said line finder operated when said link circuit is released at said telephone exchange.

4. In a telephone system, a telephone exchange, a link circuit terminating therein in a plurality of multiple jacks, a group of telephone lines, a two-movement line finder, means responsive to the initiation of a call on one of said lines for operating said line finder to connect the calling line to said link circuit, a slow-releasing relay controlling said line finder, a relay controlled from said calling line and operated in response to the connection of said link circuit with said calling line to cause said slow releasing relay to operate to maintain said line finder in its operated position, and means responsive to the seizure of said link circuit by way of one of said multiple jacks for deenergizing said second relay and substituting a holding circuit for said slow releasing relay, thereby placing said line finder under the control of both the calling line and the telephone exchange, said means being released when said link circuit is released at said telephone exchange to place the line finder under the sole control of the calling line.

In testimony whereof I have signed my name to this specification this 21st day of November, 1923.

RAND S. BAILEY.