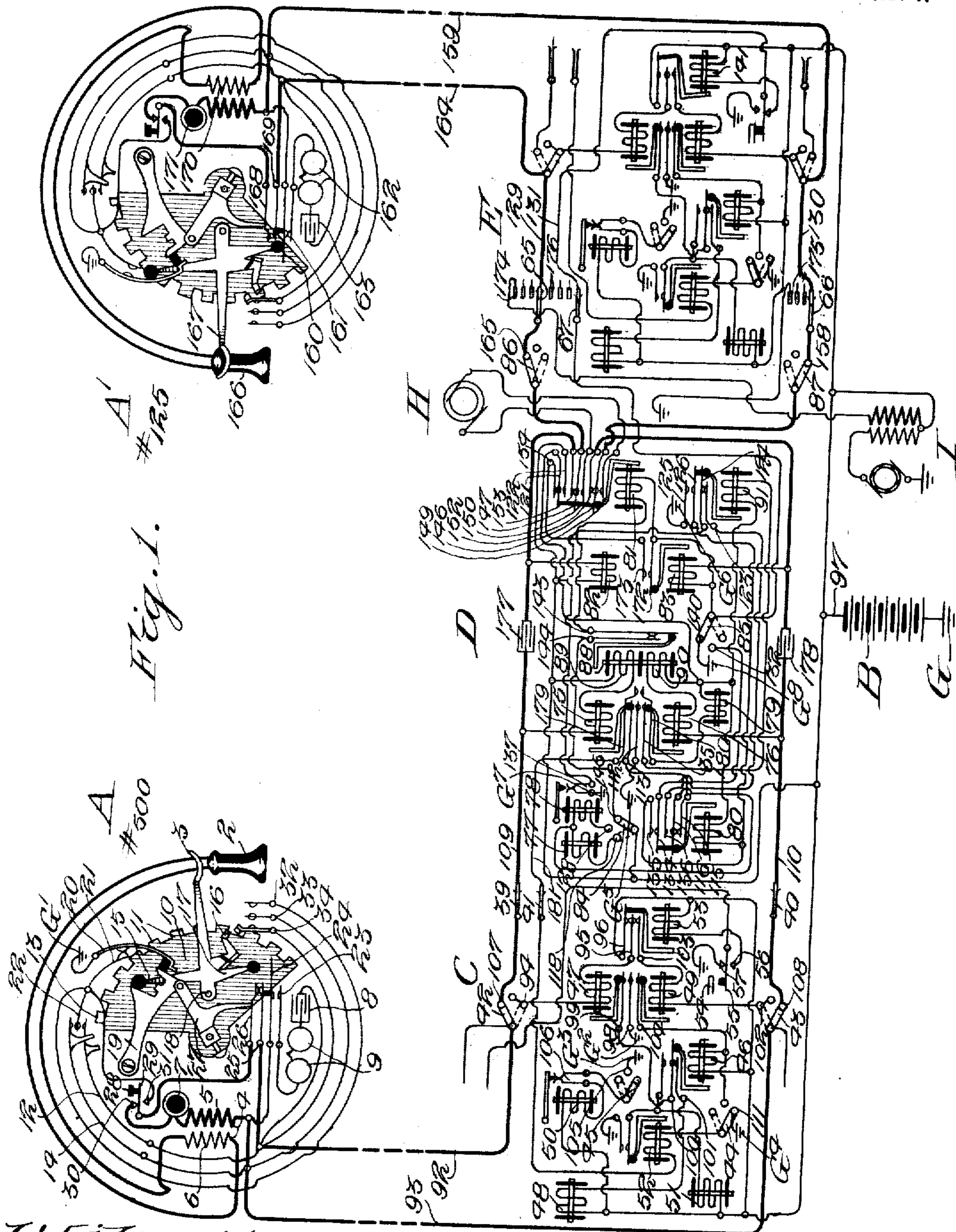
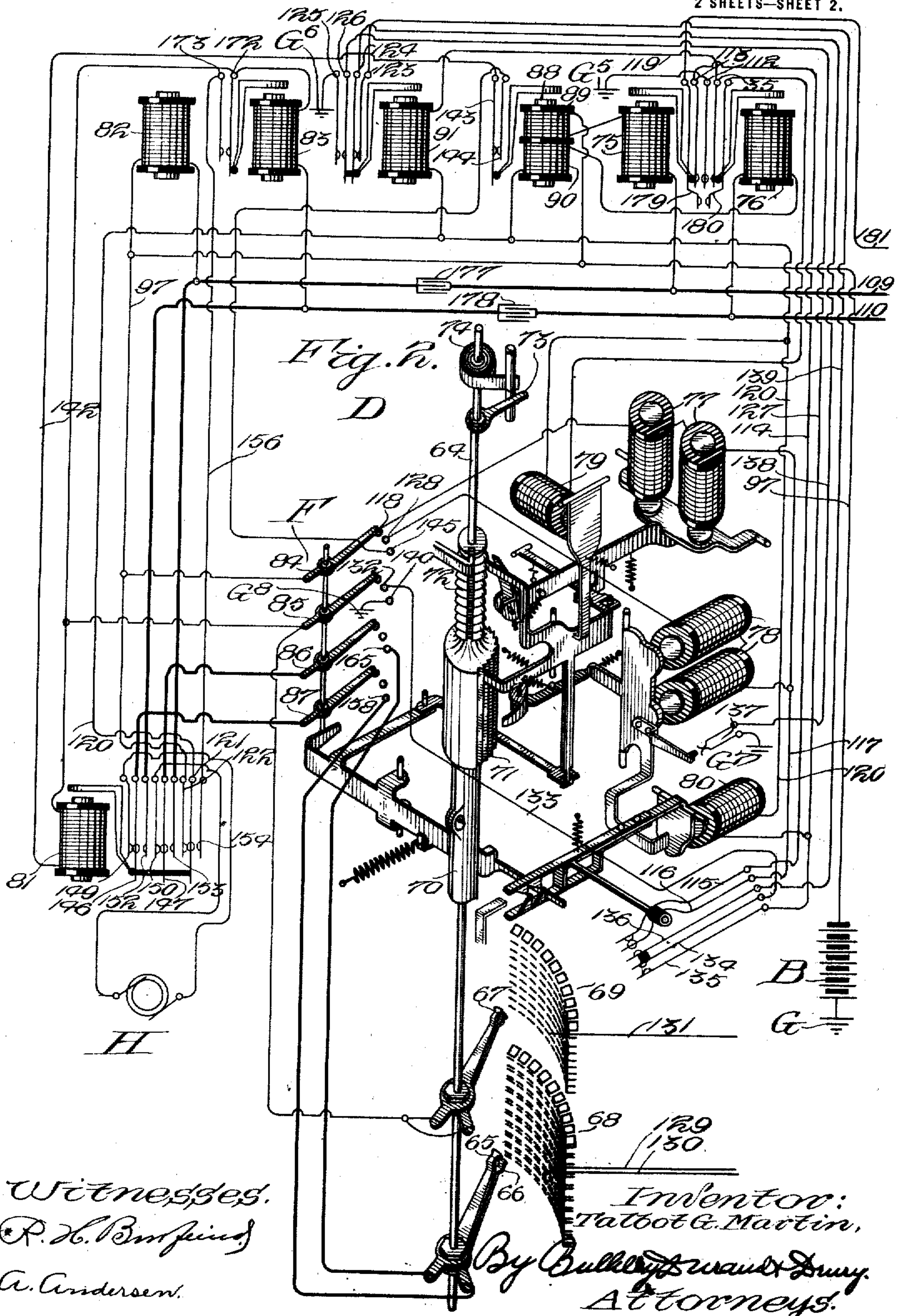




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 AUTOMATIC TELEPHONE SYSTEM AND APPARATUS.
 APPLICATION FILED MAR. 26, 1907. RENEWED JAN. 28, 1918.
 1,267,097. Patented May 21, 1918.
 2 SHEETS—SHEET 2.



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UNITED STATES PATENT OFFICE.

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AUTOMATIC ELECTRIC CO., A CORPORATION OF ILLINOIS.

AUTOMATIC TELEPHONE SYSTEM AND APPARATUS.

1,267,097.

Specification of Letters Patent.

Patented May 21, 1918.

Application filed March 26, 1907, Serial No. 364,699. Renewed January 28, 1918. Serial No. 214,253.

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 Automatic Telephone Systems and Apparatus, of which the following is a specification.

My invention relates to telephone systems in general, but more particularly to automatic systems in which step-by-step-actuated and electrically-propelled switches are employed for extending connections, and more especially to systems in which the electrical current for talking purposes is supplied from means located at the exchange or central station.

As herein disclosed, I provide an automatic switch provided with means for automatically skipping busy lines and stopping on the first idle line, so as to automatically select the first idle one of a plurality of lines, and provided also with means for controlling the flow of talking current to the calling and called telephone lines. In this way the said automatic switch combines the functions of a selector with those of a connector, and in addition has control over the supply of talking current to the calling and called telephone lines, or at least to the called telephone line. With this arrangement a subscriber may have several telephone lines running to his substation, and with an automatic switch of this character the calling subscriber will automatically select the first idle one of said lines, somewhat in the manner that a selector operates to select the first idle one of a number of trunk lines. If the called subscriber has a number of telephone lines it does not, of course, make any difference to the calling subscriber which of said lines is employed by him in extending connection to the substation of the called subscriber. With my improved system and apparatus the calling subscriber can call the number of the called substation, and the switch for completing the final connection will automatically search through the lines of the called subscriber and stop on the first idle line, which would be the first of said lines if none are busy. In addition, the said automatic switch for thus making the final connection will

then, in response to the act of the called subscriber in taking down his receiver, admit talking current to both of said lines—that is to say, to the calling telephone line as well as the selected called line—and the two connected subscribers are then ready for conversation. In this way my improved system and apparatus is adapted to give common battery telephone service to subscribers one or more of which may have one or more telephones, any one of which will answer the purpose of the calling subscriber.

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

In the accompanying drawings, Figure 1 shows diagrammatically a calling substation A and a called substation A' connected through the medium of a common battery central office comprising rotary connector switches. In the said central office the calling substation #500 has allotted to its line a first-selector C of the general type disclosed in United States Patent No. 815,321, granted March 13, 1906, to Keith, Erickson & Erickson. It will be seen that the central battery B has its positive terminal preferably grounded at G. The operating relays of the central switches are normally connected to the non-grounded terminal of said battery, so that the subscriber by grounding his line conductor may operate the said switches, as is usually the custom in systems of this type. In addition to the first-selector C, there is shown at D a common battery rotary connector switch, and at E is shown another first-selector (similar to the selector C) allotted to the called line; said selectors and connectors respond to the numeral operations of the calling subscriber and for that reason are some times spoken of as numerical switches. In this system both the calling and called substations are provided with battery current for talking purposes only when the called subscriber answers.

Fig. 2 is a diagrammatic perspective view of the rotary connector which is an improvement upon the general type of connector disclosed in United States Patent No. 815,176, granted March 13, 1906, to Keith, Erickson & Erickson. In the connector D I provide

means whereby the connector shaft may be automatically rotated (like the shaft of a first-selector) when the private wiper engages grounded contact points. My improved connector combines in a common battery switch the general features of the switch disclosed in said connector patent with the automatic selective features of the switch disclosed in said selector patent.

10 The substations may be of any suitable or approved type. The substation A, for example, comprises a receiver 2, switch-hook 3, induction-coil 4 which consists of the primary winding 5 and secondary winding 6, transmitter 7, condenser 8, ringer 9, impulse wheel 10 which has the usual vertical impulse teeth 11 that are adapted to operate the vertical impulse spring 12. The impulse wheel carries the rotary impulse tooth 13 which operates the rotary impulse spring 14. The switch-hook has radiating from its body a number of cam-arms 15, 16 and 17 and is pivotally secured to the keyboard (not shown) by the screw 18 about which it moves when the receiver is removed. The movement is produced by a spring (not shown), and the switch-hook is pushed up for the purpose of changing certain circuit connections to be disclosed.

30 The cam-arm 15 controls the so-called locking cam 19. After the dial is rotated the locking cam 19 occupies the position shown at substation A, permitting the ground springs 20 and 21 to engage, and thus placing the ground post 22 in connection with the substation ground G', whereby when the subscriber releases the dial after rotating it, as described, the vertical impulse teeth 11 will cause the vertical impulse spring 12 to come in contact with the ground post 22; and immediately after, the rotary impulse tooth 13 causes the rotary impulse spring 14 to come in contact with the same ground post 22, thus sending ground impulses to the central office for operating the switches thereat. But while the switch-hook is down the locking cam 19 occupies the position shown at substation A', thus locking the dog 27, whereby the shaft to which the dog is attached is prevented from being turned by the dial, which latter is not shown but which may be of any type usually employed at a substation of the character in question.

50 Also, the cam-arm 17 maintains a contact between the springs 23 and 24, thereby bridging the condenser 8 in series with the ringer 9 across the line, and maintaining the springs 25 and 26 disengaged, whereby the primary circuit including the winding 5 in series with the transmitter 7 is interrupted. The signaling device whereby a subscriber may signal another after a connection has been established comprises a push-button 28 and a spring 29, which latter normally engages the contact point 30;

but when the push-button 28 is pressed the spring 29 leaves the contact point 30 and engages the contact point 31 which is connected with the substation ground G'. Means whereby the subscriber may release the central station apparatus brought into service comprises three springs 32, 33 and 34, known as the release springs, and so controlled by the cam-arm 16 that when the switchhook descends the three release springs are brought into contact for a moment, thereby grounding both the subscriber's line conductors simultaneously.

The first-selector switch shown at C, being of the type described in the said selector patent, is well known and needs only general description. The switch shaft (not shown) carries the vertical and rotary wipers 39 and 40, respectively, and the private wiper 41. The side switch is also well known, and comprises the side switch wipers 42, 43, 44 and 45, which may be designated as the vertical, rotary and private side switch wipers and the rotary magnet side switch wiper, respectively. The side switch is under the control of the private magnet 46, and through the median of the vertical line relay 47 the subscriber controls the vertical magnet 48, while the side switch is in the first position, which latter magnet operates to raise the shaft and shaft wipers 39, 40 and 41 vertically. The private magnet, however, is controlled through the median of the rotary line relay 49. While the side switch is in second position, the rotary magnet 50 (which carries the shaft and shaft wipers in a rotary or circular direction) is energized, in a local circuit, and the vertical and rotary line relays 47 and 49, acting conjointly, provide means whereby the subscriber controls the release magnet 51 while the said side switch is in first or second position. However, after the side switch passes to third position, then, since the first-selector is of the trunk-release type, the said switch is controlled through the median of the next switch D, with which a connection is established, over a circuit comprising the private wiper 41 and the back-release relay 52. The bridge-cut-off relay 53 is provided to open the connection between the line relays 47 and 49 and between the said relays and battery B. This is desirable, because if the relays are not disconnected from each other and battery the ringing current for signaling the subscriber may operate to throw the selector-switch C off normal. It is also desirable to remove the bridge formed through the said relays from across the line to give the voice-currents as clear a path as possible. The first-selector switch-shaft is also provided with a normal post arm 54 which, when the shaft is in normal position, closes the spring 55 in contact with the contact point 56; but

when the shaft is raised one or more steps the spring 55 closes in contact with the contact point 57, by which switching means the line allotted to the switch is made busy while the switch-shaft is off-normal. Also, the energizing circuit for the relay 53 comprises the spring 55 and contact point 56.

The connector switch D (Fig. 2), as has been stated, is an improvement upon the one disclosed in the said connector patent. The mechanical details are very much the same, although the circuits are materially different. The usual switch shaft 64 of said connector is provided with the line wipers 65 and 66 and with the private wiper 67, which have allotted to their use the line and private banks 68 and 69. Said shaft is also provided with the cam 70, longitudinal teeth 71, circular teeth 72, normal post arm 73 and coil spring 74. Said switch is also provided with vertical and rotary line relays 75 and 76, and the vertical and rotary magnets 77 and 78, the release magnet 79, private magnet 80, ringer relay 81, and the vertical and rotary back-bridge relays 82 and 83, respectively. The side switch F performs, as usual, switching operations through the medium of the side switch wipers 84, 85, 86 and 87. Furthermore, the connector is provided with a differential relay 88 which comprises the windings 89 and 90. This connector is in addition provided with the private relay 91 which is controlled by the rotary line relay 76, which relay 91 in turn controls the private magnet 80, as will be hereinafter explained. The said private relay is the link that connects the old features of the connector with the selective feature to which reference has been made. The object in providing the connector with this automatic selective feature is as follows: A business office, for example, may be provided with three substations, all of which are given the same number, and it becomes desirable to so arrange the system that if one telephone is in use the connector switch will automatically carry the calling subscriber into connection with the second telephone, and if the second telephone is also in use the connection is carried to the third telephone, and so on. In that case there would, of course, be one line for each telephone terminating at a given set of connector banks. The calling subscriber would have no control over the apparatus as to which one of the set of telephones he makes connection with. This, of course, does not concern him, since, for the purpose of his transaction, any telephone at the said office will do. The arrangement of the connector banks themselves will be as follows: If an office to which the number 111 is allotted wishes three telephones, the subscriber will be given three lines terminating one in the first set of con-

another in the second set of contacts of the first level, and the third in the third set of contacts of the first level. Now, if the number 111 is called, the connector is raised to the first level and then rotated into engagement with the first set of contacts of the first level, but if the said first set of contacts are busy the connector is automatically rotated onto the second set of contacts, and onto the third set if the second set of contacts are also busy. It becomes desirable, of course, to provide means for signaling the calling subscriber in the event that all three of the lines are busy. For this purpose the fourth set of bank contacts of the first level are connected with a busy-signaling circuit, at which contacts the connector must stop at all events. The private contact 176 of the fourth set and corresponding contacts in the banks of all other connectors adapted to connect with this group of lines are disconnected from each other or may be made of insulating material to prevent them from receiving a guarding potential from any other switch. In this particular illustration therefore, if the first three sets of contacts are busy the connector wipers will be rotated to the fourth set where they must stop rotating and permit the side switch to pass to third position. A busy-signaling current is then sent out to the calling subscriber's line over a circuit including the fourth set of contacts of this level, notifying him of the state of affairs. It will be evident that any office may be equipped with telephones which may be numbered 155 and to which may be allotted one, two, three, or any number of lines, depending upon the number of contacts in the bank, reserving the last contact for the busy contact. If it becomes desirable, one whole level may be designated by one number; but ordinarily it is expected that each level will be divided up into sets, one number for each set, the number depending upon the position of the first contact of the set in the bank.

The operation of the system may be more clearly disclosed if each step during the process of a call is followed in detail, as in the following: It will be assumed that the subscriber at substation A wishes to call the office or substation which is numbered 125 and which is provided with substation telephone sets A', A² and A³, of which only A' is shown. When the receiver is removed from the switch-hook 3 the cam-arm 17 permits the springs 23 and 24 to disengage, and the springs 25 and 26 to engage, thereby removing the ringer 9 from across the line and bridging instead the primary circuit.

The first digit being 1 the subscriber operates his dial accordingly, and as soon as the dial is drawn down the ground springs 20 and 21 come into contact, establishing a ground connection from the substation

ground G' to the ground post 22. As the dial returns, therefore, the impulse wheel 10, by means of the first one of the vertical impulse teeth 11, thrusts the vertical impulse spring 12 against the ground post 22 once, and then the rotary impulse tooth 13, in a similar manner presses the rotary impulse spring 14 onto the ground post 22 once. The line conductors 92 and 93 are, therefore, each grounded once, and as a result the vertical line relay 47 of the selector C is first energized by a flow of current from the substation ground G' through the ground springs 20 and 21 to the vertical impulse spring 12, thence to the vertical line conductor 92, side switch wiper 42, contact point 94, vertical line relay 47, bridge-cut-off relay springs 95 and 96 to the battery lead 97, and through battery B to ground G. The vertical line relay 47 then, upon energizing once, presses the line relay springs 98 and 99 into contact, thus energizing the vertical magnet 48 once by a flow of current from ground G² through the springs 98 and 99, private springs 100 and 101 to the vertical magnet 48, thence to the battery lead 97 and through battery B to ground G. The vertical magnet 48, therefore, operates to raise the shaft wipers 39, 40 and 41 to the first level, in a well known manner. This operation having been accomplished, then when the rotary line conductor 93 is grounded the rotary line relay 49 is energized and this in turn operates the private magnet 46, which latter then trips the side switch to second position, establishing an energizing circuit through the rotary magnet 50 for rotating the wipers onto some trunk line. The energizing circuit through the said rotary line relay 49 extends from the substation ground G' to the ground post 22, thence to the rotary impulse spring 14, rotary line conductor 93, side switch wiper 43, contact point 102, rotary line relay 49, bridge-cut-off relay springs 103, 95 and 96 to the battery lead 97, thence through battery B and to ground G. The said rotary line relay, upon pressing the spring 104 onto the spring 98, closes an energizing circuit through the private magnet 46, as already stated, from ground G² through the springs 98 and 104 to the said private magnet 46, thence to the battery lead 97, and through battery B to ground G. The private magnet, upon operating once, permits the side switch to pass to second position, at which time the side switch wiper 45 engages the grounded contact point 105, whereby the energizing circuit for the rotary magnet 50 is closed from ground G³ to the contact point 105, side switch wiper 45, interrupter springs 106, rotary magnet 50 to the battery lead 97, thence through battery B to ground G. The rotary magnet is then energized and the wipers 39, 40 and 41 are carried into engagement with the first trunk. If the said trunk

is not busy, as is well known, the armature of the rotary magnet 50, by mechanically operating the armature of the private magnet 46, releases the side switch to third position; but if the said trunk is busy the private magnet energizes at the same time that the private armature is depressed and at the instant that the private wiper 41 engages the grounded contact, so that the side switch is held in second position, and an energizing circuit maintained through the rotary magnet 50 until the private wiper 41 is carried onto an idle trunk, and the energizing circuit for the private magnet destroyed. At the same instant that the side switch passes to third position, the wiper 45 leaves the contact point 105, thus breaking the energizing circuit for the rotary magnet 50 and bringing the selector to a standstill. The passage of the side switch to third position, of course, carries the side switch wipers 42 and 43 onto the contact points 107 and 108, whereby the line conductors 92 and 93 are placed in connection with the line wipers 39 and 40 which, having already entered into connection with the trunk conductors 109 and 110 that lead to the connector D, place the said conductors 92 and 93 also in connection with the said connector D. The passage of the side switch to third position, furthermore, establishes a guarding potential at the private wiper 41, when the side switch wiper 44 engages the grounded contact point 111, to protect the seized line. This potential arrives at the said private wiper 41 from ground G⁴ to the contact point 111, through the back-release relay 52 to the private wiper 41. The line conductors 92 and 93 having been thus extended to the connector D, the succeeding impulses from the substation A are directed to said connector D.

The second digit being 2, the subscriber operates his dial accordingly, grounding the vertical line conductor 92 twice, and the rotary line conductor 93 once. Each time that the vertical line conductor is grounded the vertical line relay 75 of the connector D is energized by a flow of current from the substation ground G' to the vertical line conductor 92, thence through the selector side switch 42 to the contact point 107, vertical line wiper 39, vertical trunk conductor 109 to the vertical line relay 75, thence through said relay and through the winding 89 of the relay 88 to the battery lead 97, and from battery B to ground G. Since the winding 89 is included in the energizing circuit of the vertical line relay, the relay 88 becomes energized, but its operation at this particular time is without effect. Each time that the vertical line relay 75 attracts its armature it forces the line relay springs 112 and 113 into contact, each time sending an impulse through the vertical magnet 77 from ground G⁵ through the said springs

112 and 113, conductor 114, private springs 115 and 116, conductor 117 to the vertical magnet 77, contact point 118, side switch wiper 84, thence to battery lead 97, and through battery B to ground G. The vertical magnet, as disclosed in the aforesaid connector patent, when energized operates to raise the switch shaft and wipers. The vertical magnet 77 being energized twice, the wipers 65, 66 and 67 are raised to the second level. The ground impulse to the rotary line conductor 93, after the switch shaft 64 has been raised, energizes the rotary line relay 76 of the connector, which in turn operates to energize the private relay 91. The circuit over which the said rotary line relay 76 is energized extends from the substation ground G' to the rotary line conductor 93, thence to the side switch wiper 43 of the selector C, contact point 108, rotary line wiper 40, rotary trunk conductor 110 to the said rotary line relay 76, thence through the winding 90 of the differential relay 88, through the ringer relay springs 121 and 122 to battery lead 97, and through battery B to ground G. The rotary line relay 76, upon attracting its armature for a moment, forces the spring 35 onto the spring 112 for a moment, whereby a flow of current is sent through the private relay 91 from ground G⁵ through the springs 112 and 35, conductor 119 to the private relay 91, thence through conductor 120, ringer relay springs 121 and 122 to the battery lead 97, and through battery B to ground G. The private relay 91, upon energizing, operates to disengage the springs 123 and 124 to prevent an energization of the rotary magnet 78 at the wrong time. Said relay 91 also operates at the same time to place the springs 125 and 126 in contact, whereby a momentary energizing circuit is closed through the private magnet 80, said circuit extending from ground G⁶ through the springs 125 and 126, conductor 127, private magnet 80, conductor 120, ringer relay springs 121 and 122 to the battery lead 97, thence through battery B and to ground G. The private magnet 80, upon attracting its armature and then deenergizing, operates, as disclosed in said patent, to release the side switch F from first to second position. The effect of the shifting of the side switch is to substitute the rotary magnet 78 for the vertical magnet 77 to the control of the vertical line relay 75 when the side switch wiper 84 leaves the contact point 118 and engages the contact point 128.

The third digit being 5, therefore—when the vertical line conductor 92 is grounded five times by the subscriber upon operating the dial corresponding to the said digit—the vertical line relay 75 energizes five times over circuits that are now known, which relay in turn causes the energization of the

rotary magnet 78 step by step. The energizing circuit through said rotary magnet extends from ground G⁵ through the line relay springs 112 and 113, conductor 114, private springs 115 and 116, conductor 117 to the rotary magnet 78, contact point 128, side switch wiper 84, thence to the battery lead 97, and through battery B to ground G. The rotary magnet 78 being energized five times the shaft 64 is rotated five steps, as explained in said patent, whereby the wipers 65, 66 and 67 are carried into engagement with the fifth set of contacts of the second level, from which contacts lead the normal conductors 129, 130 and 131 that extend to the selector E of the called line, the first two of which conductors continue through to the called substation A'. After the connector has thus been operated the ground impulse to the rotary line conductor 93 energizes the rotary line relay 76 of the connector over circuits that are already well known, which relay in turn operates the private relay 91 as before. Now, when the last rotary impulse operates the rotary line relay 76, one of two results occurs, namely the release of the side switch from second to third position, or the connector shaft is automatically rotated onto the next set of contacts, providing the first set of contacts is busy, and into connection with a second telephone A². Also, if the second set of contacts leading to the office desired is busy, the connector shaft wipers are rotated to the next line which leads to a third telephone A³. Furthermore, if all of the trunk lines to which the number 125 is allotted are engaged, the shaft wipers are rotated onto a set of contacts to which the busy-signaling machine I is connected, and the calling subscriber receives the busy-signal. This automatic rotation is brought about as follows: When the private relay 91 energizes, the private magnet 80 is energized, as previously explained, and is maintained energized if the fifth private contact is grounded—that is, if the first line is in use. The holding circuit for the private magnet extends from the grounded contact to the private wiper 67, side switch wiper 85, contact point 132, conductor 133, private magnet springs 134 and 135, private magnet 80, conductor 120, through the ringer relay springs 121 and 122 to the battery lead 97, thence through battery B and to ground G. The private magnet 80 is thus energized by a locking circuit and retains the side switch wipers in second position as long as the wiper 67 engages a busy or grounded contact. Furthermore, when the private magnet is energized the spring 116 is shifted out of contact with the spring 115 and into contact with the spring 136, whereby a new energizing circuit is completed through the rotary magnet 78. This circuit extends from

ground G' through the interrupter springs 137, conductor 138, private relay springs 124 and 123, conductor 139, private magnet springs 136 and 116, conductor 117, rotary magnet 78, contact point 128, side switch wiper 84 to the battery lead 97, thence through battery B and to ground G. The connector now operates to rotate automatically as long as the shaft wiper 67 engages a grounded contact point. When the shaft wiper 67 leaves the last busy contact the circuit through the private magnet is broken, whereby the said magnet deenergizes and the side switch passes to third position. If the first set of contacts is not in use there is no ground potential at the private wiper 67 to lock and hold the private magnet when the last rotary impulse comes, and therefore the side switch passes to third position. At any rate, when the side switch passes to third position, whether the shaft wipers are on the first line or after they have been rotated to another line, the side switch wiper 85 engages the contact point 140, whereby a guarding potential is established at the connector private bank for protecting the seized line. Assuming that the connector has arrived on the line leading to station A', this guarding potential closes an energizing circuit through the bridge-cut-off relay 141 of the first-selector E. Also, the instant that the side switch wiper 85 engages the grounded contact point 140, an energizing circuit is established through the ringer relay 81 extending from ground G^s to the contact point 140, side switch wiper 85, ringer relay 81, conductor 142, springs 143 and 144, contact point 145, side switch wiper 84 to the battery lead 97, thence through battery B and to ground G. The ringer relay, upon energizing, operates to shift the springs 146, 147 and 121 out of contact with the springs 149, 150 and 122 and into contact with the springs 152, 153 and 154, respectively. The engagement of the springs 146 and 152, and 147 and 153, places in contact the extended calling line conductors and the called line conductors. The disengagement of the spring 121 from the spring 122 to engagement with the spring 154 changes the polarity of the conductor 120 from the battery lead 97 to the ground conductor 156. Now, when the signal button 28 is pressed the ringer relay 81 becomes deenergized, whereby the ringer generator H becomes bridged across the line of the called subscriber. When the button 28 is pressed the spring 29 engages the grounded contact point 31, thereby grounding the vertical line conductor 92 from ground G' through the springs 20 and 21, contact point 31, spring 20, springs 26 and 25, vertical line conductor 92, thence to the connector vertical line relay 75, winding 89 of the differential relay 88 to the battery lead 97, thence through battery B and to ground G. Since the winding 89 is included in this circuit, the relay 88 becomes energized and operates to disengage the springs 143 and 144, whereby the energizing circuit through the ringer relay is broken. The ringer relay then deenergizes and the ringer relay springs come back to normal position, whereby the ringer generator is bridged across the called line conductors and a signaling current is sent from the generator H through the springs 149 and 146, side switch wiper 87, contact point 158, shaft wiper 66, rotary normal conductor 130, line conductor 159, springs 160 and 161, ringer 162, condenser 163, vertical line conductor 164, vertical normal conductor 129, shaft wiper 65, contact point 165, side switch wiper 86, ringer relay springs 147 and 150 back to the ringer generator H. When the subscriber ceases to press the button 28 the energizing circuit through the vertical line relay 75 and the differential relay 88 is broken, and the springs 143 and 144 again engage, thus reestablishing the energizing circuit through the ringer relay. The subscriber at substation A', in response to the signal, removes the receiver 166 from the switch-hook 167, which latter upon rising allows the springs 168 and 169 to engage, thereby closing an energizing circuit through the back-bridge relays 82 and 83 extending from ground G^s, contact point 140, side switch wiper 85, rotary back-bridge relay 83, through the ringer relay springs 152 and 146, side switch wiper 87, contact point 158, switch shaft wiper 66, normal conductor 130, rotary line conductor 159, primary winding 170, transmitter 171, springs 168 and 169, vertical line conductor 164, normal conductor 129, switch shaft wiper 65, contact point 165, side switch wiper 86, ringer relay springs 147 and 153, through the winding of the coil 82 to the battery lead 97, thence through battery B and to ground G. This circuit provides the called substation with battery current for talking purposes. Furthermore, when the relay 83 energizes and closes the springs 172 and 173 in contact, a circuit is closed, which provides the calling substation A with battery current for talking purposes. This circuit extends from ground G^s, contact point 140, side switch wiper 85, through the springs 172 and 173, ringer relay springs 154 and 121, conductor 120, winding 90 of the differential relay 88, rotary line relay 76, rotary trunk conductor 110, shaft wiper 40, side switch wiper 43, rotary line conductor 93, primary winding 5, transmitter 7, springs 26 and 25, vertical line conductor 92, side switch wiper 42, shaft wiper 39, trunk conductor 109, vertical line relay 75, winding 89 of the differential relay 88 to the battery lead 97, thence through battery B and to ground G. The

two substations being provided with battery current for talking purposes, the subscribers may hold communication over the circuit shown by the heavy lines in Fig. 1. Assuming that all the lines 125 are busy, then instead of making connection the shaft wipers 65, 66 and 67 are rotated to the busy contact points 174, 175 and 176, respectively, Fig. 1, and the calling subscriber receives the busy-signal from the busy machine I to the contact point 174, wiper 65, contact point 165, side switch wiper 86, ringer relay springs 147 and 153, through the condenser 177, thence over the vertical conductors, as previously traced, through the substation to the rotary line conductors and through the condenser 178, ringer relay springs 152 and 146, side switch wiper 87, contact point 158, shaft wiper 66, contact point 175, and thence to ground.

The release of the central office switching apparatus is brought about when the calling subscriber restores the receiver 2 to the switch-hook 3, thereby pressing the release springs 32, 33 and 34 into contact and grounding both line conductors 92 and 93 simultaneously. Grounding both line conductors at this time shunts or short-circuits the rotary line relay 76 and winding 90 of the differential relay 88. This shunt extends from ground G^a, contact point 140, side switch wiper 85, springs 172 and 173, conductor 156, ringer relay springs 154 and 121, winding 90 of the differential relay 88, rotary line relay 76 to the rotary line conductor 93, through the release springs 33 and 32 to the substation ground G'. The differential relay 88 then energizes and the springs 143 and 144 are disengaged, whereby the ringer relay returns to normal position, thus allowing the spring 121 to reengage the spring 122. The short-circuit of the rotary line relay 76, in series with the winding 90, is thereby removed and an energizing circuit is established instead, over previously traced circuits, through the release springs 33 and 32 to the substation ground G'. The rotary line relay 76 energizes and operates in conjunction with the vertical line relay 75 to place the trunk-release springs 179 and 180 in contact, thereby closing an energizing circuit through the connector release magnet 79 in series with the back-release relay 52 of the first-selector C. This release circuit extends from ground G^a, contact point 111, side switch wiper 44, through the release relay 52, shaft wiper 41, conductor 181, trunk-release springs 179 and 180, release magnet 79, conductor 120, through the ringer relay springs 121 and 122 to the battery lead 97, thence through battery B and to ground G. The release magnet, upon energizing, operates to restore the side switch F and the switch shaft to normal position, in the manner explained in the said

connector patent. Also, the relay 52, upon energizing and deenergizing when the release springs separate, operates to release the first-selector C, as disclosed in the said selector patent.

The various relays and magnets may be wound to any suitable resistance. Good results have been obtained when the private relay 91 is wound to a resistance of five hundred ohms; the ringer relay 81 to three hundred ohms; and the windings 89 and 90 of the differential relay 88 to seventy-five ohms each.

From the foregoing it will be seen that I provide means for giving common battery telephone service to the subscribers of an automatic exchange wherein one or more of such subscribers may have a plurality of telephones any one of which will answer the purpose of a calling subscriber. The automatic switch D is adapted to operate automatically until it finds an idle line running to the station of a called subscriber, or to the office at which several telephones are located, and is equipped with means responsive to the called subscriber for then admitting talking current to the calling and called telephone lines. It will be understood, of course, that the automatic switches D, which may be called rotary connectors, are preferably less in number than the total number of subscribers, so that the trunking between telephone lines is conducted on a percentage basis. With such arrangement the subscribers' individual switches C, which are herein illustrated as first-selectors, will be the same in number as the total number of telephone lines. It will also be understood that for a larger exchange additional selectors can be employed and arranged intermediate of the selectors C and the rotary connectors D, in a well-known manner.

It will be seen that the selectors and connectors herein disclosed are of that type in which vertical or straight line motion is employed for selecting groups, while rotary motion is employed for connecting with a line in the selected group, the system being of that character in which the subscribers are divided into groups. The vertical or straight line motion of the selectors is for the purpose of selecting the sections or divisions into which the groups of subscribers are divided, and each level in a selector represents a different group of trunks. In the connectors each level or horizontal row of bank contacts represents a group of subscribers' lines, so that in calling a subscriber first selects the section or division in which the called subscriber's group is found, and then by means of the connector selects the particular group of subscribers' lines, all of which subscribers' lines may, with the arrangement shown, be allotted to one subscriber. In such case, as explained, the

action of the connector, after the desired level or group of lines is selected by the calling subscriber, is then purely automatic, as it stops on the first idle subscriber's line.

5 What I claim as my invention is:—

1. The combination of a plurality of telephone lines, subscribers' telephones on said lines, means by which a calling subscriber automatically selects the first idle one of said
10 lines, and means under the control of the called subscriber for supplying talking current to the calling and called telephone lines.

2. In a telephone system, the combination of a plurality of telephone lines, subscribers' telephones on said lines, means by which a calling subscriber automatically selects the first idle one of said telephone lines, and means under the control of the called subscriber for supplying talking current to the
15 calling telephone line.

3. In a telephone system, the combination of a calling subscriber's line and of a plurality of lines, a plurality of progressively movable switches by means of any one of
25 which a calling subscriber automatically selects the first idle one of said lines, and means individual to each switch under the control of the called subscriber for supplying talking current to the calling telephone
30 line.

4. In a telephone system, the combination of a plurality of telephone lines running to the same substation, telephones on said lines, an automatic switch provided with means
35 for extending connection to any one of said lines, automatic means for causing the operation of said switch to select the first idle one of said lines, a common battery, and a relay allotted to said switch and controlling the
40 flow of talking current from said battery to the calling telephone line, said relay controlled by the called telephone line for supplying current for talking purposes to the calling telephone line.

5. In a telephone system, the combination of a plurality of telephone lines running to the same substation, telephone sets on said lines, an automatic switch provided with means for extending connection from a calling telephone line to any one of said telephone lines, automatic means for operating
50 said switch to select the first idle one of said lines, and a common battery, said switch provided with a relay controlled by one of said telephone lines for controlling the flow of talking current from said battery to the
55 calling telephone line.

6. In a telephone system, the combination of telephone lines, telephones on said lines, automatic means for trunking a calling line into connection with the line of a called subscriber, automatic means for causing the selection of the first idle one of a group of
60 said telephone lines, and automatic means

controlled by the subscriber of the idle telephone line for supplying talking current to the calling and called telephone lines. 65

7. In a telephone system, a calling line, a substation on said line, a plurality of other lines, an automatic switch for selecting idle
70 lines adapted to make connection with some one of said lines, unless the same are all busy, a central source of current, and means including a relay in said switch controlled by any one of said other lines for supplying
75 talking current from said source through the said switch to the calling subscriber's substation.

8. In a telephone system, a source of talking current, a combined automatic selector
80 and connector switch, and a back-bridge relay in said switch for controlling the supply of talking current to the calling subscriber's station when the called subscriber answers. 85

9. In a telephone system, the combination of a calling subscriber's line and of a plurality of lines, automatic means for selecting and extending connection to idle lines, means for signaling a called subscriber, a source
90 of current, means associated with the line-selecting means for connecting the source of current to the automatically selected line, means controlled by said called subscriber for supplying current for talking purposes
95 from said source to said calling subscriber's line, and automatic means for releasing.

10. In a telephone system, a plurality of lines, a switch adapted to operate at different levels, means in said switch for selecting
100 a level in accordance with a certain digit of the called number, means in said switch for then causing the operation thereof in the selected level in accordance with another digit of said number, means in said switch
105 for then automatically continuing the operation until an idle line is found, and automatic means for supplying the selected line with current.

11. In a telephone system, and in combination with a common battery, an automatic common battery switch having a private relay and a private magnet and a rotary line relay for operating the private relay, for in turn operating the private magnet, a side
115 switch, and a rotary magnet, said private relay adapted to prevent the energizing of said rotary magnet while said private magnet is energized, and while the side switch is in second position. 120

12. In a telephone system, a common battery switch, a plurality of line terminals divided into contact levels, said switch provided with a shaft, means in said switch for operating said shaft to elect a contact level,
125 a rotary magnet, means for first energizing said magnet by a plurality of impulses from the calling substation, and means for then

automatically energizing said magnet after said shaft has reached a certain point.

13. In a telephone system, an automatic switch provided with line conductors, a battery, a ringer generator disconnected from the battery, a ringer relay for use in signaling the called subscriber, means by which said ringer relay is adapted to switch one of said line conductors from one pole of said battery to the other, a plurality of lines, and means in said switch for automatically selecting an idle line.

14. In a telephone system, a plurality of subscribers' lines any one of which will serve the purpose of a calling subscriber, means including an automatic switch for automatically selecting an idle one of said lines for the calling subscriber, and means associated with said automatic switch and controlled by the selected line for supplying talking current to the calling subscriber's substation.

15. The combination of a plurality of telephone lines, subscribers' telephones on said lines, means by which a calling subscriber automatically selects the first idle one of said lines, including a rotary connector having straight motion to select groups and rotary motion to automatically select the first idle line in the selected group, and means under the control of the called subscriber for supplying talking current to the calling and called telephone lines.

16. In a telephone system, the combination of a plurality of telephone lines, subscribers' telephones on said lines, means by which a calling subscriber automatically selects the first idle one of said telephone lines, including a rotary connector having straight motion to select groups and rotary motion to automatically select the first idle line in the selected group, and means under the control of the called subscriber for supplying talking current to the calling telephone line.

17. In a telephone system, the combination of a plurality of telephone lines, subscribers' telephones on said lines, means by which a calling subscriber automatically selects the first idle one of said telephone lines, including a connector having one movement to select groups and a second motion to automatically select the first idle line in the selected group, and means individual to said connector under the control of the called subscriber for supplying talking current to the calling subscriber's telephone line.

18. In a telephone system, the combination of a plurality of telephone lines running to the same substation, telephones on said lines, an automatic switch provided with means for extending connection to any one of said lines, automatic means for causing the operation of said switch to select the first idle

one of said lines, said switch having vertical motion to select groups and rotary motion to automatically select the first idle line in the selected group, a common battery, and relays allotted to said switch and controlling the flow of talking current from said battery to the called telephone line.

19. In a telephone system, the combination of a plurality of telephone lines running to the same substation, telephones on said lines, an automatic switch provided with means for extending connection from a calling telephone line to any one of said telephone lines, automatic means for operating said switch to select the first idle one of said lines, said switch having vertical motion to select groups and rotary motion to automatically select the first idle line in the selected group, a common battery, and relays allotted to said switch and controlling the flow of talking current from said battery to the calling telephone line.

20. In a telephone system, the combination of telephone lines, telephones on said lines, automatic means for trunking a calling line into connection with the line of a called subscriber, automatic means for causing the selection of the first idle one of a group of said telephone lines, including a rotary connector having straight motion to select groups and rotary motion to automatically select the first idle line in the selected group, and automatic means controlled by the subscriber of the idle telephone line for supplying talking current to the calling and called telephone lines.

21. In a telephone system, a source of talking current, an automatic switch, said switch having vertical motion to select groups and rotary motion to automatically select the first idle line in the selected group, and a back-bridge relay in said switch for controlling the supply of talking current to the calling subscriber's station when the called subscriber answers.

22. In a telephone system, a source of talking current, a combined automatic selector and connector switch, said switch having vertical motion to select groups and rotary motion to automatically select the first idle line in the selected group, and a back-bridge relay in said switch for controlling the supply of talking current to the calling subscriber's station when the called subscriber answers.

23. In a telephone system, the combination of calling subscriber's line, and of a plurality of called lines, automatic means for selecting and extending connection to said called lines, including a connector having one motion to select groups and a second motion to automatically select the first idle line in the selected group, means for signaling a called subscriber, a source of cur-

rent, means for connecting the source of current to the automatically selected called line, through said line-selecting means, means controlled by said called line for supplying current for talking purposes to said calling subscriber's line, and automatic means for releasing.

24. In a telephone system, and in combination with a common battery, an automatic common battery switch having a private relay and a private magnet, and provided with a rotary line relay for operating said private relay, for operating in turn the private magnet, a side switch, and an operating magnet, said private relay adapted to prevent the energizing of said operating magnet while said private magnet is energized, and while the side switch is in second position, said switch having one motion to select groups and a second motion to automatically select the first idle line in the selected group.

25. In a telephone system, an automatic switch provided with line conductors, said switch having vertical motion to select groups and rotary motion to automatically select the first idle line in the selected group, a battery, a ringer relay for use in signaling the called subscriber, means by which said ringer relay is adapted to switch one of said line conductors from one pole of said battery to the other, a plurality of lines, and means in said switch for automatically selecting an idle line.

26. In a telephone exchange system, the combination with a line switching device carrying one group of line terminals and a second group of line terminals any one of which will serve the purpose of the calling line, of a moving contact member for said switching device, automatic means for moving said member to any of said line terminals of said first group or the first terminal of said second group, and means actuated in case the first terminal of said second group is busy for stepping said member to a terminal of an idle line in said second group.

27. In a telephone exchange system, the combination with a telephone line extending from a substation to a central office, of a connecting circuit at the central office, a connection switch for uniting said connecting circuit with the telephone line, a line switching device carrying terminals for one set of lines in the exchange, a second set of lines any one of which will serve the purpose of the calling subscriber leading to terminals of said device, a contact arm for said mechanism adapted to move over said terminals to unite said connecting circuit with said terminals, automatically operated mechanism for advancing said arm over said terminals over said second set of ter-

minals until an idle line is reached, a busy signal, and means actuated in case all of said second set of lines are busy for applying said busy signal to said connecting circuit.

28. The combination with a telephone switching mechanism provided with transmission line terminals and two groups of testing line terminals, of substation lines having third conductors connected to one group of test terminals, and groups of lines with their third conductors connected to the other group of test terminals.

29. A telephone system comprising a plurality of lines, a telephone for each line, and means for connecting each telephone to its line, an automatic switch provided with means for automatically selecting an idle one of said lines to set up a talking circuit between two of said lines, the telephone of one line acting as a calling telephone and the telephone on the other line acting as a called telephone, and means in said switch responsive to the called telephone for controlling the supply of talking current to the calling telephone line, the circuit between the connected telephones being divided into only two inductively connected sections.

30. A telephone system comprising a calling substation, a called substation, a plurality of lines, an automatic switch provided with means for automatically selecting an idle one of said lines to set up a talking circuit between said substations, relays individual to said switch, means for supplying talking current through the winding of said relays to the calling substation, and another relay associated with said switch and responsive to the called subscriber for controlling the supply of talking current to the substation of the calling subscriber, the said talking circuit being divided into only two inductively connected sections.

31. The combination of lines, substations on said lines, a switch having provisions for automatic rotation to automatically select idle lines, a calling subscriber's substation, a called subscriber's substation, means for operating the said switch to set up a talking circuit between a calling and a called substation, and means individual to said switch and responsive to the called subscriber for controlling the supply of talking current to the substation of the calling subscriber, the said talking circuit being divided into only two inductively connected sections.

32. In a telephone system, a plurality of subscribers' lines divided into groups and sub-groups, and an automatic switch having one controlled movement to select a predetermined group, a second controlled movement to select a predetermined sub-group and a third automatic selecting movement to

connect with an idle line in a selected sub-group.

33. In a telephone system, a plurality of subscribers' lines divided into groups and sub-groups, an automatic switch having one movement to select groups, a second movement to select sub-groups and a third movement to connect with a line in a selected sub-group, and common battery means for supplying talking current to said lines.

34. In a telephone system, a plurality of subscribers' lines divided into groups and sub-groups, an automatic switch having one controlled movement to select a predetermined group, a second controlled movement to select a predetermined sub-group and a third automatic selecting movement to connect with an idle line in a selected sub-group, and common battery means for supplying talking current to said lines.

35. In a telephone system, the combination of a line, a switch associated with said line, a group of telephone lines and a terminal for each line in said switch, a test circuit for each line, means operated over the lines of said group for establishing a guarding potential to said test circuits for making lines in said group busy, automatic means for operating said switch to find the group of lines, and automatic means for causing the operation of said switch to select the first idle one of said lines, a common battery, and coils associated with said switch to control the flow of talking current from said battery to the called telephone line.

36. In a telephone system, the combination of a line, a switch associated with said line, a group of telephone lines, a substation for each line and a terminal for each line in said switch, means controlled from the substations for making lines in said group busy, automatic means for operating said switch to find the group of lines, and automatic means for causing the operation of said switch to select the first idle one of said lines, a common battery, and coils associated with said switch to control the flow of talking current from said battery to the called substation.

37. In a telephone system, a plurality of subscribers' lines, any one of which will serve the purpose of the calling subscriber, means controlled by one of said subscribers and including an automatic switch for automatically selecting an idle line for the calling subscriber, and means associated with said automatic switch for supplying talking current to a subscriber's station.

38. In a telephone system, a plurality of subscribers' lines, any one of which will serve the purpose of the calling subscriber, means controlled by a plurality of subscribers and including an automatic switch for automatically selecting an idle line for

the calling subscriber, and means associated with said automatic switch for supplying talking current to a subscriber's station.

39. In a telephone system, a line, a switch for said line, a group of lines terminating in said switch, a second group of lines terminating in said switch, means for operating said switch over the said first line to establish connection with any one of the lines in the first group exclusively as a result of a numerical operation of the switch, means for operating said switch over said first line for establishing connection with some one of the lines in the second group involving a non-numerical operation of the switch, the operation of said means controlled from lines in said second group.

40. In a telephone system, the combination of a plurality of telephone lines, subscribers' telephones on said lines, means by which a calling subscriber automatically selects the first idle one of said telephone lines including a switch having means responsive to the last digit in the number of the called line, said switch having one movement to select groups and another movement to automatically select the first idle line in the selected group, and means under the control of the called subscriber for supplying talking current to the called telephone line.

41. In a telephone system, a calling line, a switch associated with said line, one group of lines terminating in said switch, a second group of lines terminating in said switch, means responsive to numerical operations for establishing connection with any one of the lines in the first group, and automatic means responsive to non-numerical operations to establish connection with lines in the second group, said automatic means controlled from lines in the second group.

42. In a telephone system, a calling line, a switch associated with said line, one group of lines terminating in said switch, a second group of lines terminating in said switch, operable moving switching equipment individual to each of said lines, means responsive to numerical operations for establishing connection with any one of the lines in the first group, and automatic means responsive to non-numerical operations to establish connection with lines in the second group, said automatic means controlled by said operable moving switching equipment.

43. In a telephone system, a group of lines, a second group of lines, a switch having terminals for said lines, switching means individual to said lines, numerical automatic operating means for finding either group and for finding a line in the first group after the first group is found, and non-numerical means for finding a line in the second group after the second group is found, said non-numerical means controlled from

the said last line by said switching means to select another line, a common battery, and means associated with said switch for controlling the flow of current for talking
5 from said battery to said other line.

44. In a telephone system, a group of lines, a second group of lines, a switch having terminals for said lines, numerical automatic operating means for finding either
10 group and for finding a line in the first group after the first group is found and non-numerical means for finding a line in the second group after the second group is found, movable switching means individual to the
15 lines of the said second group for making said lines busy, said automatic non-numerical means controlled from said movable switching means for operating said switch to select the first idle one of said lines of
20 the second group, a common battery, and means associated with said switch for controlling the flow of current for talking from said battery to said line when found.

45. In a telephone system, a group of
25 lines, a second group of lines, a switch having terminals for said lines, numerical automatic operating means for finding either group and for finding a line in the first group after the first group is found and
30 non-numerical means for finding a line in the second group after the second group is found, means operated over the lines of said second group for making lines in said group busy, said non-numerical means controlled
35 by said line operated means for operating the said switch to select the first idle one of said lines in the said second group, a common battery, and means associated with said switch for controlling the flow of current
40 for talking from said battery to the called telephone line.

46. In a telephone system, a group of lines, a second group of lines, a switch having terminals for said lines, numerical automatic operating means for finding either
45 group and for finding a line in the first group after the first group is found, and non-numerical means for finding a line in the second group after the second group is
50 found, a telephone for each of said lines, and means controlled from the telephone for making lines in said second group busy, said automatic non-numerical means controlled from said busy making means for
55 operating said switch to select the first idle one of said lines, a common battery, and means associated with said switch for controlling the flow of current for talking from said battery to the called telephone line.

60 47. In a telephone system, a plurality of lines, automatic means for selecting the first idle line including a switch having means responsive to the last digit in the number of the called line, having one motion to select

groups and another motion to automatically
65 select the first idle line in the selected group, a common battery, and automatic means for closing connection to supply talking current to a subscriber's station.

48. In a telephone system, the combina-
70 tion of a plurality of lines, automatic means for selecting and extending connection to idle lines including a switch having means responsive to the last digit in the number of the called line, said switch having one mo-
75 tion to select groups and another motion to automatically select the first idle line in the selected group, and means for signaling a called subscriber, a source of current, means for connecting the source of current
80 to the automatic selected line, and automatic means for releasing.

49. In a telephone system, a plurality of lines any one of which will serve the purpose of a calling subscriber, means including
85 an automatic switch having equipment responsive to the last digit in the number of the called line for automatically selecting an idle line for the calling subscriber, said switch having one motion to select groups
90 and another motion to automatically select the first idle line in the selected group, and means for automatically supplying talking current to a subscriber's station.

50. In a telephone system, a common bat-
95 tery automatic switch having means responsive to the last digit in the number of the called line and having provisions for selecting the first idle one of a number of lines common to a single subscriber, and
100 means for feeding talking current to any called line thus automatically selected.

51. In a telephone system, an automatic switch, automatic means for trunking a
105 calling subscriber into connection with said automatic switch, said switch having means responsive to the last digit in the number of the called line and having provisions for automatically selecting the first idle one of
110 a number of lines common to a single subscriber in combination with means for supplying talking current to any called line thus automatically selected.

52. A telephone system comprising a calling substation, a called substation, a plurality
115 of lines, an automatic switch having means responsive to the last digit in the number of the called station and provided with means for automatically selecting an idle one of said lines, relays, means for supply-
120 ing talking current through the windings of said relays to the calling substation and another relay responsive to the called subscriber for controlling the supply of talking current to the substation of the calling sub-
125 scriber.

53. The combination of lines, a switch having provisions for operating in accord-

ance with the last digit in the number of a called subscriber's station and having provisions for automatically rotating to select idle lines, a calling subscriber's substation, a called subscriber's substation, and means responsive to the called subscriber for controlling the supply of talking current to the substation of the calling subscriber.

54. In a telephone system, the combination of a plurality of lines, automatic means for selecting and extending connection to idle lines, said means responsive to the last digit in the number of a called line, means for signaling a called line, a source of current, means associated with the line selecting means for connecting the source of current to the automatically selected line, and automatic means for releasing.

55. In a telephone system, a line, a progressively movable switch for said line, terminals for said switch, a station, lines extending from said station and terminating in said terminals, any one of which lines will serve the purpose of the first line for extending a connection to said station, a telephone individual to each line, a signal for each line, means in said switch for automatically selecting an idle one of said lines and for then operating the signal thereof, a switch for the called line for connecting the telephone thereof with the line in response to said signal, and a central battery for supplying current for talking purposes to the first line and to the called line.

56. In a telephone system, a line, a progressively movable switch for said line, terminals for said switch, a station, lines extending from said station and terminating in said terminals, any one of which will serve the purpose of the first line for extending a connection to said station, a telephone individual to each line, a signal for each line, means in said switch for automatically selecting an idle one of said lines and for then operating the signal thereof, a switch for the called line for connecting the telephone thereof with the line in response to said signal, a central battery for supplying current for talking purposes to the first line and to the called line, and means for controlling the supply of said current to said first line, said means controlled over the called line.

57. In a telephone system, a line, a progressively movable switch for said line, terminals for said switch, a station, lines extending from said station and terminating in said terminals, any one of which will serve the purpose of the first line for extending a connection to said station, a telephone individual to each line, a signal for each line, means in said switch for automatically selecting an idle one of said lines and for then operating the signal thereof, a

switch for the called line for connecting the telephone thereof with the line in response to said signal, a central battery for supplying current for talking purposes to the first line and to the called line, and a relay for controlling the supply of said current to said first line, said relay controlled over the called line.

58. In a telephone system, a line, a progressively movable switch for said line, terminals for said switch, a station, lines extending from said station and terminating in said terminals, any one of which will serve the purpose of the first line for extending a connection to said station, a telephone individual to each line, a signal for each line, means in said switch for automatically selecting an idle one of said lines and for then operating the signal thereof, a switch for the called line for connecting the telephone thereof with the line in response to said signal, a central battery, and means individual to each progressively movable switch for applying said battery to the first line for talking purposes.

59. In a telephone system, a line, a progressively movable switch for said line, terminals for said switch, a station, lines extending from said station and terminating in said terminals, any one of which will serve the purpose of the first line for extending a connection to said station, a telephone individual to each line, a signal for each line, means in said switch for automatically selecting an idle one of said lines and for then operating the signal thereof, a switch for the called line for connecting the telephone thereof with the line in response to said signal, a central battery, and means individual to each progressively movable switch for applying said battery to the first line for talking purposes, said means controlled over the called line.

60. In a telephone system, a line, a line switch for said line, a plurality of progressively movable switches, means for operating said line switch to connect said line with any one of said switches, line terminals for one of said switches and multiples thereof in the other switches, a station, other lines extending from said station and terminating in said terminals, any one of which switches and any one of which other lines will serve the purpose of the said first line for extending a connection to said station, a telephone individual to each line, a signal for each line, means in all of said progressively movable switches whereby any one of said switches may be operated to automatically select an idle one of said lines after the first line has been connected to one of said switches and for then operating the signal of the selected line, an auxiliary switch for the called line for connecting the telephone thereof with

the line in response to said signal, and a central battery for supplying current for talking purposes to the first line and to the called line.

5 61. In a telephone system, a line, a line switch for said line, a plurality of progressively movable switches, means for operating said line switch to connect said line with
10 one of said switches, line terminals for one of said switches and multiples thereof in the other switches, a station, other lines extending from said station and terminating in said terminals, any one of which switches and any one of which other lines will serve
15 the purpose of the said first line for extending a connection to said station, a telephone individual to each line, a signal for each line, means in all of said progressively movable switches whereby any one of said
20 switches may be operated to automatically select an idle one of said lines after the first line has been connected to one of said switches and for then operating the signal of the selected line, an auxiliary switch for the
25 called line for connecting the telephone thereof with the line in response to said signal, a central battery for supplying current for talking purposes to the first line and to the called line, and means for controlling
30 the supply of said current to said first line, said means controlled over the called line.

62. In a telephone system, a line, a line switch for said line, a plurality of progressively movable switches, means for operating
35 said line switch to connect said line with any one of said switches, line terminals for one of said switches and multiples thereof in the other switches, a station, other lines extending from said station and terminating in said
40 terminals, any one of which switches and any one of which other lines will serve the purpose of the said first line for extending a connection to said station, a telephone individual to each line, a signal for each line,
45 means in all of said progressively movable switches whereby any one of said switches may be operated to automatically select an idle one of said lines after the first line has been connected to one of said switches and
50 for then operating the signal of the selected line, an auxiliary switch for the called line for connecting the telephone thereof with the line in response to said signal, a central battery for supplying current for talking
55 purposes to the first line and to the called line, a relay for controlling the supply of said current to said first line, said relay controlled over the called line.

63. In a telephone system, a line, a numerical line switch for said line, a plurality of progressively movable switches associated with said first switch, means for operating said first switch in response to a numerical impulse to connect said line with any one

of said progressively movable switches, line 65 terminals for one of said progressively movable switches and multiples thereof in the other progressively movable switches, a station, other lines extending from said station and terminating in said terminals, any one 70 of which switches and any one of which other lines will serve the purpose of the said first line for extending a connection to said station, a telephone individual to each line, a signal for each line, means in all of said 75 progressively movable switches whereby any one of said switches may be operated to automatically select an idle one of said lines after the first line has been connected to one of said switches and for then operating the signal 80 of the selected line, an auxiliary switch for the called line for connecting the telephone thereof with the line in response to said signal, and a central battery for supplying current for talking purposes to the 85 first line and to the called line.

64. In a telephone system, a line, an automatic switch for said line, terminals for said switch divided into groups, said switch having motion to select groups of terminals 90 and a second motion for finding a terminal in a selected group, a station, lines extending from said station and terminating in said terminals, any one of which will serve the purpose of the first line for extending a 95 connection to said station, a telephone individual to each line, a signal for each line, means in said switch for automatically selecting an idle one of said lines and for then operating the signal thereof, a switch for 100 the called line for connecting the telephone thereof with the line in response to said signal, and a central battery for supplying current for talking purposes to the first line and to the called line. 105

65. In a telephone system, a line, a line switch for said line, a plurality of automatic switches, means for operating the said line switch to connect said line with any one of said switches, line terminals for one of said 110 switches divided into groups and multiples thereof in the other of said switches, said switches having motion to select groups of terminals and a second motion to find a terminal in the selected group, a station, 115 other lines extending from said station and terminating in said terminals, any one of which switches and any one of which other lines will serve the purpose of the said first line for extending a connection to said station, a telephone individual to each line, a signal for each line, means in all of said switches whereby any one of said switches may be operated to automatically select an 120 idle one of said lines after the first line has been connected to one of said switches and for then operating the signal of the selected line, an auxiliary switch for the called line 125

for connecting the telephone thereof with the line in response to said signal, and a central battery for supplying current for talking purposes to the first line and to the called line.

66. In a telephone system, a line, a numerical line switch for said line, a plurality of automatic switches associated with said line switch, means for operating said line switch in response to a numerical impulse to connect said line with any one of said automatic switches, line terminals for one of said automatic switches divided into groups and multiples thereof in the other automatic switches, said switches having motion to select groups of terminals and a second motion to find a terminal in the selected group, a station, other lines extending from said station and terminating in said terminals, any one of which switches and any one of which other lines will serve the purpose of the said first line for extending a connection to said station, a telephone individual to each line, a signal for each line, means in all of said switches whereby any one of said switches may be operated to automatically select an idle one of said lines after the first line has been connected to one of said switches and for then operating the signal of the selected line, an auxiliary switch for the called line for connecting the telephone thereof with the line in response to said signal, and a central battery for supplying current for talking purposes to the first line and to the called line.

67. In a telephone system, a telephone station, a central office, a line connecting the station and the office, a progressively movable switch at the central office for extending a connection from said line, a motor magnet for imparting motion to said switch, a circuit including said magnet, a relay, contacts individual to said relay, said circuit including said contacts, a circuit for the relay including the line, a circuit controller for said line for sending an impulse over the line for energizing said relay whereby said relay in turn may energize the motor magnet to advance the switch while the relay is energized, a plurality of other lines, a telephone individual to each other line, means for operatively associating each telephone with its line, a terminal for each line at said progressively movable switch, means in said progressively movable switch whereby the motion of said switch may be initiated by an impulse over said first line, means in said progressively movable switch and associated with said terminals for causing the motion to persist until the switch passes over several of said terminals while the circuit controller of the first line is not changing the condition of the line circuit, means in said switch for connecting the first line

and any one of said other lines when the motion ceases to establish a talking circuit between the two, a central source of battery for supplying current to the line for talking purposes, a signal on the line to which connection is extended, a source of signaling current, and means for transmitting said current to said signal through said progressively movable switch.

68. In a telephone system, a station, a central office, a line connecting the office and the station, a progressively movable switch at the office for extending a connection from said line, a motor magnet for the switch, a circuit for the magnet, a relay for controlling the motor magnet circuit, a circuit for the relay including the line, a circuit controller for said line for sending an impulse over the line for energizing said relay to close the motor magnet circuit, a plurality of other lines, a telephone individual to each other line, means for operatively associating each telephone with its line, a terminal for each line at said progressively movable switch, means in said progressively movable switch whereby the motion of said switch may be initiated by an impulse over said first line, means in said progressively movable switch and associated with said terminal for causing the motion to persist until the switch passes over several of said terminals while the circuit controller of the first line is not changing the condition of the line circuit, means in said switch for connecting the first line and any one of said other lines when the motion ceases to establish a talking circuit between the two, a central source of battery for supplying current to the line for talking purposes, a signal on the line to which connection is extended, a source of signaling current, and means for transmitting said current to said signal through the said progressively movable switch.

69. In a telephone system, the combination of a plurality of lines, a telephone receiver for each line, a switch, automatic means for causing the operation of said switch to select any idle one of said lines, means individual to each line for operatively associating each receiver with its line, a common battery, a relay allotted to said switch and controlling the flow of talking current from said battery to the selected line, and means for effecting said current to effect said receiver for talking.

70. In a telephone system, a line, a telephone for talking over said line, a switch, a group of lines, a test circuit for each line of the group, a relay for said switch, means for moving the switch, said means controlled by said relay and controlled by said test circuits to continue the movement of the switch until an idle line in the group is found

whereby a connection may be extended from the first line to the idle line, and means for supplying current for talking purposes to said telephone through the winding of said relay while the connection is maintained, said means for moving the switch comprising a motor magnet, a circuit for said motor magnet and contacts in said circuit individual to said relay whereby the relay armature controls the motor magnet circuit.

71. In a telephone system, a line, a telephone for talking over said line, a switch, lines divided into groups, a relay for said switch, means for moving said switch, said means controlled by said relay for electing a group of said lines and controlled by said lines whereby a connection may be extended from the first line to any line in the elected group, and means for supplying current for talking purposes to said telephone through the winding of said relay while the connection is maintained, said means for moving the switch comprising a motor magnet, a circuit for said motor magnet and contacts in said circuit individual to said relay whereby the relay armature controls the motor magnet circuit.

72. In a telephone system, a line, a telephone for talking over said line, a switch, lines divided into groups, a relay for said switch, means for moving said switch; said means controlled by said relay for electing a group of said lines and for initiating a line selecting operation in the elected group, said means also controlled by said lines whereby a connection may be extended from the first line to any line in the elected group, and means for supplying current for talking purposes to said telephone through the winding of said relay while the connection is maintained, said means for moving the switch comprising a motor magnet, a circuit for said motor magnet and contacts in said circuit individual to said relay whereby the

relay armature controls the motor magnet circuit.

73. A telephone system comprising a plurality of telephone lines running to the same substation, telephones on said lines, an automatic switch provided with means for extending connection to any one of said lines, automatic means for causing the operation of said switch to select the first idle one of said lines, a common battery, and a relay allotted to said switch and controlling the flow of talking current from said battery to the calling telephone line.

74. In a telephone system, a plurality of lines, fixed terminals of said lines arranged in groups and sub-groups, an automatic switch provided with a movable terminal co-operating with said fixed terminals, directly controlled means for causing successive operations of said movable terminal to select a group and sub-group of fixed terminals, and automatic means for then operating the said movable terminal to select an idle fixed terminal in the selected sub-group.

75. In a telephone system, a plurality of groups of lines, fixed terminals of said lines arranged in a single horizontal group, an automatic switch having a movable terminal co-operating with said fixed terminals, means for operating said switch to cause the movable terminal thereof to pass by all the fixed terminals corresponding to one of said groups of lines, and means for then automatically operating said switch to cause the said movable terminal to select a fixed terminal corresponding to an idle line in another one of said groups of lines.

Signed by me at Chicago, Cook county, Illinois, this 21st day of March, 1907.

TALBOT G. MARTIN.

Witnesses:

EDWARD D. FALES,
ARTHUR B. SPERRY.

Copies of this patent may be obtained for five cents each, by addressing the "Commissioner of Patents, Washington, D. C."