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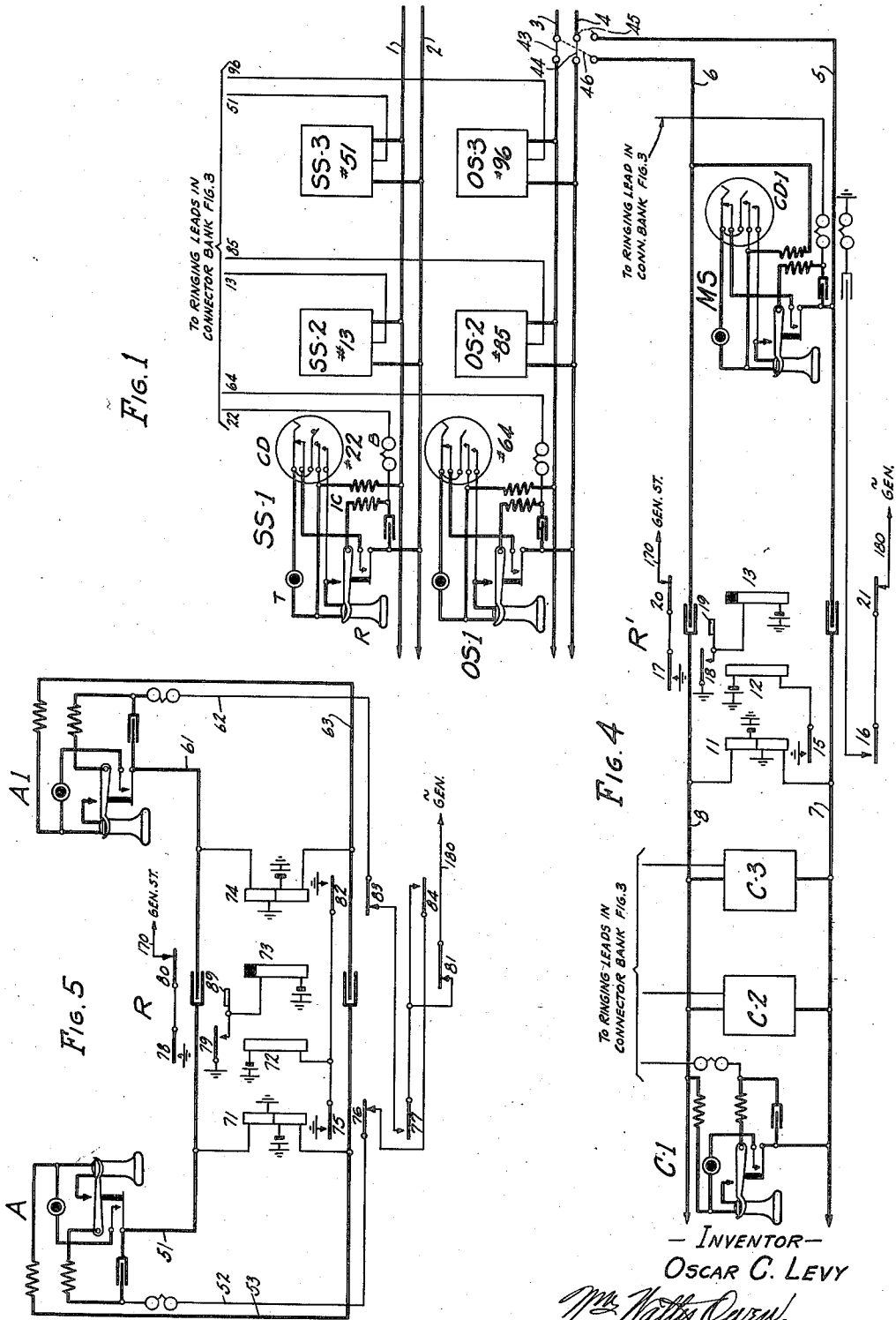
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2,052,050

AUTOMATIC TELEPHONE SYSTEM

Filed Oct. 9, 1933

3 Sheets-Sheet 1



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3 Sheets-Sheet 2

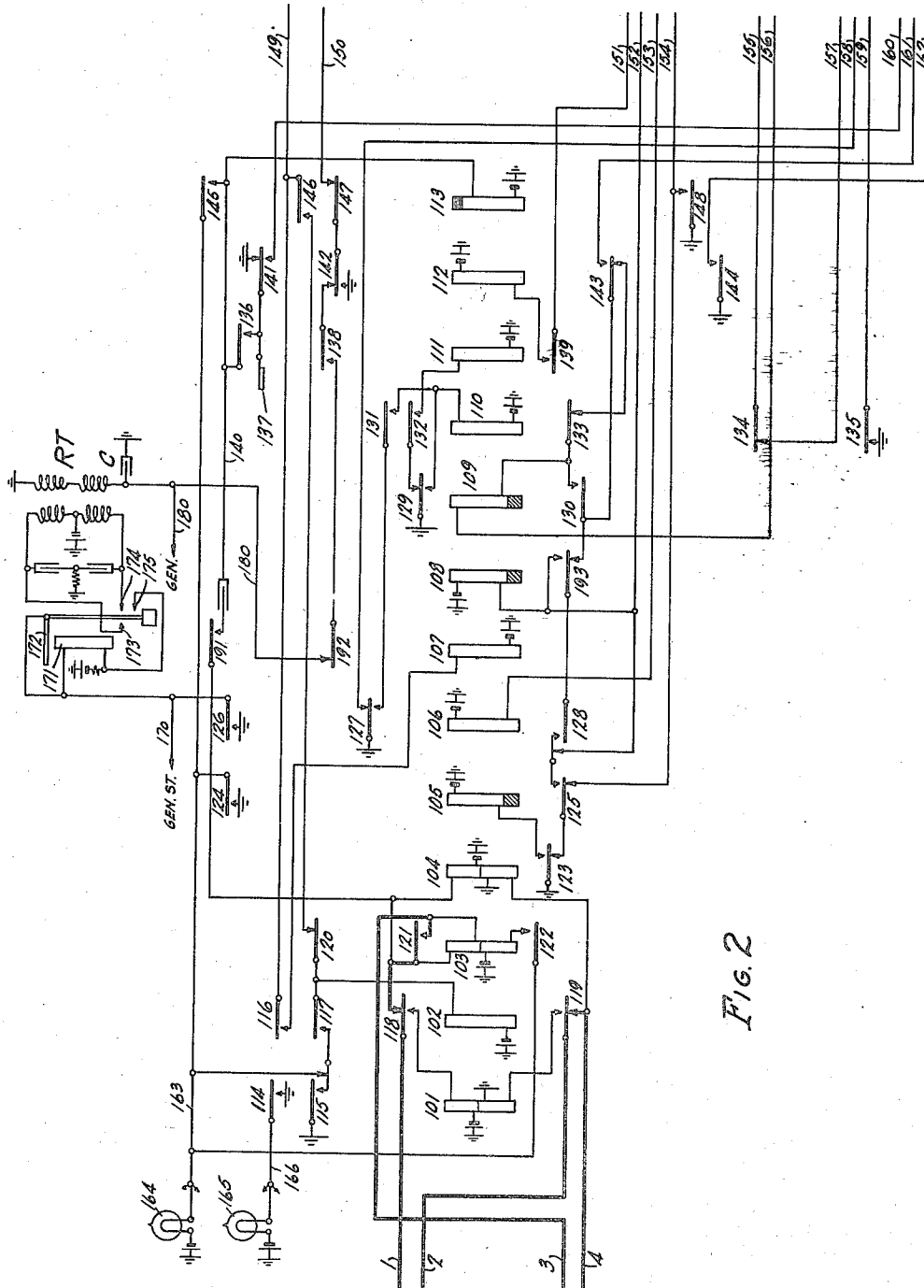


Fig. 2

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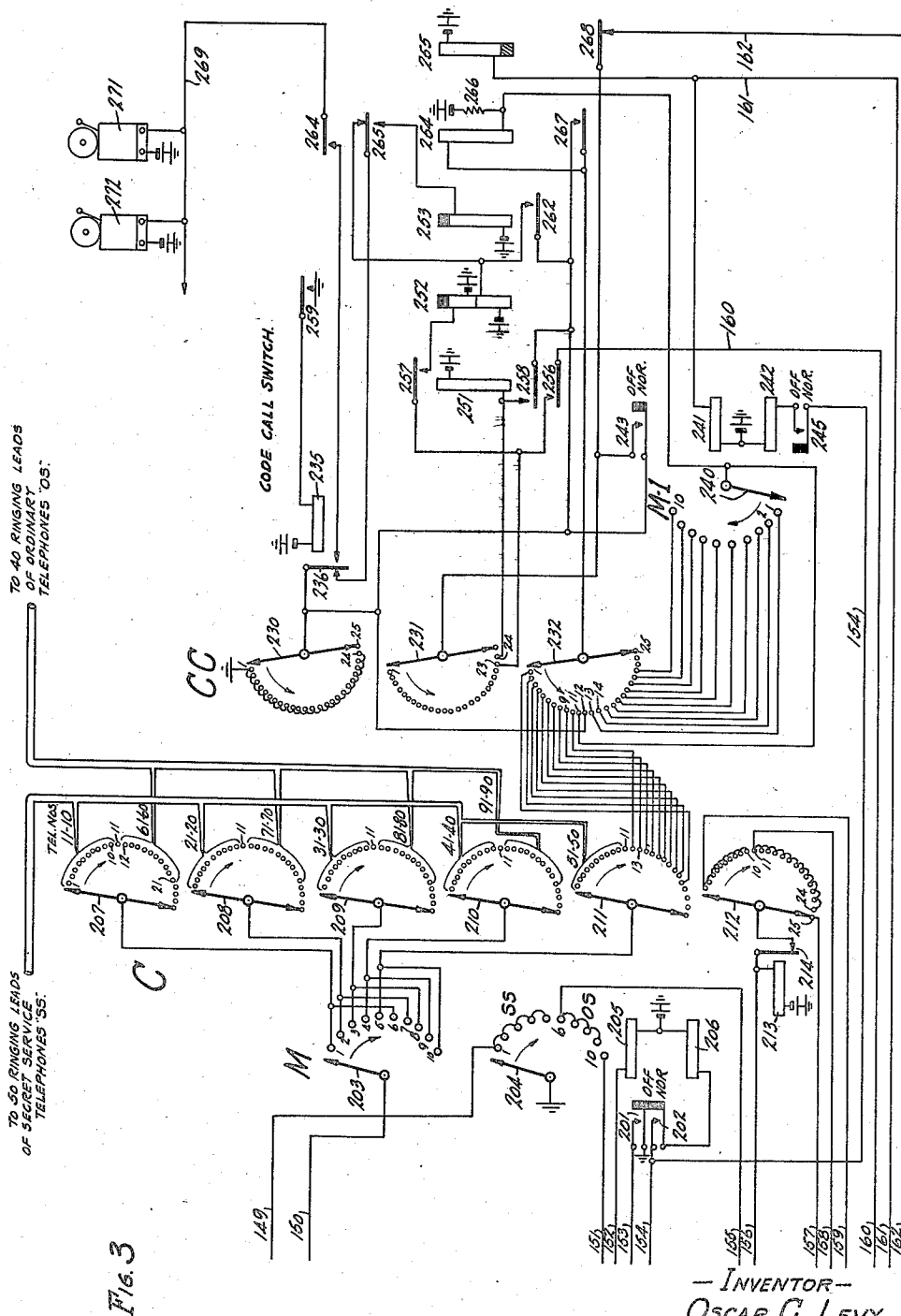
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AUTOMATIC TELEPHONE SYSTEM

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3 Sheets-Sheet 3



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2,052,050

AUTOMATIC TELEPHONE SYSTEM

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Application October 9, 1933, Serial No. 692,717

20 Claims. (Cl. 179—17)

This invention relates in general to automatic telephone systems, and more particularly to small private installations, and its principal object is to provide a common talking, selective ringing system which is an improvement over the one described in Patent No. 1,681,703, issued to C. E. Lomax on August 21, 1928. More specifically, the principal object of the invention is to provide an efficient yet inexpensive system for private installations, comprising a common talking line with a plurality of substations thereon.

Another object of the invention is the provision of a common talking circuit over which two groups of subscribers' lines may talk. This common talking circuit is so arranged that it may be divided into two parts in telephone connections involving subscribers of the same group, one part serving for connections between subscribers in one group and the other part serving for connections between subscribers in the other group. This arrangement permits a second call to be set up between subscribers in the second group after a call has been set up between subscribers in the first group.

Another object of the invention is the provision of an automatic stepping circuit for a switch serving two groups of lines to enable such switch to be automatically advanced beyond one group of lines when a digit greater than a predetermined number is dialed on a preceding switch before the switch is, itself, directly operated on a succeeding digit. This arrangement allows the switch to complete its rotating movement beyond the group of lines during the first digit and the interval before the succeeding digit is received.

The means by which the foregoing and other objects are accomplished will be fully set forth hereinafter, reference being made to the accompanying drawings, comprising Figs. 1 to 5, inclusive.

Referring to Fig. 1, two groups of subscribers' lines and the two suitable common talking paths comprising conductors 1 and 2 and conductors 3 and 4 are shown. The first group comprising fifty stations, such as SS1 to SS3, inclusive, will, for convenience, be called the secret service lines and would, for example, include the different executives' telephones and the telephones of the office help in a factory. The second group comprises, in this case, only forty stations, such as OS1 to OS3, inclusive, and will be called the ordinary service lines. The ordinary service lines would, for example, include the telephones

assigned to the different departments of the factory. In both groups each substation is provided with a standard, well known automatic telephone set, comprising the usual receiver and transmitter, induction coil, calling device, and ringer. All of the secret service lines are connected to talking conductors 1 and 2 and all of the ordinary service lines are connected to the talking conductors 3 and 4. Each subscriber has an individual ringing lead which terminates in its allotted bank contact in the banks of the connector C shown in Fig. 3.

In Fig. 2 is shown a group of relays and a ringing machine which are controlled by both groups of subscribers in establishing telephone connections. Lamps, such as lamp 164, are provided if desired and located at different visible points throughout the establishment for indicating when the common talking circuit is in use by ordinary service subscribers. In a similar manner the lamp 165 and other lamps located throughout the establishment indicate when the common talking circuit is used by secret service subscribers' lines.

In the left hand portion of Fig. 3 is shown a so-called minor switch M comprising wipers 203 and 204, motor magnet 205, release magnet 206, and off normal springs 201 and 202. The wipers of the switch M are connected as shown and are rotated upon the energization of the stepping magnet 205 and released to normal position by spring tension in response to the release magnet 206 withdrawing the holding detent from its ratchet (not shown). Off normal springs 201 and 202 are shown in normal position and are closed as soon as the wipers are moved off normal.

Near the center of Fig. 3 is shown the connector C comprising wipers 207 to 212, inclusive, and motor magnet 213. The mechanical construction of connector C is similar to the well-known 25-point rotary line switch commonly used in automatic telephone systems, in which the wipers are advanced in a forward direction only on the deenergization of the motor magnet. The first ten bank contacts accessible to wipers 207 to 211, inclusive, are connected to the individual ringing leads of the secret service lines, the eleventh bank contacts accessible to these wipers are left dead, while the twelfth to twenty-first bank contacts accessible to these wipers are connected to the individual ringing leads of the ordinary service lines and to the banks of the code call switch CC as shown. The wiper 212 and its associated bank contacts are for control-

ling the automatic operation of the motor magnet 213.

The code call switch CC is similar in mechanical construction to the connector C and comprises wipers 230 to 232, inclusive, and motor magnet 235. The minor switch MI is mechanically similar to the minor switch M and comprises the wiper 240, stepping magnet 241, release magnet 242, and off normal springs 243. The relays 251 to 255, inclusive, in connection with the code call switch CC and minor switch MI control the circuits for ringing the code call bells 271, 272, etc., located throughout the establishment or factory at different locations.

Fig. 4 shows a group of manual telephone stations, such as C1 to C3, a relay group R', and a master telephone station MS, which are to be substituted for the ordinary service lines of Fig. 1 when master station service is desired. When Fig. 4 is being used the dotted jumpers 45 and 46 are connected to the talking conductors 3 and 4 and the full line jumpers 43 and 44 of the ordinary service lines are cut. Each manual substation comprises the usual receiver, transmitter, induction coil, ringer, and an individual ringing lead which is connected to the banks of the connector C in place of the ordinary subscriber's individual ringing leads. The master telephone station MS is a standard automatic substation similar to substation SS1, having, however, an extra ringer. The individual ringing lead of station MS also terminates in the bank of the connector C in accordance with the number assigned thereto.

Referring to Fig. 5, the substations A and A1 are of the usual manual type and are located at the same places as the automatic substations SS1 and SS2 of Fig. 1. The line of substation A, when calling is connected with the line of substation A1, or vice versa, by the relay group R. The relay group R is similar to relay group R' of Fig. 4 with the exception that the relay 74 and its connections have been omitted from group R', and it will be seen that either direct line service or master station service can be given whenever this relay group is provided.

Having given a brief description of the apparatus, the operation of the same will now be explained in detail. For this purpose it will be assumed that the subscriber at station SS1 desires to call the subscriber at SS2. Subscriber SS1 will remove his receiver and listen to see if a common talking line is in use. In response to the removal of the receiver line relay 104 is energized over the following circuit: from ground through the lower winding of relay 104, resting contact and armature 119, conductor 2, through the calling substation loop to conductor 1, armature 118 and its resting contact, and through the upper winding of relay 104 to battery. At armature 123 relay 104 completes an obvious energizing circuit for release relay 105. Relay 105 upon energizing at armature 124 grounds release trunk conductor 163 to light the lamps such as lamp 164 and at armature 125 prepares a point in the impulsing circuit.

Subscriber SS1 now operates his calling device CD in accordance with the first digit of the called subscriber's number. Line relay 104 deenergizes after each impulse transmitted and at armature 123 and its resting contact completes the impulsing circuit for relay 108 and rotary magnet 205 as follows: from ground by way of armature 123 and its resting contact, armature 125 and its working contact, through the normally closed

springs controlled by armature 128 to conductor 152 where the circuit divides, one branch going through the winding of relay 108 to battery, and the other branch going through the winding of the rotary magnet 205 to battery. Relay 108 energizes over the above traced circuit to maintain its armature 193 attracted throughout the impulsing period, and at armature 193 and its resting contact opens a point in the circuit to motor magnet 213, and at its working contact prepares a new impulsing circuit for relay 108 and magnet 205. Rotary magnet 205, upon energizing over the above-traced circuit, operates its pawl to advance the wipers 203 and 204 into engagement with their first bank contacts. As soon as wipers 203 and 204 are moved off normal the off normal springs 201 and 202 close. Off normal springs 202 prepare a circuit for the release magnet 206 and the off normal springs 201 complete the energizing circuit from ground by way of conductor 153 for energizing the off normal relay 106. Relay 106, upon energizing, at armature 126 starts the ringing machine by energizing the vibrating relay 171 over the generator start lead 170. Relay 171 upon energizing operates its vibrating armature 172 to close springs 175. Springs 175, upon closing, complete a short circuit around the winding of relay 171 with the result that relay 171 now deenergizes and releases its armature. When springs 175 open relay 171 again energizes and again operates its armature 172 to close springs 175 to short circuit relay 171. In this manner the relay 171 vibrates its armature 172 as long as ground is connected to the generator start lead 170. At springs 173 and 174 vibrating arm 172 alternately connects ground to the upper and lower left hand windings of the ringing transformer RT. Due to this alternate condition the right hand windings of the ringing transformer RT transmit ringing current out over the conductor 180 in the well known manner. At armature 127 relay 106 opens one point in the restoring circuit of the connector C at its resting contact, and at its working contact prepares a locking circuit for relay 110; at armature 128 opens the original impulsing circuit and completes a new impulsing circuit before the second pulse of the first digit is transmitted. The second impulse of the first digit is transmitted from ground by way of armature 123 and its resting contact, armature 125 and its working contact, working contact and armature 128, armature 193 and its working contact, and from thence through the winding of relay 108 to battery, and over conductor 152 through the winding of rotary magnet 205 to battery. The remaining impulses of this digit, if more than two, would be transmitted over the circuit just traced.

In this case since the subscriber SS2 is being called, the first digit dialed is 1 corresponding to the first digit in the subscriber's number, and therefore the wipers 203 and 204 come to rest in engagement with their first bank contacts; the wiper 203 preparing a point in the ringing circuit and wiper 204 preparing a point in the circuit of relay 107. After the last impulse of the first digit has been transmitted, line relay 104 is maintained energized and slow to release series relay 108 is deenergized after an interval. At armature 193 relay 108 prepares an impulsing circuit to the motor magnet 213.

Subscriber SS1 now operates the calling device CD in accordance with the second digit, in this case the digit 3. Line relay 104 again follows the impulses and at each deenergization completes the following circuit for operating the rotary

series relay 109 and motor magnet 213 as follows: ground from armature 123 and its resting contact, armature 125 and its working contact, armature 128 and its working contact, armature 193 and its resting contact, armature 143 and its resting contact, armature 133 through the winding of series relay 109, conductor 156, and through the winding of motor magnet 213 to battery. Relay 109 upon energizing at armature 129 completes an obvious circuit for energizing relay 110 and at armature 130 maintains the impulsing circuit independently of armature 122. Relay 110 upon energizing at armature 131 completes a locking circuit for itself from grounded armature 127; at armature 132 prepares an energizing circuit for ringing relay 111; at armature 133 opens the impulsing circuit now closed at armature 130; and at armatures 134 and 135 opens points in the automatic stepping circuit of the connector C. Motor magnet 213 energizes and deenergizes for each impulse received and on each deenergization thereof steps the wipers 207 to 212, inclusive, one step. Since the digit dialled is 3, three impulses are transmitted to the motor magnet 213, and the wipers 207 to 212, therefore, stop in engagement with their third bank contacts, where wiper 207 prepares the circuit for ringing subscriber SS2 over its individual ringing lead 13 terminating in the third bank contact accessible to wiper 207. After the last impulse of this series is transmitted line relay 104 is again energized and slow to release relay 109 deenergizes after an interval. At armature 130 relay 109 opens the impulsing circuit and at armature 129 and its working contact opens the original energizing circuit of relay 110, which relay is now locked over armatures 127 and 131, and at its resting contact completes a circuit for energizing ringing relay 111 by way of armature 132. Relay 111 energizes and starts the arm 137 vibrating for a predetermined time to intermittently close the armature 136, at armature 139 prepares a circuit for relay 112, and at armature 138 completes the ringing circuit for ringing subscriber SS2 as follows: from generator lead 180 by way of armature 192, armature 138, resting contact and armature 142, armature 147, conductor 159, wiper 203 in engagement with its first bank contact, wiper 207 in engagement with its third bank contact, individual ringing conductor 13, through the ringer and condenser at substation SS2, conductor 2, armature 119 and resting contact, and through the lower winding of relay 104 to ground. Relay 113 being a slow to operate relay will not operate its armature, while the arm 137 is vibrating and intermittently operating armature 136. After a predetermined time arm 137 stops vibrating and closes armature 136 long enough to energize the ring cut off relay 113 as follows: From ground by way of resting contact and armature 141, armature 136, and through the winding of ring cut off relay 113 to battery. At armature 145 relay 113 completes a locking circuit for itself from grounded release trunk conductor 163, at armature 146 closes a circuit for energizing relay 102, at armature 147 opens the ringing circuit, and at armature 148 connects ground to release conductor 154. Relay 102 energizes over the following circuit: from grounded wiper 204, conductor 149, armature 146, armature 120 and through the winding of relay 102 to battery. Relay 102 upon energizing, at armature 116 completes a circuit for energizing relay 107; at armature 117 closes a temporary locking circuit for itself from grounded release trunk conductor 163

and by way of the normally closed springs controlled by armature 115 and at armatures 118 and 119 disconnects the line relay 104 and connects the relay 101 in place thereof. The circuit for energizing relay 107 may be traced from grounded wiper 204 in engagement with its first bank contact, conductor 149, armature 116, and through the winding of relay 107 to battery. At armature 191 relay 107 connects conductor 155 to the upper winding of relay 104 to prepare a tone circuit for transmitting a tone to ordinary subscribers' lines when such lines call the secret service lines at a time when the secret service lines are busy, and at armature 192 opens a further point in the ringing circuit. Relay 101 is now energized over the following circuit: from ground through the lower winding of relay 101, working contact and armature 119, conductor 2, through the calling or called subscriber's substation loop to conductor 1, and by way of armature 118 and its working contact through the upper winding of relay 101 to battery. At armature 114 relay 101 grounds conductor 166 to illuminate all of the secret service lamps, such as 165, and at armature 115 maintains the locking circuit of relay 102 independent of the grounded release trunk conductor 163. Line relay 104 deenergizes when its circuit is opened and at armature 123 opens the circuit of slow to release relay 105.

When ring cut off relay 113 grounded release conductor 154 at armature 148, release magnet 206 of the switch M is energized by way of the closed off normal springs 202. Release magnet 204 upon energizing withdraws the holding detent from its ratchet (not shown) thereby permitting the wipers 203 and 204 to be returned to normal position by spring tension at which time the off normal springs 201 and 202 are opened. In response to the restoration of wiper 204 the circuit of relay 107 is opened and said relay now deenergizes. The restoration of off normal springs 202 opens the circuit of off normal relay 104, which likewise deenergizes. Relay 107 deenergizes and at armature 191 opens a point in the prepared tone circuit and at armature 192 again prepares a point in the ringing circuit. Relay 106, upon deenergizing, at armature 126 disconnects ground from the generator start lead 170 to stop the ringing machine, at armature 127 opens the locking circuit of relay 110 at its working contact, and at its resting contact grounds conductor 158 to prepare the restoring circuit for the connector C. Relay 110 deenergizes after its locking circuit is opened and at armature 132 opens the circuit of ringing relay 111 which likewise deenergizes, at armature 133 prepares a point in the impulsing circuit, at armature 134 prepares a point in the automatic stepping circuit of connector C and at armature 135 closes the restoring circuit of the connector C as follows: from grounded armature 135, conductor 159, through the upper multiplied contacts engaged by wiper 212, through the interrupter springs 214, and through the winding of motor magnet 213 to battery. Motor magnet 213 at its interrupter springs 214 opens its own energizing circuit to thereby deenergize itself to step the wiper to its fourth contact. When interrupter springs 214 close on the deenergization of motor magnet 213 the circuit for energizing motor magnet 213 is at this time completed over the previously traced circuit and through the fourth multiplied bank contact and wiper 212, as previously described. Motor magnet 213 is again energized to again interrupt its own circuit to cause the wiper

ers to step into engagement with their fifth bank contact. This automatic stepping circuit is completed as long as the wiper 212 engages the multiplied contacts connected to grounded conductor 159. When wiper 212 reaches its eleventh bank contact a new circuit is completed from grounded armature 127 and its resting contact, conductor 158 connected to the multiplied contacts 11 to 24, inclusive. In the same manner as previously described the motor magnet 213 interrupts its own circuit to advance the wipers step by step until wiper 212 no longer encounters a grounded bank contact. The wipers of the connector C are therefore stepped into engagement with their twenty-fifth or off-normal position bank contacts, at which time wiper 212 no longer encounters a grounded bank contact. Ringing relay 111 deenergizes when its circuit is opened by relay 110 and at armature 136 disconnects ground from conductor 140 to open the original energizing circuit to ring cut off relay 113, and at armature 138 opens a point in the ringing circuit. Shortly after line relay 104 deenergizes slow to release relay 106 likewise deenergizes, and at armature 124 disconnects ground from conductor 163 to extinguish the lamps 164 and to open the locking circuit of ring cut off relay 113 which deenergizes. Ring cut off relay 113 at armature 147 again prepares the ringing circuit. All of the relays with the exception of relays 101 and 102 are now in normal position and the wipers of both the minor switch M and the connector C are restored to their normal positions and may be used for establishing the ringing circuit for signalling an ordinary service line. The secret service lines receive talking battery through the upper and lower windings of relay 101 and talk over the common talking conductors 1 and 2. By the operation of relay 102 it can be seen that the common talking circuit connecting the two groups of subscribers are divided at armatures 118 and 119 so that the ordinary service subscribers may complete connections in their own group and talk over conductors 3 and 4 during the time a conversation is being held in the secret service line group over conductors 1 and 2. After conversation and in response to both secret service subscribers replacing their receivers, relay 101 deenergizes and at armature 114 disconnects ground from conductor 166 to extinguish the secret service lamps 165. At armature 115 relay 101 opens the locking circuit of relay 102 which now deenergizes and the equipment in Fig. 2 is now fully restored to normal position.

Having described an established connection between two subscribers in the secret service group a description will now be given of the operations which take place when an ordinary service subscriber calls another subscriber in the same group. This connection may be established during the time a connection exists on the secret service lines. For example, it will be assumed that subscriber OS1 desires to call subscriber OS2, and in response to the subscriber at substation OS1 removing his receiver, after first ascertaining by means of the busy lamps that the line is idle, a circuit is completed for energizing relays 103 and 104. This circuit may be traced as follows: From ground, through the lower winding of relay 104, conductor 4, through the calling substation loop to conductor 3, through the upper winding of discriminating relay 103, and through the upper winding of line relay 104 to battery. Relay 103 at armature 129 opens a point in the original energizing circuit of relay 102 to prevent the ener-

gization of relay 102 in case the same is not already energized in a secret service line connection. At armature 121 short circuits the upper winding of relay 103 to improve the impulsing circuit to render the relay slow to release and to complete a point in the talking circuit, and at armature 122 prepares a point in its own locking circuit. Relays 104 and 105 energize as previously described and relay 105 at armature 124 grounds conductor 163 to light the busy lamps 164 and to complete the locking circuit through the lower winding of relay 103, and at armature 125 prepares the impulsing circuit.

Since the number of subscriber OS2 is 85 the calling subscriber OS1 will dial the first digit, or the digit 8. Line relay 104 deenergizes and energizes eight times, and at each deenergization closes the previously traced impulsing circuit for relay 103 and magnet 205. The magnet 205 is therefore operated eight times to step the wipers 203 and 204 of switch M into engagement with their eight bank contacts. Relay 106 is again energized from off normal springs 201. Relay 107 will be temporarily energized over its previously traced circuit only during the time the wiper 204 is passing over its first five multiplied bank contacts, and only in case relay 102 is energized due to the existing connection between two secret service subscribers. When wiper 204 engages its sixth bank contact a circuit is completed for energizing the motor magnet 203 of the connector C as follows: From grounded wiper 204 in engagement with its sixth bank contact, conductor 155, armature 134, conductor 157, twenty-fifth bank contact and wiper 212, through the interrupter springs 214, and winding of motor magnet 213 to battery. Motor magnet 213 energizes and then deenergizes when interrupter springs 214 open its circuit to step the wipers of the connector C into engagement with their first bank contacts at which time an automatic stepping circuit for motor magnet 213 is completed by wiper 212. This circuit may be traced from grounded armature 135, conductor 159 connected to the first to the tenth multiplied bank contacts, wiper 212, and through the interrupter springs 214 and magnet 213 to battery. In the same manner as previously described, motor magnet 213 automatically steps its wipers until wiper 212 no longer engages a grounded bank contact with the result that the wipers of the connector are now stepped into engagement with their eleventh bank contacts because ground has been removed from conductor 158 by the energization of relay 106. From the foregoing it will be seen that the connector is given an automatic stepping movement before the receipt of the second digit whenever the first digit is more than five. This automatic stepping circuit is provided so that a calling subscriber may dial the second digit immediately after the first without the necessity of waiting for the wipers of the connector to automatically rotate past the first group of lines. Due to this automatic stepping circuit the wipers of the connector are positioned on their eleventh bank contacts before the first impulse of the second digit is received. After transmitting the last impulse of the first digit series relay 103 deenergizes to prepare the impulsing circuit to motor magnet 213 as previously described.

In response to dialling the second digit, or digit 5 in this case, line relay 104 is deenergized and energized five times to transmit five impulses through the rotary series relay 109 to magnet 213 as previously described. Since the wipers of the

connector C were resting in engagement with their eleventh bank contacts when the first impulse of the second digit is received, the wipers of the connector in response to the operation of the motor magnet 213 are operated into engagement with their sixteenth bank contacts. Since the wipers 203 and 204 of the minor switch M are operated into engagement with their eighth bank contacts and the wipers of the connector are operated into engagement with their sixteenth bank contacts, a ringing circuit for the individual ringing lead 85 is therefore prepared by wiper 209. Relay 109 is maintained energized during the second impulsing period and at armature 129 energizes relay 110 which locks up at armature 131 and at armatures 134 and 135 opens the automatic stepping circuit of the connector C. After transmission of the last impulse of the second digit line relay 104 is maintained energized and rotary series relay 109 deenergizes. At armature 129 relay 109 energizes ringing relay 111, and the ringing relay 111, upon energizing, at armature 138 completes the ringing circuit and at the vibrating arm 137 and armature 136 prepares the circuit for the ring cut off relay 113. The ringing circuit for ringing the ringer of subscriber OS2 may be traced as follows: from generator conductor 180, armature 192, armature 138, resting contact and armature 142, armature 147, conductor 159, wiper 203 in engagement with its eighth bank contact, wiper 209 in engagement with its sixteenth bank contact, over the individual ringing lead 85 of subscriber OS2 through the ringer and condenser to conductor 4 and through the lower winding of line relay 104 to ground. After the period of time for which it is adjusted vibrating arm 137 stops vibrating and closes armature 136 long enough to energize slow to operate ring cut off relay 113 which locks at armature 145 as previously described. At armature 147 relay 113 opens the ringing circuit and at armature 148 grounds release conductor 154 to energize the release magnet 206, as previously described. Release magnet 206 energizes and withdraws its holding detent from its ratchet to restore the wipers 203 and 204 and off normal springs 201 and 202 to their normal positions. When off normal springs 201 are opened in response to the wipers of the switch M reaching their normal position relay 106 deenergizes and opens the locking circuit of relay 110 which likewise deenergizes. At armature 127 and its resting contact relay 106 grounds conductor 158 to complete the self restoring circuit for operating the motor magnet 213 of the connector C. Relay 110 at armature 132 opens the circuit of relay 111 which now deenergizes. Motor magnet 213 of the connector C is energized over the multiplied bank contacts 11 to 24, inclusive, from grounded conductor 158 to cause the wipers of the connector to be stepped to their normal or twenty-fifth position, as previously described. The deenergization of ringing relay 111 at armature 138 opens a further point in the ringing circuit.

Line relay 104 is maintained energized as long as either one of the ordinary subscribers maintain their receivers off the switchhook and release relay 105 is also maintained energized from armature 123 to maintain the release trunk conductor 163 grounded at armature 124 whereby the relays 103 and 113 are also maintained in energized position over their respective locking circuits. The ordinary service subscribers receive talking battery over both windings of line relay 104 and the heavy talking conductors 3

and 4. From the foregoing it will be seen that ordinary service subscribers can complete the connection amongst themselves during the time a connection exists between two or more subscribers in the secret service line group, but a secret service subscriber cannot complete a connection in case there is an existing connection between ordinary service subscribers because the line relay 103 is in use by ordinary service subscribers. After termination of the connection between the subscribers OS1 and OS2 and when the receivers are replaced line relays 104 and 105 deenergize as previously described. At armature 124 relay 105 disconnects ground from conductor 163 to open the locking circuits of relays 103 and 113 which deenergize, and to open the circuit of lamps 164. The equipment is now in normal position and may be used on subsequent calls.

From the foregoing it will be seen that after a secret service subscriber calls another secret service subscriber relays 101 and 102 are maintained energized during conversation and that relay 102 at armatures 118 and 119 disconnects the secret service subscriber group from the ordinary subscriber service group. Ordinary service subscribers can call other ordinary service subscribers in the same manner as just described during the time a connection exists between two secret service subscribers without interference, because the common talking circuit is broken at armatures 118 and 119.

It will now be assumed that subscriber SS1 desires to be connected with subscriber OS1 in the ordinary service group. Responsive to the subscriber at station SS1 removing his receiver line relay 104 and release relay 105 energizes in the same manner as previously described. Subscriber SS1 now dials the first digit or the digit 6 to deenergize and energize line relay 104 a corresponding number of times. In the same manner as previously described series relay 108 and stepping magnet 205 of switch M are operated and the wipers 203 and 204 of the switch M are rotated into engagement with their sixth bank contact. The closure of the off normal springs 201 again operates relay 106 and the wiper 204 of switch M closes the circuit for initiating the automatic stepping circuit of connector C so that when the wipers of the connector C engage their first bank contacts the stepping circuit from grounded conductor 159 is completed to wiper 212 to automatically step the wipers of the connector into engagement with their eleventh bank contact before the second digit is received, as previously described.

In response to the subscriber SS1 dialling the second digit, or the digit 4, line relay 104 follows the impulses to operate relay 109 and motor magnet 213, as previously described.

Relay 109 operates relay 110 and motor magnet 213 operates the connector wipers into engagement with their fifteenth bank contacts where wiper 207 prepares the ringing circuit to the individual lead 64 as previously described. After impulsing, line relay 104 energizes and series relay 109 deenergizes and the latter relay at armature 129 closes the circuit of ringing relay 111 to start the arm 137 vibrating and to close armature 138 to complete the ringing circuit. The ringing circuit may be traced as follows: from generator lead 180, armatures 192 and 138, resting contact and armature 142, armature 147, conductor 159, wiper 203 in engagement with its sixth bank contact, wiper 207 in engagement 75

with its fifteenth bank contact, over the ringing lead 64 individual to subscriber OSI through the ringer and condenser at the substation and from thence over conductor 4 and the lower winding of line relay 104 to ground. After a predetermined time arm 137 stops vibrating to close armature 136 and energize the ring cut-off relay 113, as previously described. Ring cut-off relay 113 at armature 145 completes its locking circuit, at armature 147 opens the ringing circuit, at armature 148 grounds release conductor 154 to release the minor switch M and connector C, as previously described, and in this case, at armature 146 does not complete the circuit for energizing relay 102 because the wiper 204 has been rotated past the fifth bank contact and is not, therefore, connected to conductor 149. Release magnet 206 restores the wipers of the switch M to normal and the opening of the off normal springs 201 causes the deenergization of relay 106. At armature 127 relay 106 opens the circuit of relay 110 which likewise deenergizes and grounds conductor 158 to close the self restoring circuit of the connector C. Motor magnet 213 is energized and deenergized in the same manner as previously described by way of the grounded conductor 158 and multiplied bank contacts 11 to 24, inclusive, to wiper 212 to automatically rotate the wipers of the connector C to their normal position. When subscriber OSI answers, relay 103 energizes in series with line relay 104 and locks at armature 122. At armature 121 relay 103 completes the talking circuit and at armature 120 opens a point in the energizing circuit of relay 102. The talking circuit between the two subscribers includes the talking conductors 1, 2, 3, and 4, armatures 118 and 119 and their resting contacts, and armature 121 of relay 103. Talking battery is furnished through both windings of relay 104 to both subscribers. After conversation and when both subscribers replace their receivers line relay 104 and release relay 105 deenergizes and the latter relay opens the locking circuits of relays 103 and 113 to cause their deenergization and extinguish the lamps 164. The apparatus is now in normal position and may be used on subsequent calls.

Calls originating from the OS group to subscribers in the secret service group are completed in a somewhat similar manner obvious from the foregoing description, and it is therefore thought that these detail operations need not be described.

Provisions have been made for giving ordinary service subscribers a busy tone indicating that the common talking circuit is busy when an ordinary service subscriber calls a secret service subscriber at a time when there is an existing connection between secret service subscribers. For example, if two secret service subscribers are talking over conductors 1 and 2, when an ordinary service subscriber desires to call a secret service subscriber, relays 101 and 102, it will be remembered, are energized. Now when the ordinary service subscriber dials the first digit of a secret service number, the wipers 204 of switch M will ground conductor 149. Since relay 102 is energized at this time because of the existing connection between two secret service lines, relay 107 is energized over the following circuit: from grounded wiper 204 in engagement with any one of its first five multiplied bank contacts, conductor 149, armature 116, and through the winding of relay 107 to battery. At armature 192 relay 107 opens the ringing circuit to prevent the application of generator to the called subscriber's ring-

ing lead, and at armature 191 prepares a point in a circuit for transmitting a tone to the calling subscriber. When relay 111 energizes after dialling the last digit of the secret service line, vibrating arm 137 intermittently connects ground to conductor 140 at armature 136. This intermittent connection and disconnection of ground to conductor 140 causes a tone to be transmitted to the calling subscriber by way of conductor 140, armature 191, to the upper winding of relay 104 from whence the tone is transmitted over the talking conductors 3 and 4 in the well known manner. When the ordinary service subscriber hears this tone such subscriber will replace his receiver and release the apparatus, as previously described.

Code call provisions have also been provided to enable a secret service subscriber or an ordinary service subscriber to call another subscriber by means of code call bells, such as 271, 272, etc., which are located throughout the establishment at different points. Certain subscribers will be assigned code call numbers for operating the bells in accordance with a corresponding code to enable such subscriber to be located quickly. When the subscriber hears his code he will go to the nearest phone and answer the call.

Assuming now that subscriber SS1 has called the ordinary subscriber OSI over the common talking circuit, as previously described, and OSI does not answer, or if some other person does answer but does not know where the subscriber OSI is, then the calling subscriber will dial the digit 0 to seize the code call switch and then dial the two digits assigned to this particular subscriber's code call number. In response to dialling the digit 0 the relays in Fig. 2 and the switch M operate in the same manner as previously described. Since the digit 0 is dialled the wipers 203 and 204 of the switch M are rotated into engagement with their tenth bank contacts. Wiper 203 prepares a circuit for grounding wiper 211 and wiper 204 in passing over the sixth to the ninth bank contacts closes the previously described automatic stepping circuit of the connector C to cause the connector wipers to be automatically rotated to their eleventh bank contacts. When wiper 204 reaches its tenth bank contact it prepares a circuit for energizing relay 112. In response to dialling the second digit the relays and connector C operate as before and when the series relay 109 deenergizes after the impulsing period relay 111 energizes. At armature 139 relay 111 now completes the circuit for energizing relay 112 as follows: from grounded wiper 204 in engagement with its tenth bank contact, conductor 151, armature 139, and through the winding of code call relay 112 to battery. At armature 141 relay 112 prepares a new circuit for the ring cut off relay 113, at armature 142 grounds conductor 150 and wipers 203 and 211 to mark the first code in the banks of the connector C and code call switch CC, at armature 143 prepares an impulsing circuit for the series relay 255 and the rotary magnet 241 of the switch M1, and at armature 144 grounds conductor 162 to prepare the circuit for the code start relay 252.

The calling subscriber now dials the third digit for operating relay 255 and magnet 241 over the following impulsing circuit: from ground by way of armature 123 and its resting contact, armature 125 and its working contact, working contact and armature 128, armature 193 and resting contact, armature 143 and working contact, over conductor 161, and through the winding of relay 255 and through the winding of

magnet 241 to battery. Relay 255 at armature 268 opens the prepared circuit to the code start relay 252, and the magnet 241 operates the wiper 240 one step for each impulse received to step the wiper 240 of the switch M1 in accordance with the second digit. On the first step of wiper 240 off normal springs 243 close and prepare a further point in the circuit for code start relay 252. Slow to release series relay 255 is maintained energized during the impulsing period and shortly after the last impulse is received this relay deenergizes and at armature 268 completes the circuit for energizing the code start relay 252 as follows: from grounded armature 144, conductor 162, armature 268, off normal springs 243, armature 236 and resting contact, armature 265 and resting contact, and through the lower winding of code start relay 252 to battery. Code start relay 252 is fairly slow to operate and upon operating at armature 259 completes the circuit for energizing the motor magnet 235 of the code call switch CC. Motor magnet 235, upon energizing, positions its pawl preparatory to stepping the wipers and near the end of the armature stroke operates armature 235 to open the circuit to relay 252. Relay 252 is also slightly slow to release and after a short interval opens the circuit of motor magnet 235 at 259. Motor magnet 235 deenergizes and steps the wipers one step and at armature 236 again closes the circuit to relay 252. Relay 252 energizes over the same circuit as before or from the grounded multiplied contacts accessible to wiper 230 to again operate its armature 259 to energize the motor magnet 235. Motor magnet 235 again interrupts the circuit of relay 252 at armature 236 and the latter relay again deenergizes to in turn cause motor magnet 235 to deenergize. This interaction between magnet 235 and relay 252 continues until wiper 232 encounters a grounded bank contact marked by wiper 211 of the connector. Assuming that the code ring of the subscriber OSI is 2—2, that is, two rings, a pause, followed by two more rings, then the last two digits dialled by subscriber SSI would have been 2 and 2. The wiper 211 was therefore rotated into engagement with its thirteenth bank contact and wiper 240 of the switch M1 was rotated into engagement with its second bank contact. Therefore, when wiper 232 engages its ninth bank contact a circuit for energizing relay 254 is completed as follows: from ground by way of the working contact and armature 142, armature 147, conductor 150, wiper 203 in engagement with its tenth bank contact, wiper 211 in engagement with its thirteenth bank contact, ninth bank contact and wiper 232 of switch CC, through the winding of relay 254 and resistance 266 to battery. At armature 264 relay 254 prepares a point in the ringing circuit, at armature 265 and its resting contact opens the original energizing circuit of relay 252, and at its working contact closes a circuit for relay 253 instead of relay 252; and at armature 267 completes a locking circuit for relay 254. This locking circuit may be traced from grounded multiplied contacts accessible to wiper 230, through armature 267, the winding of relay 254, and resistance 266 to battery. Relay 253 instead of relay 252 now energizes from the multiplied grounded contacts engaged by wiper 230, through armature 236 and resting contact, armature 265 and working contact, and through the winding of relay 253 to battery. At armature 262 relay 253, which is slightly slow to operate, completes

the circuit for energizing relay 252 from the grounded multiplied contacts accessible to wiper 230 through its lower winding. At armature 259 relay 252 completes the circuit for energizing the magnet 235. At armature 236 and its working contact magnet 235 completes the ringing circuit for ringing bells 271, 272, etc., from the grounded multiplied contacts accessible to wiper 230, armature 236 and working contact, armature 264 to code ringing conductor 269, and thence through the various bells, such as bells 271 and 272, to battery. At armature 236 and its resting contact, magnet 235 opens the circuit of relay 253 which deenergizes after a short interval and at armature 262 opens the circuit of relay 252. Relay 252 again at armature 259 opens the circuit of magnet 235 which deenergizes to step the wipers of the code call switch another step and operates its armature 236 to open the ringing circuit to the code call conductor 269 at its working contact, and at its resting contact again completes the circuit for reenergizing slow to operate relay 253. Relay 253 again energizes relay 252 at armature 262. Relay 252 again energizes magnet 235 and this magnet at armature 236 again rings the code call bells and again opens the circuit of relay 253. From the foregoing it will be seen that when wiper 232 encounters the marked bank contact which designates when the code ring is to start, relay 253 is included in the automatic stepping circuit of the code call switch by the operation of ringing relay 254 to decrease the speed of operation of the code call switch and to cause a uniform ring to be given. The wipers of the code call switch are operated in the same manner as described and each operation of the motor magnet 235 operates the code bells until the wiper 232 encounters its eleventh bank contact where a circuit is completed for short circuiting relay 254 to cause its deenergization. This circuit may be traced from the left hand terminal of relay 254, wiper 232 in engagement with its eleventh bank contact, to the right hand terminal of said relay. Relay 254 is therefore deenergized and at armature 264 opens the ringing circuit, at armature 265 connects relay 252 in place of relay 253, and at armature 267 opens a point in its own locking circuit. Relay 252 energizes after an interval and at armature 259 again closes the circuit of magnet 235 which also energizes. This energization of magnet 235 does not cause the code call bells to ring, because the ringing circuit is opened at armature 264. Relay 252 deenergizes and causes the magnet 235 to step the wipers into engagement with their twelfth bank contacts where a circuit is completed for energizing relay 254 as follows: from the grounded multiplied contacts engaged by wiper 230, twelfth bank contacts engaged by wiper 232, and through the winding of relay 254 and resistance 266 to battery. Relay 254 at armature 264 again prepares the ringing circuit, at armature 265 substitutes relay 253 for relay 252, and at armature 267 completes its own locking circuit. Relays 253 and 252 and magnet 235 operate in the same manner as previously described to ring the code call bells and to step the wipers of the code call switch CC until the wiper 232 encounters the bank contact marked by the wiper 240 of switch M1. In this case, since wiper 240 is in engagement with its second bank contact, the fourteenth bank contact accessible to wiper 232 is the marked bank contact. Therefore, when wiper 232 is operated into en-

gagement with this marked bank contact relay 254 is short circuited over the following circuit: from the left hand terminal of relay 254, wiper 232 in engagement with its fourteenth marked bank contact, second bank contact and wiper 240 at switch M1, to the right hand terminal of relay 254. In the same manner as previously described, relay 254 deenergizes and opens the ringing circuit and substitutes relay 252 for relay 253. Relay 252 and magnet 235 cause the wipers of the code call switch to be advanced into engagement with their twenty-fourth bank contacts where the circuit is completed for energizing relay 251 as follows: from the grounded multiplied contacts accessible to wiper 230 through the off normal springs 243, or from grounded code start conductor 162 by way of armature 258, wiper 231 and twenty-fourth bank contact, and through the winding of relay 251 to battery. At armature 256 relay 251 prepares a circuit for the ring cut-off relay 113, at armature 257 prepares a circuit for the upper winding of relay 252 and at armature 258 completes a locking circuit for itself from grounded code start conductor 162 by way of armature 268, off normal springs 243, and the winding of relay 251 to battery. When the wipers of code call switch CC reach their normal or twenty-fifth position the grounded conductor 162 again energizes relay 252 by way of armature 268, off normal springs 243, armature 236 and resting contact, armature 265 and resting contact, and through the lower winding of relay 252 to battery. The wipers of the code call switch are now rotated through a second cycle in the same manner as previously described to again operate the code call bells in accordance with the code dialled. In the second cycle of operation when wiper 231 encounters its twenty-third bank contact the circuit prepared for cut-off relay 113 is completed from grounded wiper 230 and off normal springs 243 or from grounded conductor 162 to wiper 231 in engagement with its twenty-third bank contact, armature 256, conductor 160, working contact and armature 141, armature 136, and through the winding of ring cut-off relay 113 to battery. This circuit is also connected through armature 257 to the upper winding of relay 252. Ring cut-off relay 113, upon energizing, at armature 145 completes its locking circuit, at armature 147 disconnects ground from conductor 150 to remove the marking ground from the banks accessible to wipers 203, 211, and 232, and at armature 148 grounds release conductor 154 to energize release magnets 206 and 242 by way of their off normal springs 202 and 245, respectively. In response to the operation of the release magnets 206 and 242 the minor switch M and M1 restore their wipers to their normal positions at which time their respective off-normal springs open. Wiper 204 in restoring opens the circuit of relay 112 which is now deenergized and off normal springs 201 open the circuit of relay 106 which likewise deenergizes. At armature 141 relay 112 opens a circuit to the code stop conductor 160, at armature 142 prepares a point in the regular ringing circuit, at armature 143 restores the impulsing circuit, and at armature 144 disconnects ground from code start conductor 162. Relay 106 deenergizes and at armature 127 opens the circuit of relay 110 which now deenergizes and grounds conductor 158 to restore the connector as previously described. Relays 104, 105, and 113 are now the only relays energized in Fig. 2.

In the code call switch in Fig. 3 when ground is removed from conductor 162 and off-normal springs 243 open in response to the restoration of wiper 240 of switch M1 ground is disconnected from wiper 231 which is now in engagement with its twenty-third bank contact with the result that relay 252 deenergizes. The deenergization of relay 252 causes the deenergization of magnet 235 to step the wipers to their twenty-fourth bank contacts. In the same manner as previously described relay 252 and magnet 235 operate to cause the wipers to step to their twenty-fifth bank contact or normal position. Since at this time ground has been removed from start conductor 162 the wipers of the code call switch come to rest in their normal position and no circuit is completed for relay 252 and relay 251 deenergizes. The code call switch is now in normal position having operated in two complete cycles to ring the code of the called subscriber twice. When the called subscriber hears his code he will remove the receiver at the nearest telephone and will then be connected over the heavy talking conductors and converse with the calling subscriber. After conversation when both subscribers replace their receivers relays 104 and 105 and 113 deenergize, as previously described, and restore the circuits to normal position.

In the preceding explanation this system has been described as a common talking selective ringing automatic P. A. X., in which any station can call any other station. In certain institutions, such as schools, it is not always desirable to have all stations call all other stations and provisions have been made for operating the system in connection with a so-called "master station service system". In this type of system most of the stations can call no one but the master station and the master station then completes the call to the desired party. In Fig. 4 there is shown standard manual substations C1, C2 and C3, which in order to originate a call remove their receivers to automatically signal the master station MS. The master station then by means of the calling device CD' controls the apparatus shown in Figs. 2 and 3 to signal the desired subscriber. When the master station service is used the ordinary service substations, such as OS1, OS2, and OS3, are disconnected and replaced by the master station line group comprising substations MS, C1, C2, and C3. The jumpers 43 and 44 are cut to disconnect the ordinary substations from conductors 3 and 4, and the jumpers 45 and 46 are connected as shown to connect conductors 3 and 4 to conductors 5 and 6 of the master station line group. Assuming now that subscriber C1 wishes to talk to the subscriber at C3 and in response to the removal of the receiver at C1 relay 11 of the relay group R' is energized over the following circuit: from ground, through the lower winding of relay 11, conductor 7, through the calling substation loop to conductor 8, and through the upper winding of relay 11, to battery. At armature 15 relay 11 closes a circuit for energizing relay 12 and at armature 16 completes the ringing circuit for operating the ringer at the master station. Relay 12 at armature 17 connects ground to the generator start conductor 170 by way of armature 29 to start the ringing machine shown in Fig. 2 and at armature 18 starts the arm 19 vibrating. Due to the arm 19 vibrating, armature 18 is not permanently closed until after a predetermined time. Since relay 13 is a slow to operate relay, said relay will not operate until arm 19 stops

vibrating and allows armature 18 to be steadily closed. During the time that arm 19 is vibrating, ringing current from generator lead 180 passes over armature 21 and 16 to the ringer at master switch MS to ground. When the arm 19 stops vibrating the ring cut off relay 13 is energized from armature 18 and at armature 21 opens the ringing circuit and at armature 20 disconnects ground from the generator start lead 170. The subscriber at the master station MS answers by removing the receiver and after being informed by subscriber C1 that subscriber C3 is desired, the master station will dial the number assigned to the subscriber at C3. In response to the removal of the receiver by the subscriber at station MS relays 103 and 104 energize over the following circuit: from ground through the lower winding of line relay 104, conductor 4, jumper 45, conductor 5, through the master station substation loop to conductor 6, jumper 46, conductor 3, through the upper winding of relay 103, and through the upper winding of relay 104 to battery. At armature 123 line relay 104 energizes release relay 105 and the latter relay at armature 124 grounds the release trunk conductor 163 to lock relay 103 energized by way of armature 122 and its lower winding.

In response to the master station MS dialling the digits of the called subscriber C3, the wipers of the minor switch M and connector C are operated in the same manner as previously described to select the individual ringing lead of subscriber C3. Relay 109 deenergizes after the last digit is dialled and completes the circuit to energize ringing relay 111 which at armature 138 completes the ringing circuit over the wipers of switches M and C to the individual lead of subscriber C3 in a manner similar to that previously described. The ring cut off relay 113 cuts the ring off after a predetermined time and restores the minor switch M and the connector C to their normal positions in the same manner as previously described. When the subscriber at C3 answers the two subscribers talk over the heavy talking conductors 7 and 8 and receive their talking battery through the windings of relay 11. When the subscriber at C3 answers the subscriber at master station MS will replace his receiver to release the relays in Fig. 2, as previously described.

In case the secret service subscriber such as SS1 is desired by subscriber at C1, the removal of the receiver by subscriber C1 causes relays 11, 12, and 13 to signal the master station as described. The subscriber at the master station MS then dials the digits 2 and 2 to operate the minor switch M and connector C to select the individual ringing lead 22 of subscriber SS1 and ring such subscriber. When subscriber SS1 answers the call the master station subscriber replaces his receiver and subscriber C1 and SS1 talk over the following talking circuit: the heavy talking conductors 1 and 2, armatures 118 and 119 and their resting contacts, armature 121, conductors 3 and 4, jumpers 45 and 46, conductors 5 and 6, and conductors 7 and 8. C1 subscriber receives his talking battery through the windings of relay 11 while the subscriber SS1 receives his talking battery through the windings of line relay 104. In case the master station subscriber at MS or any manual subscriber such as C1, C2, or C3, is described by any secret service subscriber, the calling secret service subscriber will dial the digits assigned to the desired subscriber to operate the minor switch M and connector C to select the individual ringing lead and ring such subscriber

thereover in the same manner as previously described.

An explanation will now be given of the direct line service such as shown in Fig. 5 and for this purpose it will be assumed that subscriber A wishes to call subscriber A1. In response to the subscriber at A removing his receiver relay 71 is energized through the calling subscriber's loop over the conductors 51 and 52 and at armature 75 completes an energizing circuit for relay 72. At armature 76 relay 71 opens the ringing circuit to the ringer at substation A and at armature 77 completes the ringing circuit to the ringer at substation A1. Relay 72, upon energizing, at armature 79 grounds the generator start conductor 170 by way of armature 80 to start the ringing machine shown in Fig. 2, and at armature 79 operates the vibrating arm 89 to prepare a circuit for the slow to operate relay 73. The ringing circuit for operating the ringer of substation A1 may be traced from generator lead 180, armature 81, armatures 77 and 83, conductor 62, and the ringer and condenser at substation A1, conductor 61, and through the upper winding of relay 74 to ground. When arm 89 stops vibrating arm 79 remains closed long enough to energize slow to operate relay 73 and the latter relay at armature 80 disconnect ground from the generator start lead 170 to stop the ringing machine and at armature 81 opens the ringing circuit. When the subscriber at substation A1 answers relay 74 is energized over the subscribers 61 and 63 and the substation loop. At armature 82 relay 74 closes another circuit for relay 72, at armature 83 opens another point in the ringing circuit to substation A1, and at armature 84 prepares a point in the ringing circuit to substation A. The talking circuit extends over the heavy talking conductors 51 and 61 and 53 and 63. The battery feed for subscriber A extends through the windings of relay 71 and the battery feed for the subscriber A1 extends through the windings of relay 74. After conversation and in response to the subscriber at substation A replacing his receiver, line relay 71 deenergizes and at armature 75 opens the original energizing circuit of relay 72 which, however, is now held energized over armature 82 by relay 74 in case subscriber A1 has not replaced his receiver. At armature 76 relay 71 prepares a point in the ringing circuit for substation A and at armature 77 opens a point in the ringing circuit for substation A1. When the subscriber at substation A1 replaces his receiver line relay 74 deenergizes and at armature 82 opens the circuit of relay 72 which deenergizes. At armature 79 relay 72 opens the circuit of ring cut-off relay 73 which likewise deenergizes and restores the relay group R to normal position. Should the subscriber at substation A1 originate the call instead of the subscriber at A practically the same operations will take place as described when A originated the call. The only difference lies in the fact that line relay 74 energizes instead of line relay 71 to energize relay 72 so as to automatically ring the called subscriber.

Having described the invention, what is considered to be new and is desired to be protected by Letters Patent will be set forth in the following claims.

What is claimed is:

1. In a telephone system, a first common talking circuit, a first group of subscribers' lines permanently connected to said first common talking circuit, a second common talking circuit normally connected to said first common talking circuit,

a second group of subscribers' lines permanently connected to said second common talking circuit, and means operative only in case a first group subscriber calls another first group subscriber for separating said two common talking circuits.

2. In a telephone system, a first common talking circuit, a first group of subscribers' lines permanently connected to said first common talking circuit, a second common talking circuit normally connected to said first common talking circuit, a second group of subscribers' lines permanently connected to said second common talking circuit, means operative only in case a first group subscriber calls another first group subscriber for separating said two common talking conductors, and a single subscriber selective signalling means controlled from any of said subscribers' lines for selectively signalling any desired subscriber's line.

3. In a telephone system, a first common talking circuit, a first group of subscribers' lines permanently connected to said first common talking circuit, a second common talking circuit normally connected to said first common talking circuit, a second group of subscribers' lines permanently connected to said second common talking circuit, means operative only in case a first group subscriber calls another first group subscriber for separating said two common talking circuits, and means operative in case a second group subscriber attempts to call a first group subscriber during the time a talking connection exists between two first group subscribers over the first common talking circuit for transmitting a tone to the calling second group subscriber indicating the busy condition of the first common talking circuit.

4. In a telephone system, a common talking circuit, subscribers' lines normally connected to said common talking circuit, means for automatically dividing said common talking circuit into two parts, and means for thereafter completing two separate and simultaneous non-interfering conversations between certain of said subscribers' lines over the said two divided parts of the common talking circuit.

5. In a telephone system, a common talking circuit, two groups of subscribers' lines normally connected to said common talking circuit, means operative only in case a subscriber in the first group calls another subscriber in the first group for automatically dividing said common talking circuit into two parts, and means for thereafter completing a talking connection between a calling and a called subscriber in the first group over the first divided part of the common talking circuit and for thereafter completing a non-interfering talking connection between two subscribers in the second group over the remaining part of the common talking circuit in response to one of said second group subscribers calling another second group subscriber.

6. In a telephone system, a common talking circuit, two groups of subscribers' lines normally connected to said common talking circuit, means operative only in case a subscriber in the first group calls another subscriber in the first group for automatically dividing said common talking circuit into two parts, means for thereafter completing a talking connection between a calling and a called subscriber in the first group over the first divided part of the common talking circuit and for thereafter completing a non-interfering talking connection between two subscribers in the second group over the remaining part of the com-

mon talking circuit in response to one of said second group subscribers calling another second group subscriber, and means operative in case a second group subscriber attempts to call a first group subscriber during the time a talking connection exists between two first group subscribers over the first part of said common talking circuit for transmitting a tone to the calling second group subscriber indicating the busy condition of the first part of the common talking circuit.

7. In a telephone system, a common talking circuit provided with two groups of subscribers' stations, means controlled over said circuit responsive to a calling subscriber in either group calling any other subscriber for automatically signalling the called subscriber and for automatically discontinuing the signalling operation after an interval, said common talking circuit completing a talking path between said calling and called subscribers, means automatically operative in case a calling subscriber in the first group calls another subscriber in the first group for automatically dividing said common talking circuit into two common talking paths, the first of which is common to the first group subscribers and the second being common to the second group subscribers, and the second common talking path completing a non-interfering talking circuit between second group subscribers independent of said first common talking path in case a second group subscriber calls another second group subscriber at a time when a talking connection exists between two first group subscribers over the said first common talking path.

8. In a telephone system, subscribers' lines each having an individual ringing lead, an automatic switch, a plurality of wipers in said switch having access to said individual ringing leads, means responsive to a calling subscriber dialling a digit of a called subscriber's number for selecting a particular one of said wipers, means responsive to the calling subscriber dialling another digit in the called number for operating each of said wipers into engagement with an individual subscriber's ringing lead, and means for transmitting ringing current over only the selected wiper and the called subscriber's individual ringing lead to signal the called subscriber.

9. In a telephone system, subscribers' lines each having an individual ringing lead, an automatic switch, a plurality of wipers in said switch having access to said individual ringing leads, means responsive to a calling subscriber dialling a digit of a called subscriber's number for selecting a particular one of said wipers, means responsive to the calling subscriber dialling another digit of the called number for operating each of said wipers into engagement with an individual subscriber's ringing lead, means for transmitting ringing current over only the selected wiper and the called subscriber's individual ringing lead to signal the called subscriber, and a common talking circuit for completing the talking connection between the calling and called subscribers' lines.

10. In a telephone system, subscribers' lines each having an individual ringing lead, an automatic switch, a plurality of wipers in said switch having access to said individual ringing leads, means responsive in case a calling subscriber dials a digit of a called subscriber's number for selecting a particular one of said wipers, means responsive to the calling subscriber thereafter dialling another digit of the called number for operating each of said wipers into engagement

with an individual subscriber's ringing lead, a code call switch also accessible to a predetermined one of said wipers, said first means responsive in case the calling subscriber dials a digit of a code call number for selecting said predetermined wiper, said second means thereafter responsive to the calling subscriber dialing another digit of the code call number for operating the said predetermined selected wiper to mark the code call number in the code call switch and for operating the remaining wipers into engagement with individual subscribers' ringing leads, and means for operating said code call switch to ring a code in accordance with the said marking by said predetermined wiper.

11. In a telephone system, two groups of subscribers' lines, an automatic switch, a plurality of wipers in said switch, a set of bank contacts for each wiper, a first and a second group of subscribers' individual ringing leads corresponding to said first and second line groups terminating in each set of bank contacts, means responsive to a calling subscriber dialling a digit of a called subscriber's number for selecting a particular one of said wipers, means for automatically stepping said wipers past their first groups of individual ringing leads in response to the operation of said first means in case the digit dialled designates a subscriber's line in the second group, and means responsive to the calling subscriber dialling another digit of the called number for operating each of said wipers into engagement with an individual subscriber's ringing lead.

12. In a telephone system, two groups of subscribers' lines, an automatic switch, a plurality of wipers in said switch, a set of bank contacts for each wiper, a first and a second group of subscribers' individual ringing leads corresponding to said first and second line groups terminating in each set of bank contacts, means responsive to a calling subscriber dialling a digit of a called subscriber's number for selecting a particular one of said wipers, means for automatically stepping said wipers past their first groups of individual ringing leads in response to the operation of said first means in case the digit dialled designates a subscriber's line in the second groups, means responsive to the calling subscriber dialling another digit of the called number for operating each of said wipers into engagement with an individual subscriber's ringing lead, and means for transmitting ringing current over only the selected wiper and the called subscriber's individual ringing lead to signal the called subscriber.

13. In a telephone system, a first automatic switch, a second automatic switch, a plurality of wipers in the second switch, a first and a second group of subscribers' individual leads accessible to each of said wipers, means responsive to a calling subscriber dialling a digit of a called subscriber's number for operating the first switch to select a particular one of said wipers, and means for automatically stepping said wipers past their first groups of individual leads in response to the operation of said first switch beyond a given position.

14. In a telephone system, a first automatic switch, a second automatic switch, a plurality of wipers in the second switch, a first and a second position in said first switch for each wiper of the second switch, means for directly operating said first switch to a particular one of said positions to select the corresponding wiper, and means for automatically operating all the wipers

of said second switch in response to said first switch operating beyond all the said first selecting positions corresponding to said wipers.

15. In a telephone system, a first automatic switch, a second automatic switch, a plurality of wipers in the second switch, a first and a second position in said first switch for each wiper of the second switch, means for directly operating said first switch to a particular one of said positions to select the corresponding wiper, means for automatically operating all the wipers of said second switch in response to said first switch operating beyond all the said first selecting positions corresponding to said wipers, and means for thereafter directly operating all the wipers of said second switch.

16. In a telephone system, a first automatic switch, a second automatic switch, a plurality of wipers in the second switch, a first and a second position in said first switch for each wiper of the second switch, means for directly operating said first switch to a particular one of said positions to select the corresponding wiper, means for automatically operating all the wipers of said second switch in response to said first switch operating beyond all the said first selecting positions corresponding to said wipers, a code call switch selectable in case said first switch is directly operated to a particular one of said second positions in a code call, and means for thereafter directly operating the wipers of said second switch to cause the wiper of the second switch corresponding to said particular second code call position to mark a code in the code call switch.

17. In a telephone system, a plurality of automatic subscribers' lines including a master station line, a plurality of manual subscribers' lines, individual ringing leads for each subscriber's line, signalling means controlled from each automatic subscriber's line in response to a call for directly selecting the called subscriber's individual ringing lead and for signalling such subscriber thereover, means controlled from each manual subscriber's line in response to a call for automatically signalling the master station line, said master station line thereafter controlling said first signalling means to signal the subscriber desired over such called subscriber's individual ringing lead, and a common talking circuit connecting all said subscribers' lines for talking purposes.

18. In a telephone system, a plurality of automatic subscribers' lines including a master station line, a plurality of manual subscribers' lines, individual ringing leads for each subscriber's line, signalling means controlled from each automatic subscriber's line in response to a call for directly selecting the called subscriber's individual ringing lead and for signalling such subscriber thereover, means controlled from each manual subscriber's line in response to a call for automatically signalling the master station line, said master station line thereafter controlling said first signalling means to signal the subscriber desired over such called subscriber's individual ringing lead, a common talking circuit connecting all said subscribers' lines for talking purpose, and means including a code call switch controlled over said common talking circuit by any automatic subscriber for ringing the code call of any desired subscriber.

19. In a telephone system, a group of automatic subscribers' lines, a group of manual subscribers' lines, a master station line, an automatic

switch, a plurality of wipers in said switch, manual subscribers' individual ringing leads and automatic subscribers' individual ringing leads accessible to each of said wipers, means controlled
5 from each automatic line and from said master station line in response to a call for directly operating said switch and wipers to select any desired subscriber's individual ringing lead and signal such subscriber thereover, means con-
10 trolled from each manual line in response to a call for automatically signalling the master station line, said master station thereafter controlling said first signalling means to signal the subscriber desired over the called subscriber's indi-
15 vidual ringing lead, and a common talking circuit connecting all said subscribers' lines for talking purposes.

20. A telephone system comprising two stations normally connected in a direct line system over a talking circuit, a central source of signalling current, a signal for each station, a conductor separate from the talking circuit connected to the
5 signal of each station, means responsive to the removal of the receiver at either station for automatically connecting said signaling current source to the separate conductor line of the other sta-
10 tion, means controlled over the talking circuit for automatically cutting off said signaling source in response to said other station answering the call, and means for automatically cutting off said
15 signalling source after a predetermined time interval independently of said other station answering.

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