T. G. MARTIN.

TELEPHONE INTERCOMMUNICATING AND SUPERVISORY SYSTEM.

APPLICATION FILED MAR. 30, 1909.

1,191,210.

Patented July 18, 1916.

2 SHEETS—SHEET 1.

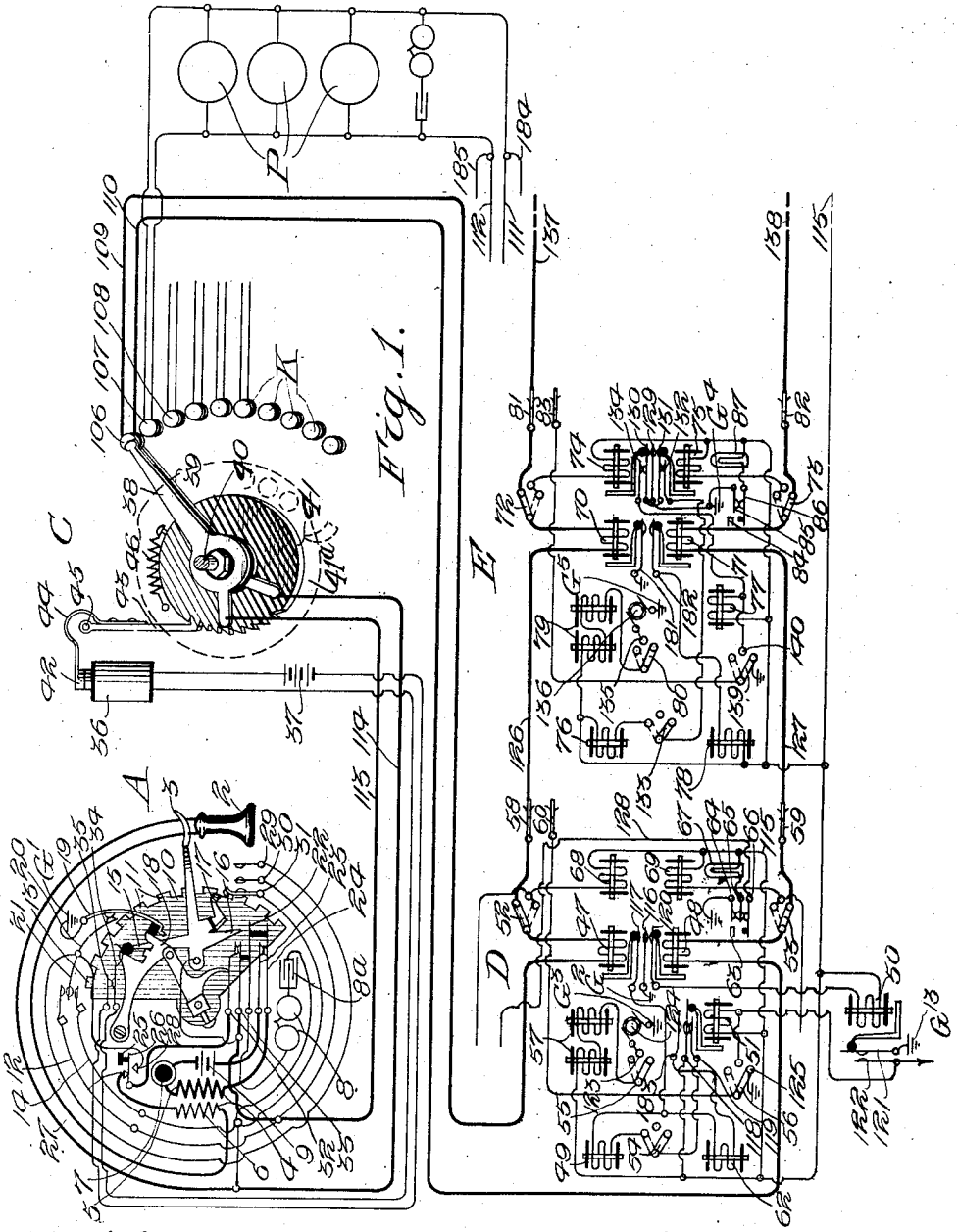


Fig. 1.

Witnesses.

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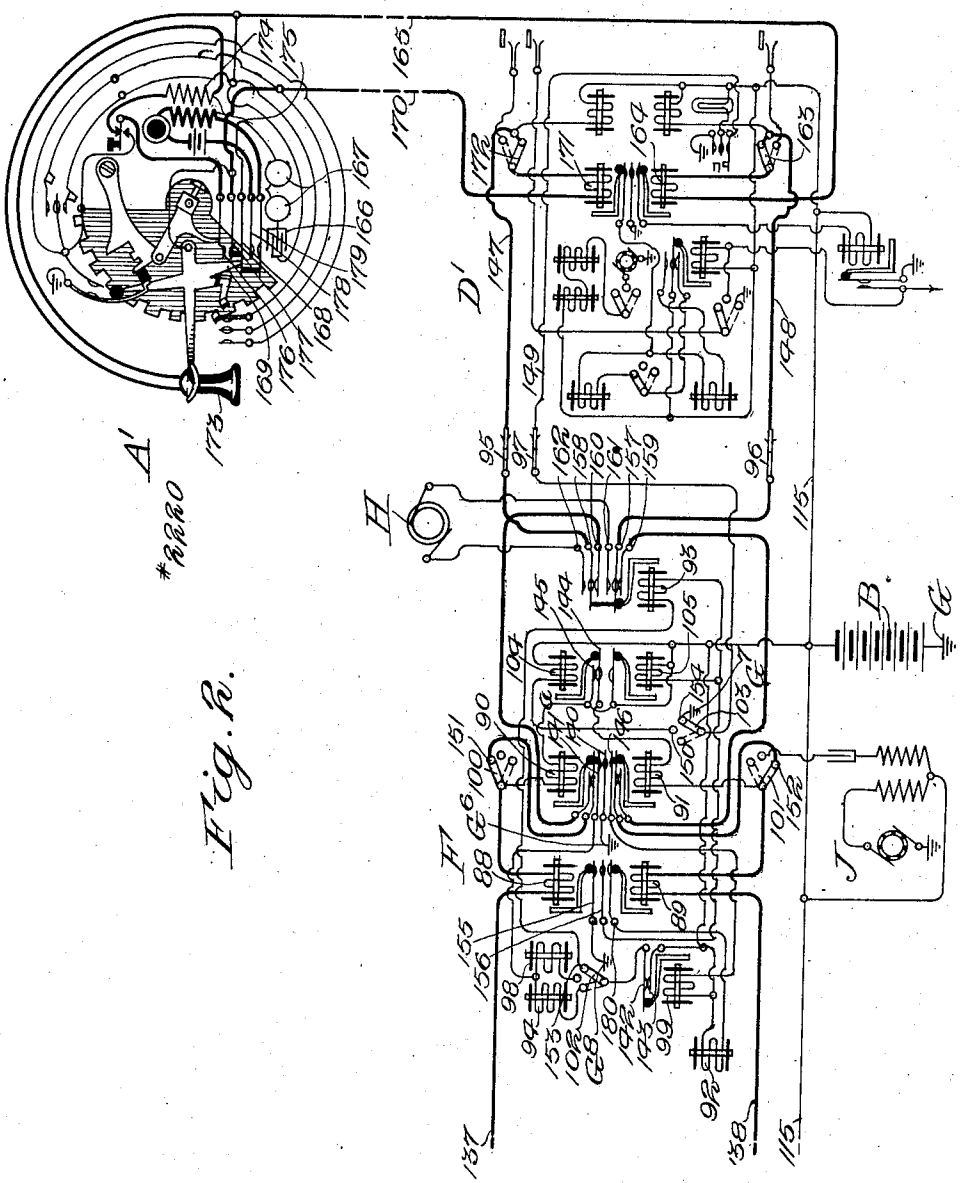


Fig. 2.

Witnesses.

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UNITED STATES PATENT OFFICE.

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TELEPHONE INTERCOMMUNICATING AND SUPERVISORY SYSTEM.

1,191,210. Specification of Letters Patent. Patented July 18, 1916.

Application filed March 30, 1909. Serial No. 486,723.

To all whom it may concern:

Be it known that I, TALBOT G. MARTIN, a citizen of the United States of America, and resident of Chicago, Cook county, Illinois, have invented a certain new and useful Improvement in Telephone Intercommunicating and Supervisory Systems, of which the following is a specification.

My invention relates to telephone systems in general, but more particularly to automatic or semi-automatic telephone exchange systems, and especially to those in which step-by-step-actuated switching machines are employed for automatically extending connection between calling and called lines.

In the installation of exchanges it often becomes necessary or desirable to provide some arrangement for enabling an attendant or a subscriber at one telephone to supervise several other telephones on other lines, and to make connection directly with any one of said lines without calling through the central station or exchange.

My invention contemplates, therefore, a system in which an attendant or a subscriber at one telephone may supervise the calls that are extended to any one of a plurality of telephones on other lines, and may make connection directly with any one of said other lines without first calling through the exchange or central station. Prior to my invention, and so far as I am now aware, no arrangement for accomplishing this supervision of several lines by an attendant or a subscriber on another line, and no provision at the telephone of the said attendant or subscriber for extending connection directly to any one of said lines without first calling through the exchange or central station, had ever been proposed. The arrangement, therefore, it will be understood, involves a telephone on a line extending from the exchange or central station, or on a line at the exchange or central station, which line can be called by other subscribers, and means at the said telephone for switching the line thereof into connection with any one of a plurality of other lines, which other lines can also be called by other subscribers of the exchange, whereby the attendant or subscriber at the first-mentioned telephone can answer a call extended to the substation of any one of said other lines, or may intercommunicate with any one of said other lines without calling through the exchange or central station.

To the foregoing and other useful ends my invention consists in matters hereinafter set forth and claimed.

In the accompanying drawings Figure 1 is a diagram of a telephone system involving the principles of my invention, showing my improved substation A with the line-selecting means C at the right thereof. At D there is represented diagrammatically a first selector switch, and at E there is similarly shown a second selector switch.

In Fig. 2 there is diagrammatically shown a connector switch F and a first selector switch D′ allotted to the line of substation A′, in a system embodying the principles of my invention. At H and J, respectively, there are represented a ringing generator and a busy signaling machine, and a central battery B is shown having its positive terminal preferably grounded at G.

The substation A may be of any suitable type and, as shown, comprises a receiver 2, a switch-hook 3, induction-coil 4 which consists of the primary winding 5 and secondary winding 6, transmitter 7, ringer 8, condenser 8^a and local battery 9. In addition to the above-mentioned parts there is provided an impulse wheel 10 which has the usual vertical impulse teeth 11 that are adapted to operate the vertical impulse spring 12 for sending ground impulses to one side of the line. The impulse wheel also carries the rotary impulse tooth 13 which operates the rotary impulse spring 14 for grounding the rotary side of the line. The said impulse wheel is rigidly connected to the same shaft to which the substation dial is secured. The switch-hook has radiating from its body a number of cam arms 15, 16 and 17 and is pivotally secured to the keyboard. The cam arm 15 controls the so-called locking arm 18 which is used to lock the dial while the receiver is on the hook. When the coöperating ground springs 19 and 20 engage, the ground post 21 is then connected to the substation ground G′. When the switch-hook is down the cam arm 16 maintains a contact with the spring 22, thereby bridging the ringer 8 in series with the condenser 8^a across the line. The springs 23 and 24 are then disengaged, and the primary circuit including the primary winding

5, transmitter 7 and local battery 9 is interrupted. Furthermore, when the switch-hook is down the springs 32 and 33 are disengaged; but when the receiver is removed from the switch-hook the said springs engage, thereby bridging the secondary circuit across the line. The signaling device, whereby a subscriber may signal another after connection has been established, comprises a push-button 25 and a spring 26 which normally engages the contact point 27; but when the button 25 is pressed the spring 26 leaves the contact point 27 and engages the contact point 28, which latter is connected with the substation ground G'. The means whereby the subscriber may release the central station apparatus brought into service comprises three springs 29, 30 and 31, known as the release springs, and so controlled by the cam arm 17 that when the switch-hook descends the three release springs are brought into contact, thereby grounding both the subscriber's line conductors simultaneously. Furthermore, the substation A is provided with the springs 34 and 35, so that when the receiver is removed from the switch-hook the cam arm 15 presses the springs 34 and 35 into contact, thereby closing a circuit including the relay 36 and battery 37. The line-selecting means C comprises the wipers 38 and 39 rigidly secured to the shaft 40 upon which the ratchet wheel 41 and dial 41^a are also mounted. The relay 36 controls the armature 42 which is in turn secured to the pawl 43 by means of a flexible spring 44. The pawl 43 is pivoted at the point 45 and normally, when the relay 36 is deënergized, rests out of engagement with the teeth of the wheel 41. The coil spring 46 is provided for restoring the ratchet wheel 41 to normal position when the relay 36 deënergizes.

The first selector switch D is of the general type disclosed in United States Letters Patent No. 815,321, issued March 13, 1906, to Keith, Erickson & Erickson, and, as here shown, is what is generally known as the series selector. It comprises the usual vertical and rotary line relays 47 and 48 which control the vertical magnet 49 and the private magnet relay 50. The private magnet relay 50, upon energizing, operates to close an energizing circuit through the private magnet 51, which latter controls the side switch wipers 52, 53, 54, 55 and 56. When the side switch wiper 55 is in second position the rotary magnet 57 operates to carry the shaft wipers 58, 59 and 60 in a rotary or circular direction. The release magnet 62 constitutes the means for restoring the switch D, which release magnet may be energized by the vertical and rotary line relays 47 and 48 acting conjointly. The switch shaft, which carries the wipers 58, 59 and 60, is provided with a normal arm 63, and when the switch shaft is given one or more vertical steps this normal arm permits the springs 64, 65 and 66 to engage. By this movement the signal lamp and the private normal conductor are connected with ground. Furthermore, it will be seen that the additional resistance coils 68 and 69 are arranged in such manner that when the side switch wipers 52 and 53 are in first or second position, the said resistance coils are connected in series with the vertical and rotary line relays; but after the side switch passes to third position, the resistance coils are then disconnected and the vertical and rotary line relays remain in series with the line conductors. The object, then, of the resistance coils 68 and 69 is to cut down the flow of battery current, since the vertical and rotary line relays are of comparatively low resistance.

The second selector E is similar in construction and general arrangement to the first selector switch D. The vertical and rotary line relays 70 and 71, when the side switch wipers are in first or second position, receive current in series with the coils 74 and 75, respectively. These coils correspond to the resistance coils 68 and 69 of the first selector D, but instead of acting merely as resistance coils, as do those of the first selector, they are provided with a set of springs and are adapted to control the vertical and private magnets 76 and 77. The line relays 70 and 71 control the energizing circuit of the release magnet 78. The relay coils 74 and 75 in the selector E perform the functions of line relays, while the sole object of the line relays 70 and 71 is to close an energizing circuit for the release magnet upon energizing simultaneously. When the side switch wiper 80 is in second position the rotary magnet 79 operates to carry the switch shaft wipers 81, 82 and 83 in a rotary direction. The switch shaft of the second selector E is also provided with a normal arm 84 which, when the switch shaft is given one or more vertical steps, permits the normal springs 85 and 86 to engage, thereby closing a circuit through the off-normal signal lamp 87.

The connector switch E (Fig. 2) is a modified form of the general type of connector switch shown in United States Letters Patent No. 815,176, granted March 13, 1906, to Keith, Erickson & Erickson, and, as here shown, is commonly known as a series connector, because of the vertical and rotary line relay coils in the line and talking circuit. The vertical and rotary line relays 88 and 89 operate in series with the relays 90 and 91. As in the second selector E the relays 90 and 91 are effective in closing the energizing circuits of the operative magnets of the switch, while the line relays 88 and 89 control the circuit of the release magnet 92 and of the ringer relay 93. The

vertical magnet 94, upon energizing, operates to carry the shaft wipers 95, 96 and 97 in a vertical direction, while the rotary magnet 98 is effective in producing a rotary motion of the shaft wipers. The private magnet 99, as usual, controls the side switch wipers 100, 101, 102 and 103. The relays 104 and 105 control the battery lead circuit to the rotary line relay 91 when the connector switch calls-in on a busy line. It will be seen that in the connector F the usual condensers which separate the calling line from the called line are absent. The calling and called lines are, however, separated at the relays 90 and 91 when impulses are being sent. The first selector D′ allotted to the line of substation A′ is a duplicate of the first selector D.

A clearer understanding of my invention may be had from a consideration of its operation when the substation A is employed to establish connection with another substation. Suppose, for example, that the subscriber at substation A desires to establish connection with the subscriber at substation A′ (Fig. 2) on the line #2220. The subscriber at station A removes the receiver 2 from the switch-hook 3, thereby placing the substation ground G′ in connection with the ground post 21 through the coöperating ground springs 19 and 20. Also, when the receiver is removed the cam arm 15 presses the springs 34 and 35 into contact, thereby closing an energizing circuit through the relay 36 in series with the battery 37. The relay 36 thereupon energizes, attracting its armature and placing the pawl 43 in engagement with the first tooth of the ratchet wheel 41. It should be explained that from the various contact points K of the line-selecting means trunk lines may lead to various places. From the first or home contact 106 the trunk line conductors 109 and 110 lead to the first selector D of the automatic central office. To the second contact 107 there are connected the terminals of a line upon which there is a plurality of telephones P. Also, the conductors 111 and 112 of this party line may lead to the central office and terminate in a first selector similar to the first selector D. The remaining contacts 108, etc., may be the terminals of lines leading to any desired place. The subscriber at substation A desiring to extend his substation line conductors 113 and 114 to one of these lines, rotates the dial 41^{a} so that the wipers 38 and 39 are carried into engagement with the contact of the desired line. But since the subscriber at substation A desires connection with the trunk line conductors 109 and 110, which lead to the first selector D, the selecting dial 41^{a} is not turned, the wipers 38 and 39 normally occupying the trunk line contacts.

In making a call the calling subscriber operates his calling dial once for each digit of the desired number. On the return motion of the dial, at each operation, first the vertical impulse teeth engage the vertical impulse spring 12, and then the rotary impulse tooth engages the rotary impulse spring 14, forcing said springs into contact with the ground post 21, and as a result grounding the vertical and rotary line conductors 113 and 114, respectively. After the first digit is called the first selector shaft wipers 58, 59 and 60 are raised to the second level of the line and private banks as follows: When the spring 12 engages the ground post 21 an energizing circuit is established through the vertical relay 47 of the first selector D. The current in this circuit flows from ground G′ through the springs 19 and 20 to the ground post 21, thence to the vertical impulse spring 12, vertical line conductor 113, trunk-selecting wiper 38, trunk line 109, vertical line relay 47, resistance coil 68 to the battery lead 115, thence through battery B to ground G. Each time that the vertical line relay 47 is energized the springs 116 and 117 are pressed into engagement, and an energizing circuit is each time established through the vertical magnet 49. The circuit through the said magnet extends from ground G^{2} to the springs 116 and 117, vertical magnet 49, side switch wiper 54, private magnet springs 119 and 118 to the battery lead 115, thence through battery B and to ground G. The vertical magnet being operated twice, the first selector switch shaft and wipers 58, 59 and 60 are carried to a level with the contact points that constitute the terminal of the trunk line leading to the second selector switch E. Following the vertical impulses the rotary impulse spring 14 comes into contact with the ground post 21, thereby grounding the rotary line conductor 114 once and energizing the rotary line relay 48 of the first selector once. The path of the energizing circuit may be traced as follows: From the substation ground G′ through the springs 19 and 20 to the ground post 21, rotary impulse spring 14, rotary line conductor 114, trunk-selecting wiper 39, trunk line conductor 110, rotary line relay 48, side switch wiper 53, resistance coil 69 to the battery lead 115, thence through battery B and to ground G. The rotary line relay 48, upon energizing, closes the springs 120 and 116 in contact, thereby closing an energizing circuit through the private magnet relay 50, said circuit extending from ground G^{2} through the springs 116 and 120, private magnet relay 50 to the battery lead 115, thence through battery B and to ground G. The private magnet relay, upon energizing, operates to close an energizing circuit through the private magnet 51. This circuit extends from ground G^{13} through the

springs 121 and 122, through the winding of the private magnet 51 to the battery lead 115, thence through battery B to ground G. The private magnet 51 being energized for a moment, the side switch of the first selector A passes from first to second position, thereby permitting the side switch wiper 55 to engage the contact point 123, thus closing a circuit through the rotary magnet 57. The current-flow is from ground G^3 through the interrupter 124 to the contact point 123, side switch wiper 55, thence through the rotary magnet 57 to the battery lead 115, and through battery B to ground G. The rotary magnet is energized once and the shaft wipers 58, 59 and 60 are carried into engagement with the first set of bank contacts of the second level which, it is assumed, constitute the terminals of the second selector switch E. But if the first trunk line is busy, assuming that the trunk leading to the said selector leads off from the first set of contacts of the second level, it is, as is well known, protected by a positive guarding potential, and an energizing circuit is established through the private magnet 51 when the private wiper 60 strikes the grounded private bank contact, thereby retaining the side switch in second position and maintaining the energizing circuit through the rotary magnet 57 in a well-known manner. However, as soon as the private magnet is deënergized, the side switch is tripped to third position; but if there are no busy contacts to be passed over, as assumed in the first instance, then the rotary magnet 57, as is well known, trips the side switch wipers 52, 53, 54, 55 and 56 into engagement with their respective third-position contact points, thus extending the subscriber's line conductors 113 and 114 to the selector E. Also, since the side switch wiper 56 engages the grounded contact point 125, a guarding potential is established at the private wiper 60 for protecting the seized trunk line from being molested by any other switch. Furthermore, it should be stated that when the first selector switch shaft is given the first vertical step the normal springs 64, 65 and 66 engage, thereby closing a circuit through the signal lamp 67 and providing a guarding potential at the connector private bank contact over the private normal conductor 128.

The second digit is called after the subscriber has operated the first selector switch D to extend the substation line conductors 113 and 114 to the trunk conductors 126 and 127. When the dial returns to normal position for the second digit (2) an energizing circuit is closed through the line relay 70 and relay 74 of the second selector E. This circuit extends from ground G′ at the substation A to the trunk conductor 109, as previously traced, vertical line relay 47 of the first selector D, side switch wiper 52, shaft wiper 58, trunk conductor 126, vertical line relay 70, side switch wiper 72, winding of the relay 74 to the battery lead 115, thence through battery B to ground G. It will be seen that this circuit includes the line relays 47 and 70, but their operation at this time is without effect. The relay 74, however, upon energizing, places the springs 129 and 130 in contact, thereby closing a circuit through the vertical magnet 76. This circuit extends from ground G^4 through the springs 129 and 130, 131 and 132, side switch wiper 133, vertical magnet 76 to the battery lead 115, thence through battery B to ground G. The vertical magnet is given two impulses and operates accordingly to carry the shaft wipers 81, 82 and 83 two steps in a vertical direction opposite the level in which terminate the trunk line conductors leading to the connector switch F. Following the vertical impulses the rotary impulse spring 14 is pressed onto the ground post and an energizing circuit including the rotary line relays 48 and 71 and the relay 75 in series is closed, said circuit extending from ground G′ through the relay 48 to the side switch wiper 53, as previously traced, through this wiper to the shaft wiper 59, trunk conductor 127, rotary line relay 71, side switch wiper 73, winding of the relay 75 to the battery lead 115, thence through battery B to ground G. The rotary line relays energize and operate the same as the vertical line relays, but their operation at this time is also without effect. The relay 75, upon energizing, places the springs 131 and 129 in contact, whereby an energizing circuit is closed through the private magnet 77. This circuit extends from ground G^4 through the springs 129 and 131, springs 130 and 134, private magnet 77 to the battery lead 115, thence through battery B to ground G. The private magnet, upon energizing and deenergizing, operates to release the side switch from first to second position. When the side switch wiper 80 engages the contact point 135 an energizing circuit is closed through the rotary magnet 79. This circuit extends from ground G^5 through the interrupter 136, contact point 135, side switch wiper 80, rotary magnet 79 to the battery lead 115, thence through battery B to ground G. The rotary magnet is energized once, and the shaft wipers 81, 82 and 83 are carried into contact with the first set of bank contacts of the second level which, it is assumed, are the terminals of the trunk line conductors 137 and 138 which lead to the connector switch F. But if the first trunk line is busy a guarding potential will be found upon the private bank contact, and when this is engaged by the private wiper 83 a new energizing circuit is established through the private magnet 77, said circuit

extending from the grounded private bank contact through the shaft wiper 83, side switch wiper 139, contact point 140, through the private magnet 77 to the battery lead 115, thence through battery B to ground G. The private magnet remains energized, locking the side switch in second position, and maintaining the energizing circuit through the rotary magnet 79. As soon as the private wiper 83 engages a bank contact upon which there is no guarding potential, the energizing circuit through the private magnet is broken and the side switch trips to third position; but if there are no busy contacts to pass over the side switch trips to third position, when the shaft wipers engage the first bank contact, as assumed. When the side switch wiper 139 passes to third position, a positive guarding potential is established at the private bank contact corresponding to the line engaged. The passage of the side switch wipers 72 and 73 to third position extends the subscriber's line conductors 113 and 114 to the trunk line conductors 137 and 138 which lead to the connector switch F (Fig. 2). The engagement of the normal springs 85 and 86 provides a circuit for the signal lamp 87 so that the exchange attendant may know that the accompanying switch is in an off-normal position.

The third digit is called after the subscriber has established connection with the connector F by sending impulses to the trunk conductors 137 and 138. The subscriber rotates the dial, as described, for the third digit 2, thereby grounding the vertical and rotary line conductors 113 and 114, which causes the energization of the connector vertical and rotary line relays 88 and 89 in series with the relays 90 and 91, and also in series with the vertical and rotary line relays of the first and second selectors. This circuit through the vertical line relay extends from the substation ground G′ to the trunk conductor 109 and through the line relays 47 and 70 in series to the shaft wiper 81, trunk line conductor 137, vertical line relay 88, through the winding of the relay 90 to the battery lead 115, thence through battery B to ground G. Of course, the line relays 47, 70 and 88 operatively energize, but their operation is without effect. The relay 90, upon energizing, operates to press the springs 140 and 141 into contact, thereby closing a circuit through the vertical magnet 94 extending from ground G^6 through the springs 140 and 141, vertical magnet 94, side switch wiper 102, private magnet springs 142 and 143 to the battery lead 115, thence through battery B to ground G. The vertical magnet is thus energized and operates to raise the shaft and shaft wipers one step at a time until the said wipers are carried two steps to the level in which are located the terminal contacts of the line #2220. The impulses to the vertical side of the line being followed by the ground impulse to the rotary side, when the rotary impulse spring strikes the ground post 21 the rotary line relay 89 in series with the relay 91 of the connector become energized through the following path: from ground G′ to the trunk conductor 110, through the rotary line relays 48 and 71 to the shaft wiper 82, trunk conductor 138, rotary line relay 89, relay 91, springs 144 and 145 to the battery lead 115, thence through battery B to ground G. The line relays included in this circuit energize at this time but produce no effect. The energization of the rotary relay 91, however, causes the energization of the private magnet 99 over a circuit extending from ground G^6 through the springs 140 and 146 to the private magnet 99, and to the battery lead 115, thence through battery B to ground G. As a result the connector side switch and wipers 100, 101, 102 and 103 are released from first to second position. The last digit being naught, the subscriber operates the dial as previously described, grounding the vertical line conductor 113 ten times and the rotary line conductor 114 once. The vertical and rotary relays 90 and 91 are operated over previously traced circuits. However, when the line relay springs 140 and 141 engage, due to the vertical impulses, a circuit is closed through the rotary magnet 98 instead of through the vertical magnet 94. The energizing circuit extends from ground G^6 through the line relay springs 140 and 141, rotary magnet 98, side switch wiper 102 (which is now in second position), private magnet springs 142 and 143 to the battery lead 115, thence through battery B to ground G. Each time that the rotary magnet is energized it rotates the shaft wipers 95, 96 and 97 one step until the said wipers are carried into engagement with the normal conductors 147, 148 and 149 that lead to the called subscriber's line. The energization of the rotary relay 91, as previously stated, completes a circuit through the private magnet 99, which now operates to release the side switch to third position, establishing connection between the calling and called lines, if the latter is not busy. If the called line is busy, the rotary relay 91 is not energized, and the side switch consequently remains in second position. This retaining of the side switch is brought about as follows: If the called line is busy a guarding potential appears at the private bank contact in engagement with which the private wiper 97 has previously been rotated. A circuit is thereby closed through the relay 104 extending from the grounded bank contact to the shaft wiper 97, side switch wiper 103, contact point 150, through the winding of the relay 104 to the battery lead 115, thence through battery B to ground G. The relay 104 there-

upon energizes and operates to disengage the springs 144 and 145, whereby the rotary relay 91 is disconnected from the battery lead; hence, when the line conductor 114 is grounded for the rotary impulse the rotary relay 91 does not energize and operate to close a circuit through the private magnet 99 to trip the side switch to third position. The side switch, therefore, remains in second position, and the calling subscriber receives the busy signal from the busy signaling apparatus J, through the side switch wiper 101 to the rotary line conductors, and through the substation receiver in the usual manner.

Upon hearing the busy signal the subscriber, understanding that the desired line is busy, will restore his receiver to the switch-hook, grounding the vertical and rotary line conductors 113 and 114 simultaneously, energizing the line relays of the first and second selector switches and connector switch simultaneously, and pressing their release springs into contact. The engagement of said springs establishes energizing circuits through the release magnets of their respective switches and produces the release of the switches, as will be hereinafter more fully described. The foregoing is, therefore, an explanation of the result following if the subscriber's line is busy. Considering now the result if the called line is not busy, it will be evident that the side switch passes to third position, thus placing the side switch wipers 100, 101, 102 and 103 in contact with their respective contact points 151, 152, 153 and 154 in third position. Furthermore, when the side switch passes to third position a guarding potential is established for protecting the called line. This potential extends from ground G^7 to the contact point 154, side switch wiper 103, switch shaft wiper 97, which latter engages the private contact of the called line. In order to signal the called subscriber, the calling subscriber presses the signaling button 25, placing the spring 26 in contact with the substation ground G', thereby energizing the vertical relay 90. The path of the energizing circuit extends from ground G', contact point 28, spring 26, springs 32 and 33 to the vertical line conductor 113, thence to the vertical line relay 88 and relay 90 in series to the battery lead 115, thence through battery B to ground G. It will be remembered that the connector side switch has passed from second to third position, and that the side switch wiper 102 is in engagement with the contact point 153. Now, when the vertical line relay 88 energizes and places the springs 155 and 156 in contact a circuit is closed through the ringer relay 93. The operation of the vertical relay 90 is at this time without effect. The circuit through the ringer relay 93 extends from ground G^8 through the springs 155 and 156, ringer relay 93, contact point 153, side switch wiper 102, private magnet springs 142 and 143 to the battery lead 115, thence through battery *b* to ground *g*. The ringer relay, upon energizing, shifts the springs 157 and 158 from the springs 159 and 160 and onto the springs 161 and 162, respectively. This results in the separation of the calling subscriber's line from the called subscriber's line, and in bridging across the line of the latter the terminals of the ringer generator H. A signaling current is, therefore, sent from the generator H to the ringer relay springs 161 and 157, connector shaft wiper 96, normal conductor 148, side switch wiper 163, rotary line relay 164 of the selector D', rotary line conductor 165, through the condenser 166 to the ringer 167, spring 168, switch-hook 169 to the vertical line conductor 170, vertical line relay 171, side switch wiper 172, normal conductor 147, connector shaft wiper 95, ringer relay springs 158 and 162 back to the generator H. As soon as the calling subscriber ceases to press the signaling button 25 the ringer relay 93 becomes deënergized, and the springs 157 and 158 resume their normal position in contact with the springs 159 and 160, respectively. In response to the signal the subscriber at substation #2220 removes the receiver 173 from the switch-hook 169, thereby removing the ringer 167 from across his line and bridging the secondary circuit instead, which circuit includes the receiver 173, secondary winding 174 of the induction-coil 175 and the springs 176 and 177. The local transmitter circuit is closed as soon as the springs 178 and 179 engage. The two substations A and A' are now connected over the circuit shown in heavy lines in the drawing.

The release of the central office switching apparatus occurs when the calling subscriber restores his receiver to the switch-hook, thereby pressing the springs 29, 30 and 31 into engagement for a moment. The contact of these release springs grounds the vertical and rotary line conductors 113 and 114 simultaneously, thereby providing an energizing circuit for the vertical and rotary line relays of the selector and connector switches. The circuit for the vertical line relays extends from ground G' through the release springs 29 and 30 to the vertical line conductor 113, then through the vertical line relays 47, 70 and 88 and the relay 90 in series to the battery lead 115, thence through battery B to ground G. The circuit for the rotary line relays extends from ground G' through the release springs 29, 30 and 31 to the rotary line conductor 114, then through the rotary line relays 48, 71 and 89 and relay 91, springs 144 and 145 to the battery lead 115, thence through battery B to ground G. These line relays be-

ing energized simultaneously operate to press their respective springs into contact, whereby energizing circuits are closed through their respective release magnets. The simultaneous energizing of the relays 90 and 91 of the connector is without effect except to energize the private magnet 99, which does not interfere with the release. The energizing of the relays 88 and 89, however, provides an energizing circuit for the release magnet 92, said circuit extending from ground G^8 through the springs 155, 156 and 180, through the release magnet to the battery lead 115, thence through battery B to ground G. The release magnet energizes and attracts its armature, remaining in readiness to restore the connector side switch and shaft when the ground to the line conductors is removed. The relays 70 and 71 of the second selector E, upon energizing, simultaneously place the springs 181 and 182 in contact, which provides an energizing circuit for the release magnet 78. This magnet also energizes and attracts its armature. In the first selector D, when the line relays energize for the release, the rotary line relay operates to energize the private magnet relay 50, and the private magnet in turn operates to place the springs 118 and 183 in contact, thereby connecting the battery lead 115 to one terminal of the release magnet. The vertical line relay operates to connect the other terminal of the release magnet to ground, thus establishing an energizing circuit extending from ground G^2 through the springs 116 and 117, through the release magnet 62, private magnet springs 183 and 118 to the battery lead 115, thence through battery B to ground G. All of the release magnets thus energized attract their armatures and remain in readiness to restore their respective switch shafts and side switches when the substation springs 29, 30 and 31 disengage, thereby removing the ground connection from the line conductors 113 and 114 and breaking the energizing circuit for the line relays.

From the foregoing it will be seen how the subscriber at substation A may operate the central office switches to establish connection with substation A'. In a similar manner the substation A or the substation A' may be operated to connect with any other line of the central office. It will be remembered that when the subscriber at A desires to call to the central office the line-selecting means C is not operated, but left in normal or home position, thus extending the substation line conductors to the trunk line conductors. Suppose that a call is received over the normal conductors 184 and 185 of the line conductors 111 and 112. In that event it may be answered from any one of the telephones P; or the shaft 40 of the line-selecting means may be turned so that the wipers 38 and 39 engage the contact 107 at which the line 111 and 112 terminates, and the subscriber at substation A may answer. Also, the line from the contact 108 may lead to another telephone line, and when it is desired at station A to connect with this line the shaft 40 is turned two contacts and the substation conductors 113 and 114 are extended to the line of the contact 108. In a similar manner the remaining contacts may be connected with any desired line, and the substation A may be connected therewith by turning the dial 41^a so that the wipers 38 and 39 engage the proper contact. Thus it will be seen from the foregoing that the substation A, in conjunction with the line-selecting means C, becomes a master or supervisory telephone, since substation A may at any time be connected with any one of the lines terminating at C.

From the foregoing it will be seen that I provide an arrangement whereby the subscriber or attendant at the telephone of one line, as, for example, at A, may supervise the incoming calls to the substations of a plurality of other lines, such, for example, as those leading to the switch terminal K. When the bell at the substation of any one of said lines is sounded, assuming the telephones to be all in one room, the attendant or subscriber at substation A, recognizing the signal of a particular telephone, immediately switches the line wires 113 and 114 into connection with the line that is called, assuming that the subscriber or attendant is not at the substation thereof, and thus answers the call. In this way the subscriber or attendant at substation A can answer the calls to a number of other substations on other lines, and may extend connection to any one of said lines at will, regardless of whether the same is busy, and without having to first call into the exchange or central station. In fact, the arrangement involves an interconnecting and supervisory system located outside of the exchange or central station, or at least separate and apart from the regular switchboard apparatus of the exchange. Such an interconnecting and supervisory system can be used between the attendants at the exchange or central station, or can be used for special service between subscribers outside of the exchange or central station.

What I claim as my invention is:—

1. In a telephone system, a telephone line, devices at the substation thereof for receiving calls, means controllable from said substation for extending a call from said telephone line in the direction of a called subscriber, a plurality of lines, means at the substation of said telephone line for connecting the same directly with any one of said plurality of lines, a telephone on each one

of said other lines, and means at the exchange or central station for seizing any one of said plurality of lines in response to a call from some other subscriber.

2. In a telephone system, a telephone line, a telephone on said line, devices at said telephone for receiving and sending calls, a plurality of other lines, a telephone on each one of said other lines, devices for extending calls to and from said other lines, and a switch at said first-mentioned telephone operative to open the line thereof and connect the said telephone with any one of said other lines.

3. In a telephone system, a telephone line, a telephone for said line, devices at said telephone for sending and receiving calls, another telephone line, a telephone on said other line, devices for extending calls to and from said other line, and a device at said first-mentioned telephone for switching the same into direct connection with said other telephone line.

4. In a telephone system, a telephone line, devices for extending calls to and from said line, another line, and means independent of said devices for extending connection directly between the substation of said telephone line and said other line, said means provided with devices for automatically releasing it.

5. In a telephone system, a telephone line, a telephone set on said line, an individual interconnecting switch allotted to said telephone, suitable means for extending calls to and from said telephone line, and a plurality of lines terminating in the exchange, each of said other lines also terminating in said individual switch.

6. In a telephone system, a telephone line, a plurality of other lines, and means at the substation for opening up said telephone line and disconnecting the substation thereof from the exchange to connect the same with any one of said other lines, said means provided with devices for automatically releasing it.

7. In a telephone system, a telephone line, another line, and means at the substation for disconnecting the substation of said telephone line from the exchange to connect the same with said other line, said means provided with devices for automatically releasing it.

8. In a telephone system, a substation interconnecting switch, lines terminating in said switch, a rotary dial for operating said switch, said dial having as many holes as there are lines terminating in the switch, whereby the substation of said switch may be placed in connection with any one of said lines terminating therein, and other automatic devices for connecting to and from the line of said switch.

9. In a telephone system, a rotary switch, a plurality of lines terminating therein, a rotary dial for operating said switch, said dial having as many holes therein as there are lines terminating in said switch, whereby connection may be extended to any one of said lines by selection of the proper hole in said dial, and other automatic devices for connecting to and from the line of said switch.

10. In a telephone system, a rotary switch, a plurality of lines terminating therein, a rotary dial for operating said switch, said dial having a hole therein for each line, a stop for variably limiting the rotation of said dial, depending upon which hole is selected, and other automatic devices for connecting to and from the line of said switch.

11. In a telephone system, a plurality of telephone lines extending to a central station, automatic switches at said central station controllable over said telephone lines for extending the connection from a calling subscriber to a called subscriber, another telephone line having a substation thereon, and a switch at said substation adapted to connect said last-mentioned telephone line with any one of said first-mentioned lines and means for automatically releasing said switch.

12. In a telephone system, a telephone, a central office and a line connecting said telephone and said central office, a plurality of other telephone lines terminating in the central office and means in the central office for extending connection from any one of said lines, a switch in said first line located between the central office and the telephone, said switch being provided with means for disconnecting said telephone in said first line from the central office and for connecting the said telephone with any one of said other lines.

13. In a telephone system, a telephone, a central office and a line connecting said telephone and said central office, a plurality of other telephone lines terminating in the central office and means in the central office for extending connection to and from any one of said lines, a switch in said first line located between the central office and the telephone, said switch being provided with means for disconnecting said telephone in said first line from the central office and for connecting the said telephone with any one of said other lines.

14. In a telephone system, a telephone, a central office and a line connecting said telephone and said central office, a plurality of other telephone lines terminating in the central office and automatic means in the central office for extending connection from any one of said lines, a switch in said first line located between the central office and the telephone, said switch being provided with means for disconnecting said telephone in

said first line from the central office and for connecting the said telephone with any one of said other lines.

15. In a telephone system, a telephone, a central office and a line connecting said telephone and said central office, a plurality of other telephone lines terminating in the central office and automatic means in the central office for extending connection to and from any one of said lines, a switch in said first line located between the central office and the telephone, said switch being provided with means for disconnecting said telephone in said first line from the central office and for connecting the said telephone with any one of said other lines.

16. In a telephone system, a telephone, a central office and a line connecting said telephone and said central office, a plurality of other telephone lines terminating in the central office and means in the central office for extending connection from any one of said lines, a switch in said first line located between the central office and the telephone, said switch being provided with means for disconnecting said telephone from the central office and for connecting the said telephone with any one of said other lines, and means associated with said switch for locking the same into connection with any one of said lines.

17. In a telephone system, a telephone, a central office and a line connecting said telephone and said central office, a plurality of other telephone lines terminating in the central office and automatic means in the central office for extending connection from any one of said lines, a switch in said first line located between the central office and the telephone, said switch being provided with means for disconnecting said telephone from the central office and for connecting the said telephone with any one of said other lines.

18. In a telephone system, a substation, a central office and a line connecting said substation and said central office, a plurality of other telephone lines terminating in the central office and means in the central office for extending connection from any one of said lines, a switch in said first line located between the central office and the substation, said switch being provided with means for disconnecting said substation from the central office and for connecting the said substation with any one of said other lines, and means associated with said switch for locking the same controlled from the said substation.

19. In a telephone system, a substation, a central office and a line connecting said substation and said central office, a plurality of other telephone lines terminating in the central office and means in the central office for extending connection from any one of said lines, a switch in said first line located between the central office and the substation, said switch being provided with means for disconnecting said substation from the central office and for connecting the said substation with any one of said other lines, and means associated with said switch for locking the same controlled from said substation when the receiver is removed from the hook.

20. In a telephone system, a telephone, a central office and a line connecting said telephone and said central office, a plurality of other telephone lines terminating in the central office and automatic means in the central office for extending connection to and from any one of said lines, a switch in said first line located between the central office and the telephone, said switch being provided with means for disconnecting said telephone from the central office and for connecting the said telephone with any one of said other lines, said automatic means responsive to impulses sent over the line for operating the same.

21. In a telephone system, a plurality of telephone lines extending to a central station, automatic switches at said central station controllable over said telephone lines for extending the connection from a calling subscriber to a called subscriber, another telephone line having a substation thereon, and a manually operated switch at said substation adapted to connect said last-mentioned telephone line with any one of said first-mentioned lines, and automatic means for releasing said switch.

22. In a telephone system, a telephone line, devices for extending calls to and from said line, another line, and manually operated means independent of said devices for extending connection directly between the substation of said telephone line and said other line, said means provided with devices for automatically releasing it.

23. In a telephone system, a telephone line, a plurality of other lines, and manually operated means at the substation for disconnecting the said substation from the exchange and for connecting the same with any one of said other lines, said means provided with devices for automatically releasing it.

24. In a telephone system, a telephone, a central office and a line connecting said telephone and said central office, a plurality of other telephone lines terminating in the central office and means in the central office for extending connection from any one of said lines, a manually operated switch in said first line located between the central office and the telephone, said switch being provided with means for disconnecting said telephone from the central office and for connecting the said telephone with any one of said other lines.

25. In a telephone system, a telephone, a central office and a line connecting said tele-

phone and said central office, a plurality of other telephone lines terminating in the central office and means in the central office for extending connection from any one of said lines, a manually operated switch in said first line located between the central office and the telephone, said switch being provided with means for disconnecting said telephone from the central office and for connecting the same with any one of said other lines, and automatic means for releasing said switch.

Signed by me at Chicago, Cook county, Illinois, this 24 day of March, 1909.

TALBOT G. MARTIN.

Witnesses:

BERNARD D. WILLIS,

EDWARD D. FALES.