

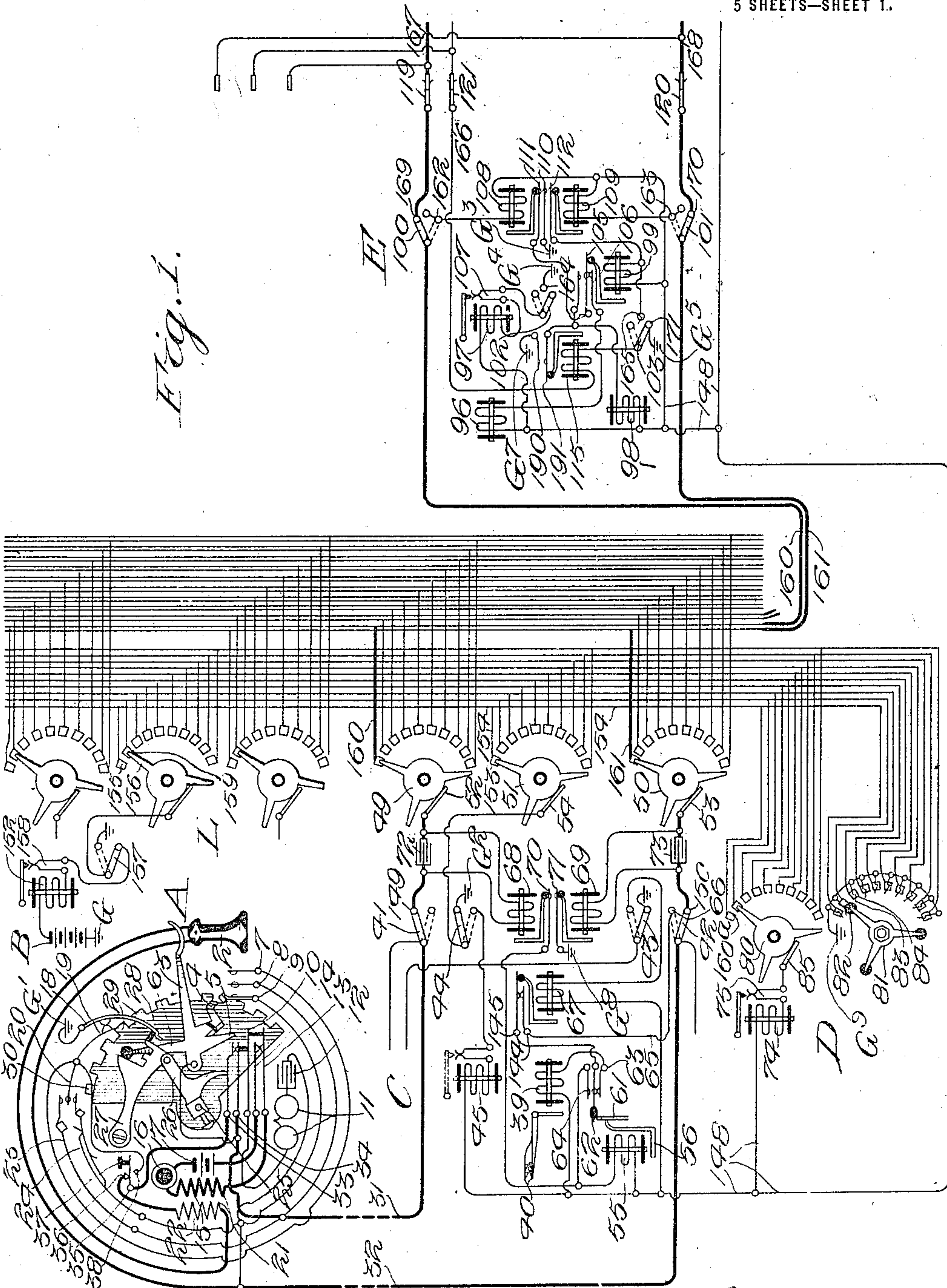
E. D. FALES.
TELEPHONE SYSTEM.
APPLICATION FILED MAY 7, 1907.

1,201,569.

Patented Oct. 17, 1916.

5 SHEETS—SHEET 1.

Fig. 1.



Witnesses.

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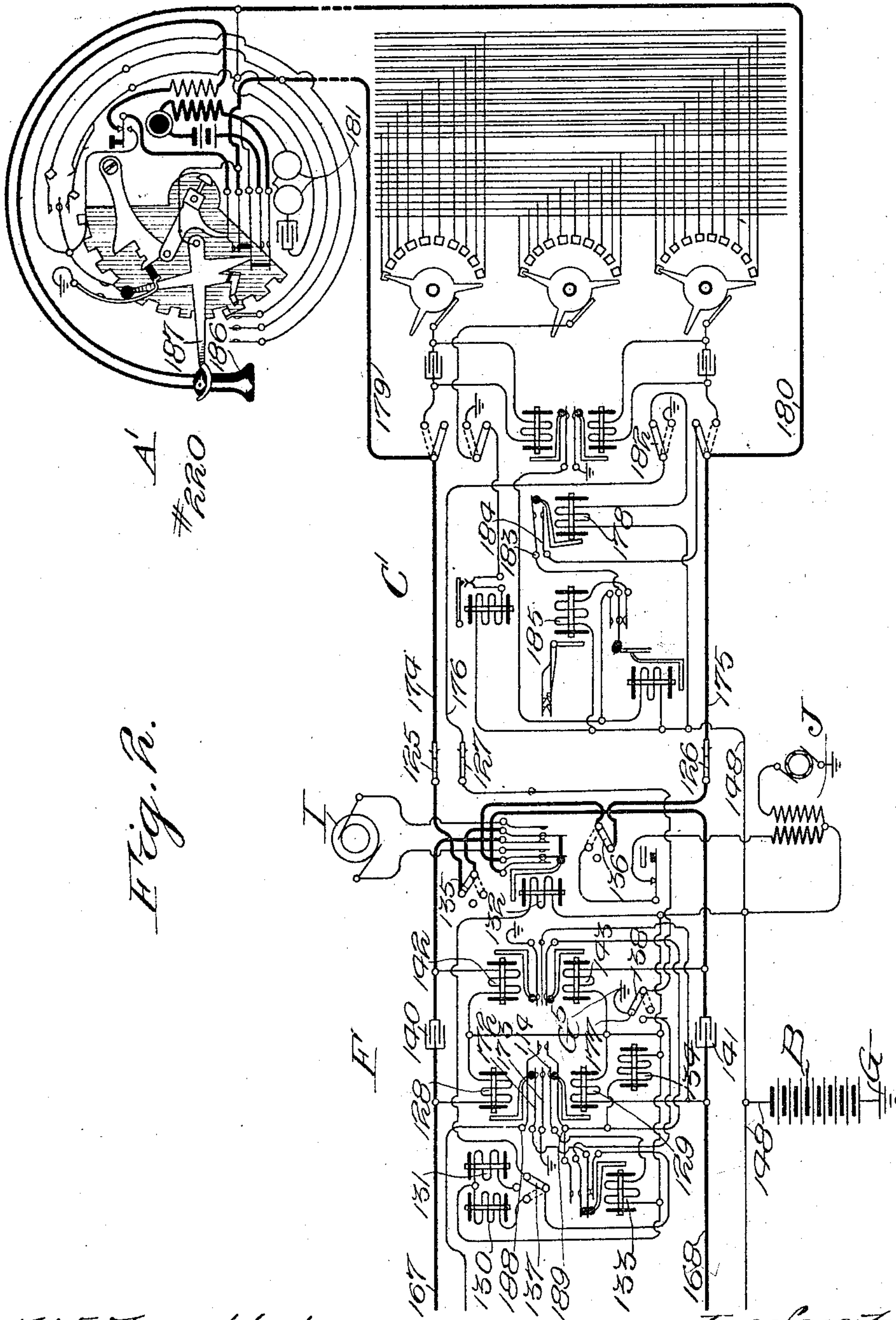
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5 SHEETS—SHEET 2.



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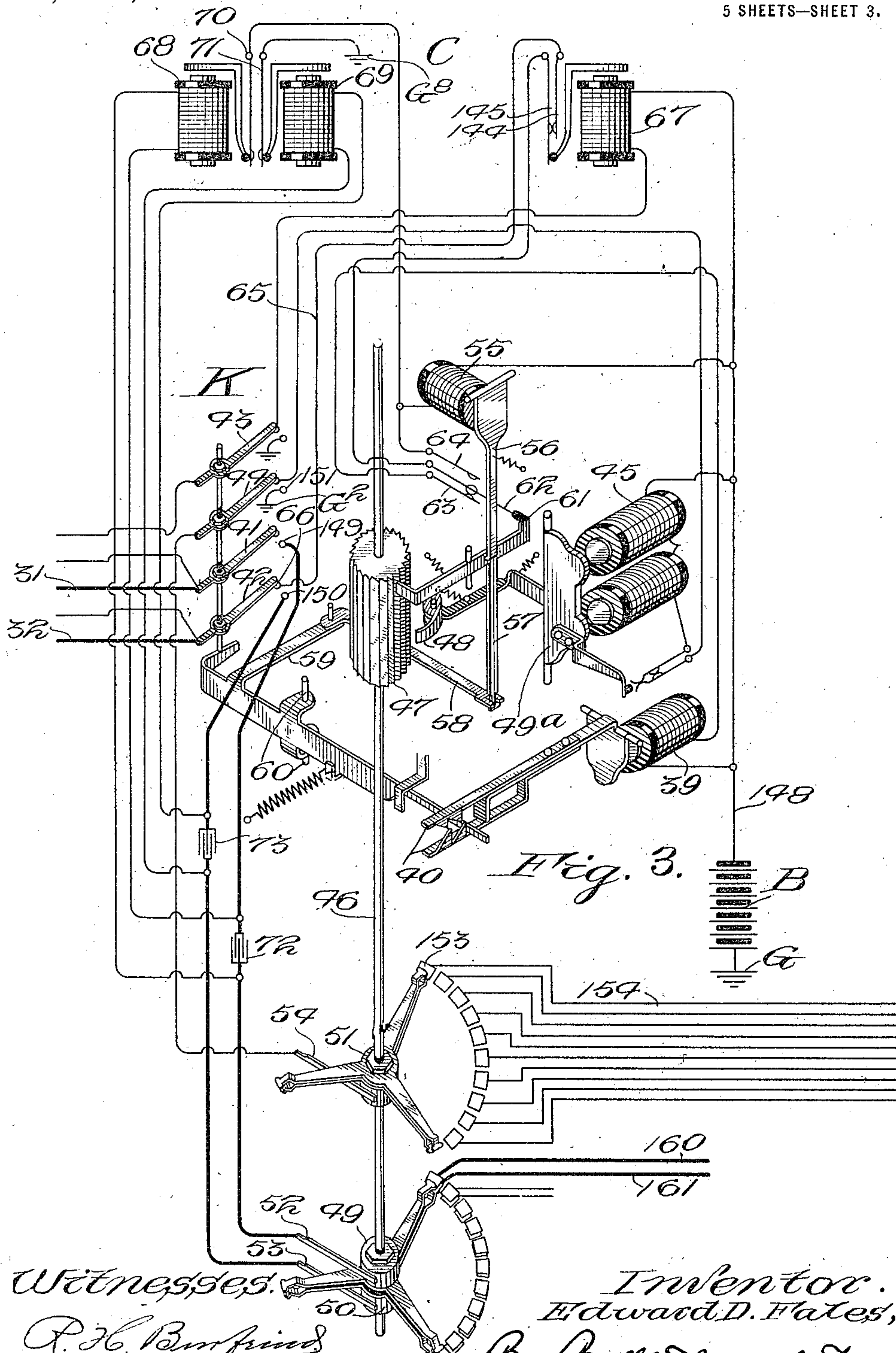
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5 SHEETS—SHEET 3.



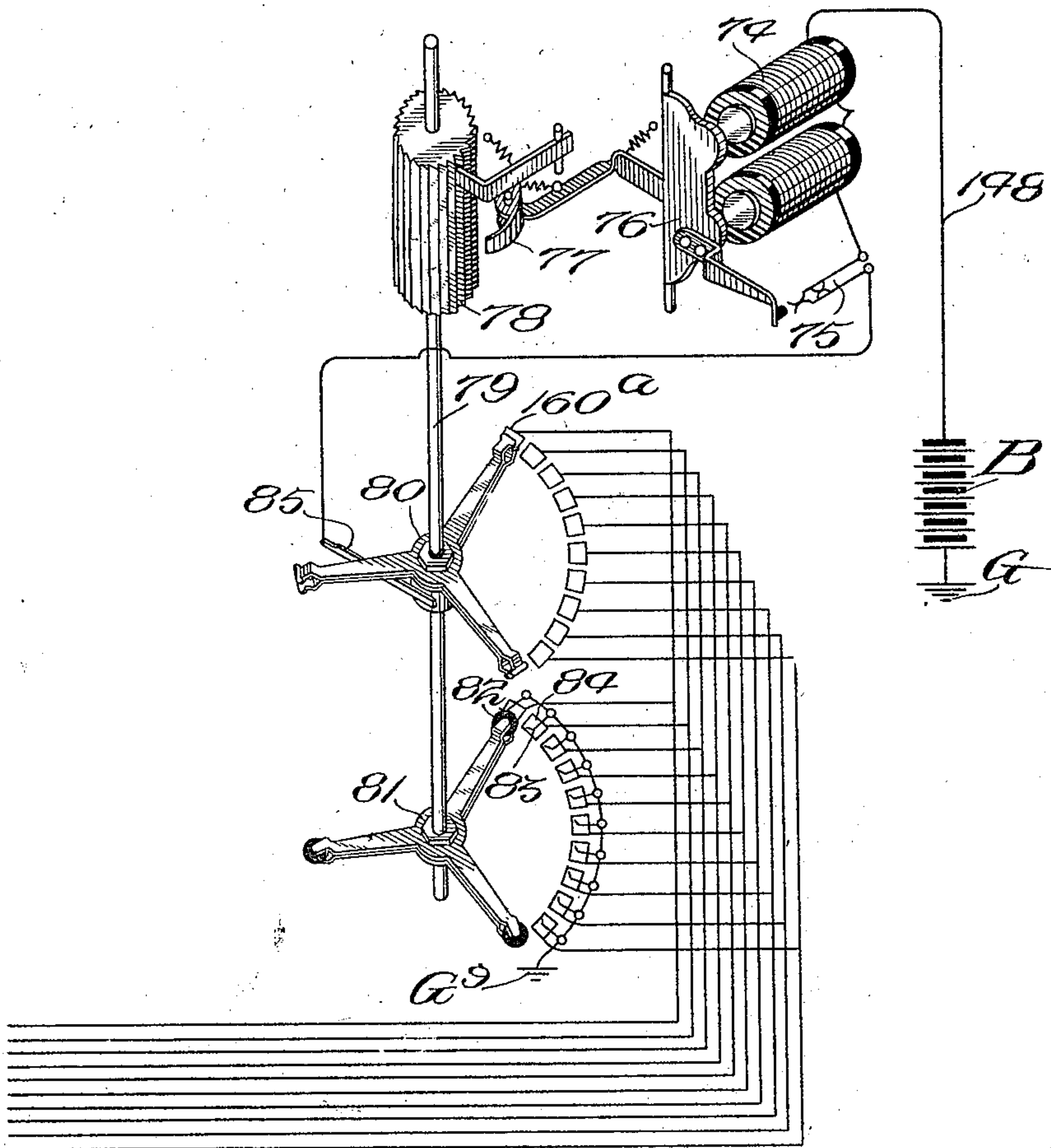
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5 SHEETS—SHEET 4.

Fig. 4. D



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Fig. 5.

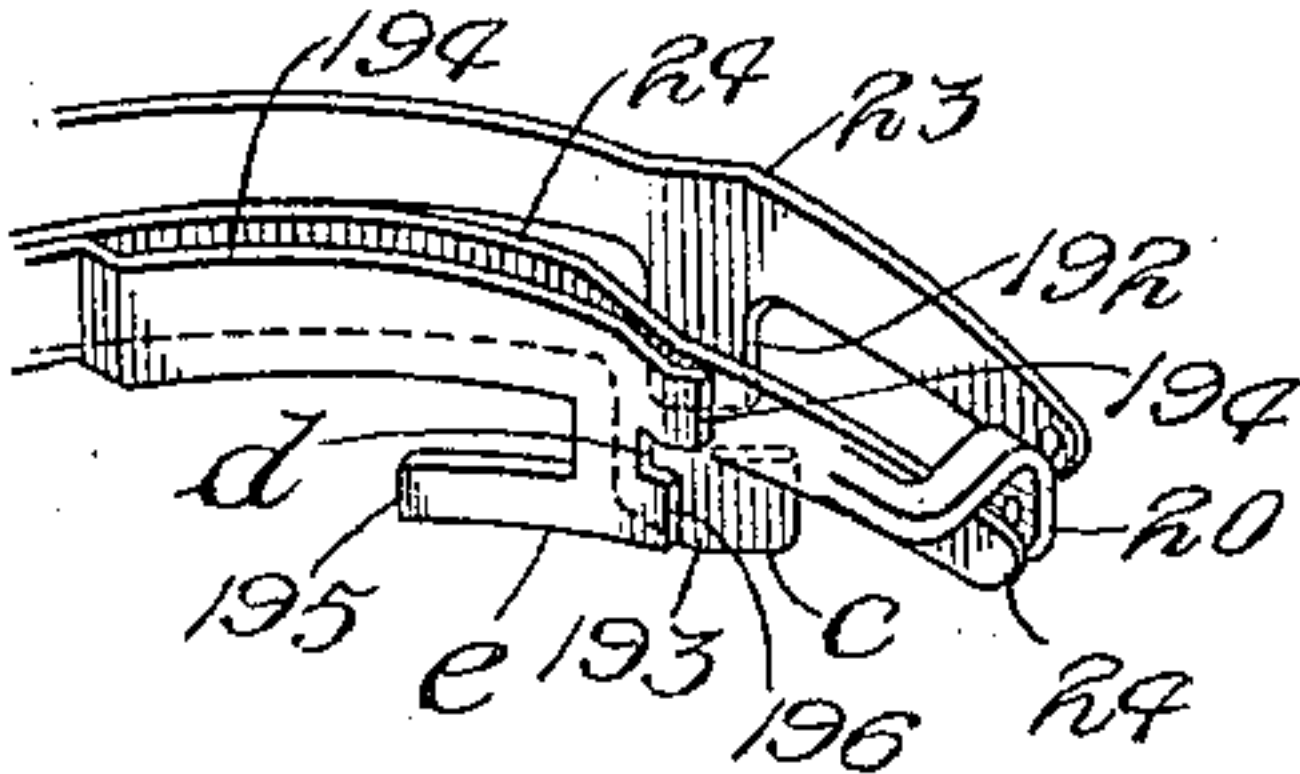


Fig. 6.

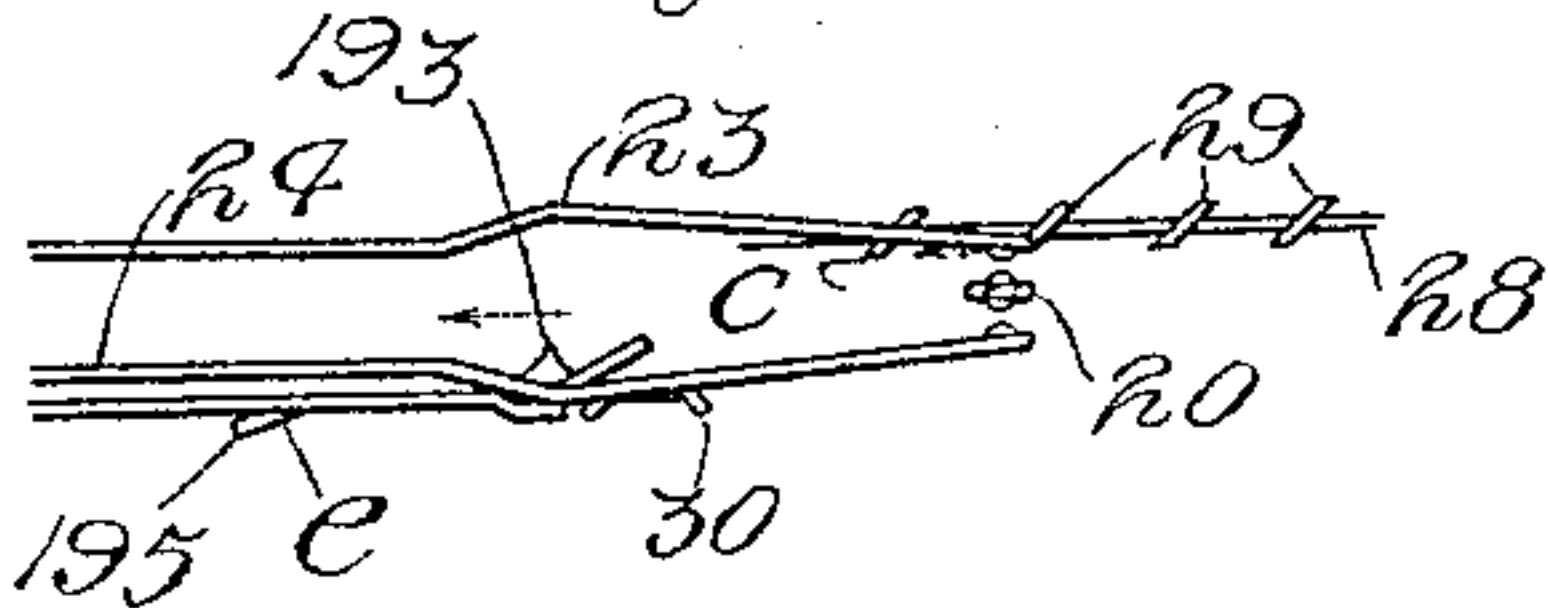
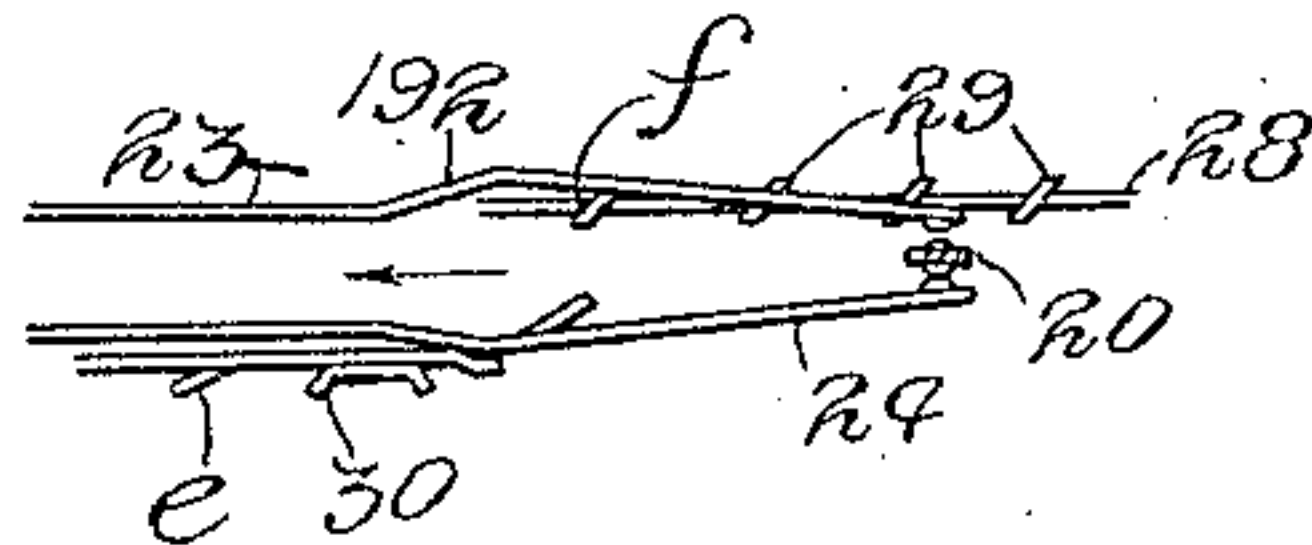


Fig. 7.



UNITED STATES PATENT OFFICE.

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TELEPHONE SYSTEM.

1,201,569.

Specification of Letters Patent.

Patented Oct. 17, 1916.

Application filed May 7, 1907. Serial No. 372,383.

To all whom it may concern:

Be it known that I, EDWARD D. FALES, 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 Systems, of which the following is a specification.

My invention relates to telephone systems in which provision is made for automatically extending either all or a portion of the connection from the calling subscriber's line to the called subscriber's line.

Generally stated the object of my invention is to provide an improved and highly efficient telephone exchange system in which provision is made for automatically selecting trunks or trunk lines or other suitable connections.

Special objects of my invention are the provision of means by which a step-by-step-operated line wiper may normally rest upon the terminal of an idle trunk or line, and whereby the use of this line wiper for talking purposes automatically advances all idle associated line wipers into connection with another idle trunk or line, all idle line wipers being thus normally connected in multiple with an idle trunk or line, which idle trunk or line is preferably the one next in order after the one last put in use; the provision of an improved arrangement by which a group of subscribers' lines may be provided with movable line wipers or terminals, and by which all of said line wipers or terminals may normally be connected in multiple to an idle trunk or line, whereby the use of any subscriber's line for talking purposes does not necessitate the removal of the calling subscriber's line wiper or terminal from the trunk or line terminal upon which it was normally resting before the subscriber called; the provision of a group of step-by-step switches having movable line wipers or terminals which are all normally connected in multiple to an idle trunk or line, and a master switch provided with means for normally maintaining a guarding potential for all of said trunks or lines except the one normally engaged by the wipers or terminals of the said switches; and the provision of certain details and features of improvement and combinations tending to increase the

general efficiency and serviceability of a telephone exchange system of this particular character.

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

In the accompanying drawings Figure 1 represents diagrammatically a subscriber's substation A and its allotted line switch C. A group-switch D, allotted to the group of which switch C is a member, provides the means whereby all of the idle line switches are normally maintained in engagement with an idle trunk line. At E is shown diagrammatically a first-selector switch. Fig. 2 represents diagrammatically a connector switch F, and a line switch C' allotted to the line of substation A', which latter is the called substation. A ringer generator is shown at I, and at J is indicated a busy-signaling machine. Fig. 3 is a diagrammatic perspective view of one of my improved line or subscribers' individual switches. Fig. 4 is a diagrammatic perspective view of the said group-switch. Figs. 5, 6, 7, 8, 9, 10 and 11 are detail views of the substation impulse springs, showing the various positions of the same.

The substations may be of any suitable or approved type. Those in connection with which I have elected to illustrate my invention comprise a receiver 2, a switch-hook 3 for controlling the substation circuits, which controlling operations are accomplished through the medium of any suitable means, such as the cam-arms 4, 5 and 6, as indicated. As the switch-hook is lowered the cam-arm 4 momentarily presses the release springs 7, 8 and 9 into engagement, whereby the substation line conductors may be grounded simultaneously. When the switch-hook is down the cam-arm 5 engages the spring 10, thereby bridging the ringer 11 in series with the condenser 12 across the line. Furthermore, when the switch-hook is down the said cam-arm 5 disengages the springs 13 and 14, thus breaking the local circuit which includes in series the primary winding 15, transmitter 16 and local battery 17, as illustrated. The substation ground circuit is normally broken between the ground springs 18 and 19 by the cam-

arm 6; but when said springs are together, ground is then provided to the ground post 20, and to the release spring 7, as is usually the case in telephones of this type. The said
 5 substation comprises the usual induction-coil 21 having the primary winding 15 and the secondary winding 22, as shown. Being an automatic substation, it is provided with the usual vertical and rotary impulse springs
 10 23 and 24, for the purpose described. The vertical impulse spring 23 is provided with an oblique projection or lug 192 on its under side, with which the vertical impulse teeth 29 are adapted to engage for driving
 15 the spring 23 intermittently onto the ground post 20 (Fig. 5) to ground the line. The rotary impulse spring 24 is provided with somewhat similar mechanism for driving the said rotary spring 24 onto the ground
 20 post once when the dial is rotated in one direction, and once when the dial is rotated in the opposite direction. The said rotary impulse spring 24 has on its under side a V-shaped member 193 having two sides *c*
 25 and *d*, and there is, in addition, an auxiliary spring 194 which works in conjunction with said V-shaped member. As shown more clearly in Fig. 5, the auxiliary spring 194 is provided with a lower curved part *e* hav-
 30 ing the rear section 195 curving outwardly, as shown also in Figs. 5 to 10, inclusive. The front section 196 of said member *e* is designed to fall just below the apex of the V-shaped member 193, so that the rotary
 35 impulse tooth 30, when moved in the direction of the arrow (Fig. 6), will pass onto the curved member *e*, thus pressing the rotary impulse spring 24 onto the ground post 20 for a comparatively long time (see Fig.
 40 7), and sending to the line a comparatively long ground impulse. As the impulse wheel advances, the vertical impulse teeth 29 approach the lug 192 of the vertical impulse spring 23 (Fig. 7), and eventually the first
 45 tooth *f* that meets the lug 192 clears the said lug, as shown in Fig. 8, but not until after the rotary impulse tooth 30 clears the curved member *e* in the manner illustrated. As the impulse wheel continues to advance in the
 50 direction of the arrow (Fig. 8), the next impulse tooth will clear the projection 192, as shown in Fig. 9. Then when the impulse wheel is released the vertical impulse spring 23 is twice carried into engagement with
 55 the ground post 20, in the manner indicated in Fig. 10; but as the impulse wheel nears its normal position the rotary impulse tooth 30 passes under the curved member *e* of the auxiliary spring 194 (Fig. 11), engaging the
 60 V-shaped member 193 directly and for a short time only, and sending to the line the ordinary impulse through the medium of the rotary impulse spring 24, after which the said member 193 is cleared or disen-
 65 gaged as the impulse wheel reaches its nor-

mal position, as shown in Fig. 6. The operations as thus described are repeated each time that the dial is operated, and the number of impulses provided through the medium of the vertical impulse spring 23 are
 70 accurately and definitely determined at each operation of the dial by the finger-hole which the subscriber selects on the dial. It should be stated that the well-known stop is, of course, provided to always limit the
 75 rotation of the dial, which stop indicates to the subscriber when to release the dial. The dial is not shown, but is secured to the shaft 25, together with the locking dog 26, as illustrated. Furthermore, there is a locking
 80 cam 27 that locks the dog 26 while the receiver is on the switch-hook, to prevent a rotation of the dial. It should be noted that the vertical impulse teeth 29 and the rotary impulse tooth 30 are carried on the periph-
 85 ery of the so-called impulse wheel 28, said wheel being rigidly secured to the shaft 25 in the well-known manner. With the equipment thus described the subscriber's vertical line conductor 31 may first be given a num-
 90 ber of ground impulses, and then the rotary line conductor 32 is given one ground impulse. It will be noticed that as long as the dial is out of normal position the construction is such that the dog 26 permits the pri-
 95 mary circuit springs 33 and 34 to separate, thus preventing the impulses that are delivered to either line conductor from passing to the other.

The means whereby the subscriber may signal the called subscriber comprises the
 100 push-button spring 35 which normally engages the contact point 36; but when the button 37 is pressed the spring 35 engages the contact point 38, whereby the vertical
 105 line conductor 31 may be grounded.

As shown in Fig. 3, the line switch C comprises the private magnet 39 which, through the medium of the escapement springs 40, permits the side switch K to pass from first
 110 to second position. The side switch K comprises the side switch wipers 41, 42, 43 and 44 which may be termed the vertical, rotary and private side switch wipers, and the rotary magnet side switch wiper, respectively.
 115 The operation of the private magnet 39 and the side switch K is similar to the operation of the private magnet and side switch of the selector switch disclosed in United States Letters Patent No. 815,321, granted March
 120 13, 1906, to Keith, Erickson and Erickson. The rotary magnet 45, when energized, operates to carry the shaft 46 in a rotary or circular direction. The shaft 46 is provided with the hub 47 which has longitudinal teeth
 125 around its circumference. These teeth are adapted to be engaged by the pawl 48 upon the end of the armature 49^a to rotate the shaft. The wipers 49, 50 and 51 mounted upon the lower end of the shaft 46 may be
 130

designated as the vertical, rotary and private shaft wipers, respectively, and are adapted to have sliding electrical contact with the brushes 52, 53 and 54, respectively. Furthermore, the wipers 49, 50 and 51 have their arms arranged at an angle of about one hundred and twenty degrees, so that whenever one arm engages the first contact, as shown, a second arm has just passed out of engagement with the tenth contact (Fig. 3) and is in the position where the eleventh contact would be found. The release magnet 55 is provided for restoring the side switch K to normal position. When the magnet 55 energizes, the armature 56 is attracted, whereby the member 57 is pressed to the left. This member 57 in turn presses the link 58, which engages the arm 59, thus rotating the side switch K about the pivot points 60, restoring the side switch from second to first position. When the member 57 is operated the tip 61 carries the spring 62 out of engagement with the spring 63 and into engagement with the spring 64. By this operation of the spring 62 the conductor 65, leading from the contact point 66 of the side switch wiper 42, is shifted from connection with the private magnet 39 to connection with the release magnet 55. The cut-off relay 67 is provided for disconnecting the private magnet 39 from the subscriber's rotary line conductor when a connector calls in on the line. The relays 68 and 69 are so arranged that when both are energized simultaneously the springs 70 and 71 are pressed into contact, thereby closing an energizing circuit through the release magnet 55, for the purpose explained. It will be seen that across the terminals of the relays 68 and 69 are bridged the condensers 72 and 73, respectively.

The group-switch D (Fig. 4) comprises a rotary magnet 74, with the usual interrupter springs 75; and when the magnet 74 is energized the armature 76 is attracted, whereby the pawl 77 is carried into engagement with the hub 78, whereby the shaft 79 is rotated. Upon the shaft are mounted the wipers 80 and 81 which are adapted to engage their respective banks. Upon the ends of the wiper 81 are carried insulating bushings 82 which, as the wiper passes over the bank, carries the ground spring 83 out of contact with its associated segment 84, as shown. The operating magnet 74 is maintained in electrical connection with the wiper 80 by means of the brush 85, as illustrated.

The first-selector switch E (Fig. 1) is the same as the selector switch disclosed in said selector patent, with the exception that there are no normal conductors. There is also, of course, no necessity in the selector switch E for a bridge-cut-off relay, and it is also omitted, and the line relays 108 and 109 are connected directly to the battery

lead. The private normal conductor is of no use in connection with the selector switch E, and is also omitted. Since like parts are likewise represented throughout the drawings, the vertical magnet 96 and the rotary magnet 97, the release magnet 98 and the private magnet 99 will be recognized and understood. The said private magnet 99, of course, controls the side switch wipers 100, 101, 102 and 103, the said private magnet also controlling the circuit of the vertical magnet 96, in the usual manner, by means of the springs 105 and 106, and of the release magnet 98, while the side switch is in first and second positions. The vertical movement of the switch shaft, and, therefore, of the wipers 119, 120 and 121, is controlled by the vertical magnet, and the rotary movement by the rotary magnet 97, the rotary magnet circuit being provided with the usual interrupter springs 107 to make and break the circuit. The operative magnets of the switch are, of course, controlled by the subscriber through the medium of the vertical and rotary line relays 108 and 109, as is well known. Said relays have under their control the usual springs 110, 111 and 112 for controlling the local circuits. By means of the back-release relay 115 the release of the switch E is brought about after the side switch has passed to third position.

The connector switch F is of the general type described in United States Letters Patent No. 815,176, granted March 13, 1906, to Keith, Erickson and Erickson. The mechanical details of the first-selector and connector, as is well known, are very much the same. The connector switch shaft (not shown), like the first-selector switch shaft, carries the line wipers 125 and 126 and the private wiper 127. The connector switch is also controlled by the calling subscriber through the medium of the vertical and rotary line relays 128 and 129, as explained. The vertical line relay 128 directly controls the vertical magnet 130 and also the rotary magnet 131 and the ringer relay 132, for the well-known purposes. The office of the vertical magnet 130 is to give the shaft and shaft wipers their vertical motion, and the rotary magnet 131 imparts to the shaft and shaft wipers a rotary or circular motion. The rotary line relay controls the private magnet 133 which, under certain conditions, in turn controls the vertical and rotary magnets 130 and 131, the release magnet 134, and also the side switch wipers 135, 136, 137 and 138, to change the circuits. The side switch of the connector, like the side switch of the first-selector, has a normal or first position, a second position and a third position. The release magnet 134 is also controlled by the line relays 128 and 129 conjointly. By the condensers 140 and 141 the circuit through

the connector is divided into two sections. The back-bridge relays 142 and 143 constitute means whereby the called subscriber may release the connector switch that has been connected with his line.

A clearer understanding of my improved system may be obtained from an explanation of the operation by which one subscriber calls another. Assuming, for example, that the subscriber at substation A desires to call the subscriber at substation A', to which is allotted the line #220, the mode of operation is as follows: To call the number 220 the subscriber at substation A operates his calling device once, in the well known manner, for each digit. The preliminary impulse for operating the line switch C occurs when the calling subscriber rotates the dial forward for the first digit, whereby the rotary impulse spring 24 is momentarily pressed against the ground post 20 to ground the line. As a result the private magnet 39 of the line switch C is energized by a flow of current from ground G' to the springs 18 and 19, ground post 20, impulse spring 24 to the rotary line conductor 32, side switch wiper 42, contact point 66, cut-off relay springs 144 and 145, release magnet springs 62 and 63, magnet 39, thence through said private magnet to the battery lead 148, thence through battery B to ground G, as shown. As soon as the private magnet energizes and deenergizes, the side switch passes from first to second position, whereby when the side switch wipers 41 and 42 engage the contact points 149 and 150, respectively, the subscriber's line conductors 31 and 32 are extended to the shaft wipers 49 and 50, respectively, which are in engagement with the contact terminals of a trunk line leading to the first-selector E (Fig. 1). When the side switch wiper 44 engages the grounded contact point 151 a protecting or guarding ground potential is established at the contact point engaged by the private wiper 51. This potential protects the engaged trunk line from seizure by other individual switches. Furthermore, this guarding potential sends an energizing current through the rotary magnet 152 of the individual switch L of the same group of which the switch C is a member. An energizing circuit is also established through the rotary magnet 74 of the group-switch D, as illustrated. The circuit through the rotary magnet 74 of the group-switch D extends from ground G² to the contact point 151, side switch wiper 44, brush 54, private wiper 51 to the contact point 160^a on which the private wiper 80 is resting (see Fig. 4), thence to the private wiper 80, brush 85, interrupter springs 75, rotary magnet 74 to the battery lead 148, and through battery B to ground G, as

shown. The rotary magnet 74, upon energizing, operates to rotate the shaft, so that the wipers 80 and 81 are advanced one step, as shown in Fig. 1. The wiper 81 is adjusted slightly in advance of the wiper 80—that is, the bushing 82 is so arranged that the springs 83 and 84 are carried out of engagement before the wiper 80 engages the next contact point. When the springs 83 and 84 disengage, the normal ground potential from ground G⁰ is removed from all of the second private bank contacts of the line or individual switches allotted to the switch D, such as the contact 159 of the switch L, for example. The circuit through the rotary magnet 152 of the individual switch L extends from ground G² to the contact point 151, side switch wiper 44 to the brush 54, shaft wiper 51, contact point 153, conductor 154 to the contact point 155, shaft wiper 156, side switch wiper 157, through the interrupter springs 158, and through the rotary magnet 152 to the battery B and to ground G, as shown. The rotary magnet 152, upon energizing, operates to rotate the shaft wipers of the individual switch L to the next set of idle contact points which, for the private wiper 156, is the contact point 159, as illustrated. Not only is the switch L thus operated, but also all idle switches of the same group, similar to the switch L, are likewise operated, and the shaft wipers of each switch are carried into contact with the multiple contacts of the same trunk line. Now, if the switch L were operated by its subscriber exactly as the switch C has been operated, its side switch will also be tripped, whereby a ground potential is established at all second private bank contacts, so that the group-switch D and all individual switches resting on this contact are again moved one step to the next contact, and so on.

Returning again to the operation of the switch C it will be seen that when the side switch wipers 41 and 42 engage the contact points 149 and 150, respectively, the subscriber's line conductors 31 and 32 are extended to the trunk conductors 160 and 161, respectively, which lead to the selector switch E, as explained. The first digit being 2, the subscriber operates his dial accordingly, grounding the vertical line conductor 31 each time that the spring 23 is pressed onto the ground post 20, and the rotary line conductor 32 once when the rotary impulse spring 24 is pressed onto the ground post 20. As a result the vertical line relay 108 of the first-selector E is energized by a flow of current from the substation ground G' through the springs 18 and 19 to the ground post 20, thence through the spring 23 to the vertical line conductor 31, side switch wiper 41, contact point 149, relay 68, brush 52, vertical shaft wiper 49, vertical trunk conductor 160, 161,

switch wiper 100 of the selector E, contact point 162, vertical line relay 108 to the battery lead 148, thence through battery B and to ground G, energizing the line relay. Each time that the said vertical line relay 108 energizes, the line relay spring 111 is pressed onto the ground spring 110, closing the local circuit. The vertical magnet 96 is thereby energized, and the wipers 119, 120 and 121 of the selector E are raised to the second bank level and brought opposite the first contact of said level. The energizing circuit of the said vertical magnet 96 extends from ground G³ through the springs 110 and 111, private springs 105 and 106 to the vertical magnet 96, thence to the battery lead 148, and through battery B to said ground. The spring 24 is then pressed onto the ground post 20, grounding the rotary line conductor 32 and energizing, therefore, the rotary line relay 109 of the selector E, thus closing a local circuit. The energizing current passes from ground G' to the rotary line conductor 32. Thence it flows through the side switch wiper 42, contact point 150, relay 69, brush 53, shaft wiper 50 to the rotary trunk conductor 161, side switch wiper 101 of the selector E, contact point 163 to the rotary line relay 109, thence to the battery lead 148, and through the battery B to said ground. The rotary line relay, upon operating, presses the line relay spring 112 onto the ground spring 110, thereby establishing a circuit through the private magnet 99 from ground G³ through the springs 110 and 112 to the private magnet 99, and through the said magnet to battery lead 148, thence through battery B to ground. The private magnet, upon energizing and deenergizing, permits the selector side switch to pass from first to second position, permitting the side switch wipers 102 and 103 to engage the contact points 164 and 165, respectively. The closure of connection between the side switch wiper 102 and the contact point 164 sets up an energizing circuit for the rotary magnet 97 from ground G¹ to the contact point 164, through the side switch wiper 102, interrupter spring 107, rotary magnet 97 to the battery lead 148, and then through battery B to said ground G, as illustrated. The said rotary magnet 97 then operates to rotate the wipers 119, 120 and 121 of the selector E into engagement with a trunk line leading to some idle connector switch, and, in the particular case under consideration, to the connector switch F in order to extend the connection. If the wipers have to pass over busy trunk lines, then as soon as the private wiper 121 engages a grounded contact point the private magnet 99 energizes again, locking the side switch in second position. The energizing circuit for said private magnet extends from the grounded terminal G of battery B through an occupying switch

(not shown) to the private wiper 121, thence over the conductor 166 and through the back-release relay 115 to the side switch wiper 103, contact point 165, private magnet 99, thence through said magnet to the battery lead 148, and through battery B to the ground. The private magnet 99, upon thus becoming energized, locks the grounded side switch wiper 102 in engagement with the contact point 164, whereby the rotary magnet 97 will be energized step by step until the wipers are carried beyond the last busy trunk line. At the instant that the private wiper leaves the last busy contact point the energizing circuit through the private magnet 99 is destroyed, and as a result the selector side switch passes to third position. If, however, there are no busy trunk lines, the rotary magnet 97 releases the side switch to third position as soon as the wipers are carried into engagement with the first trunk line. As soon as the side switch passes to third position, as stated, the subscriber's line conductors 31 and 32 are extended to the conductors 167 and 168, which in this case, it is assumed, lead to the connector switch F, as shown. The extension of the line connection occurs, of course, as soon as the side switch wipers 100 and 101 engage the contact points 169 and 170, respectively. Not only is the subscriber's line thus extended, but a guarding potential is also established at the private wiper 121, when the side switch wiper 103 passes onto the ground contact point 171, for protecting the seized trunk line against interference by other calling subscribers. This guarding potential is established from ground G⁵ to the contact point 171, thence through the side switch wiper 103 and through the back-release relay 115, conductor 166 to the private wiper 121, as illustrated.

It will, of course, be necessary that the energizing circuit for the rotary magnet 97, to which reference has already been made, be destroyed when the idle trunk line is seized. This occurs when the side switch wiper 102 leaves the contact point 164. The ground impulses from the substation to the line conductors for the last two digits are effective in operating the connector F to further extend the connection. For the second digit 2 the vertical impulse spring 23 is pressed onto the ground post 20 twice, and the rotary impulse spring 24 is pressed onto the ground post once, whereby an energizing circuit is closed through the connector vertical and rotary line relays 128 and 129, closing local circuits. The circuit through the vertical line relay extends from ground G' through the ground post 20, spring 23, line conductor 31, side switch wiper 41, shaft wiper 49, trunk conductors 160 and 167, vertical line relay 128 to the battery lead 148, thence through battery B to ground. Each

time that the vertical line relay 128 is energized the line relay springs 172 and 173 are pressed into contact, thereby closing an energizing circuit each time through the vertical magnet 130, which operates in the usual manner one step at a time. The shaft wipers 125, 126 and 127 are, therefore, raised two steps opposite the level in which are located the normal terminals of the line #220. Following the vertical impulses the rotary impulse spring 24 makes contact with the ground post 20, thereby closing an energizing circuit through the rotary line relay 129 extending from ground G' through the ground post 20 and spring 24, line conductor 32, trunk conductors 161 and 168, through the rotary line relay 129 to the battery lead 148, thence through battery B to ground G, as shown. The rotary line relay upon operating closes an energizing circuit through the private magnet 133 which operates in turn to release the connector side switch from first to second position. The energizing circuit through the private magnet 133 is established when the rotary line relay 129 presses the spring 114 onto the ground spring 173, at which time the energizing current flows from ground through the private magnet 133, causing the said connector side switch to trip from first to second position. The last digit being naught, the calling device is operated, as previously described, grounding the vertical line conductor 31 ten times and the rotary line conductor 32 once. The vertical and rotary line relays 128 and 129 are operated over previously traced circuits. However, when the line relay springs 172 and 173 engage, a circuit is closed through the rotary magnet 131, instead of through the vertical magnet 130, to energize the former. Each time that the rotary magnet is energized it operates to rotate the shaft and shaft wipers 125, 126 and 127 one step at a time until the said wipers are carried into engagement with the normal conductors 174, 175 and 176, the former two of which lead to the line terminals of the desired substation. The energizing of the rotary line relay 129, as previously stated, completes an energizing circuit through the private magnet 133, which now operates to release the side switch from second to third position, thus placing the side switch wipers 135, 136, 137 and 138 in contact with their respective contact points. Furthermore, when the side switch wiper 138 engages the contact point 177, a guarding potential is established for protecting the called line. This potential extends from ground G⁵ to the contact point 177, side switch wiper 138, and to the private wiper 127 which engages the private contact of the called line. The said engagement of the side switch wiper 138 and contact point 177 also closes

an energizing circuit through the cut-off relay 178 of the line switch C', as illustrated. This circuit extends from ground G⁵ to the side switch wiper 138, shaft wiper 127, side switch wiper 182 of the switch C', through the cut-off relay 178 to the battery lead 148, and through battery B to ground. The relay 178, upon energizing, operates to disengage the springs 183 and 184, whereby the private magnet 185 is disconnected from the rotary line conductor 180, as explained. The line conductors 179 and 180 of the substation are now connected to the calling substation. To signal the called subscriber, the calling subscriber presses the button 37, whereby the spring 35 is pressed into engagement with the ground spring 38, whereby an energizing circuit is established through the connector vertical line relay 128, closing a local circuit. The said relay 128 now operates to close an energizing circuit through the ringer relay 132 which operates in the usual manner to bridge the ringer generator I across the line conductors 179 and 180 to operate the ringer 181 at the substation A', to signal the called subscriber. The subscriber at substation A' upon removing the receiver 186 from the switch-hook 187 may converse with the subscriber at substation A over the circuit shown by the heavy lines in Figs. 1 and 2—that is, over the talking circuit.

The release of the central office switching apparatus occurs when the calling subscriber restores the receiver 2 to the switch-hook 3, thereby pressing the release springs 7, 8 and 9 into engagement for a moment, and thus grounding the line. The contact of the said release springs grounds the vertical and rotary line conductors 31 and 32 simultaneously from ground G' to the release spring 7, thence through the springs 8 and 9 to the vertical and rotary line conductors, thereby simultaneously energizing the line switch relays 68 and 69, and the vertical and rotary line relays 128 and 129 of the connector F, whereby the release relay 115 of the selector E is energized in series with the release magnet 134 of the connector F, releasing the switches. The path of the series circuit through the release relay 115 and release magnet 134 extends from ground G⁵ to the side switch wiper 103, release relay 115, selector shaft wiper 121, release springs 188 and 189, release magnet 134 to the battery lead 148, thence through battery B to ground G, as shown. When the connector release magnet 134 is thus supplied with current it energizes, and as a result the switch shaft and side switch are restored to normal position, thus breaking the connection between the connector switch shaft wipers 125, 126 and 127 and the normal conductors 174, 175 and 176, to release the connector. The back-release relay 115 of the

selector E, being in the same circuit with the release magnet 134, energizes simultaneously with the latter and presses the springs 190 and 191 into engagement, which in turn close an energizing circuit through the release magnet 98 of the first-selector E, releasing the latter. This circuit extends from ground G⁷ through the release relay springs 190 and 191, through the winding of the release magnet 98 to the battery lead 148, thence through battery B to ground G, as illustrated. The energizing circuit through the release relay 115 is maintained as long as the connector vertical and rotary line relays are energized simultaneously. When the connector line relays 128 and 129 de-energize, the energizing circuit through the release relay 115 is broken, and the release magnet 98 of the selector E de-energizes, restoring the selector shaft wipers and side switch wipers to normal position. The line switch relays 68 and 69 upon energizing simultaneously press into contact the springs 70 and 71, whereby an energizing circuit is established through the release magnet 55 of the individual or line switch C, said circuit extending from ground G⁸ through the springs 71 and 70, release magnet 55 to the battery lead 148, and through battery B to ground G, giving a flow of battery current. The release magnet 55 upon energizing attracts its armature 56 which operates, as previously explained, to restore the side switch to first position. When the release magnet 55 operates, the spring 62 is then carried out of engagement with the spring 63 into engagement with the spring 64. Now, when the side switch wiper 42 returns to first position a new energizing circuit is established through the release magnet 55, said circuit extending from the grounded rotary line conductor 32 through the side switch wiper 42, contact point 66, through the cut-off relay springs 144 and 145, springs 62 and 64 to the release magnet 55, thence to the battery lead 148, and through battery B to ground G, as illustrated. The energizing circuit through the release magnet 55 is broken when the release springs 7, 8 and 9 disengage, thereby removing the ground from the vertical and rotary line conductors 31 and 32 and restoring them to normal condition. The calling subscriber thus restores all the switching apparatus which he brought into use. When the side switch wipers 41 and 42 pass from second to first position the energizing circuits through the connector vertical and rotary line relays 128 and 129 are broken. Furthermore, when the side switch wiper 44 returns to first position the rotary magnet 45 is restored to normal connection with the shaft wiper 51, as shown.

It has been explained how all the private bank contacts of the line switches C, L, etc.,

are normally grounded at the master or controlling switch D, except one, so as to make it impossible for any of the line switches C, L, etc., to rest (while the side switch is in normal position) with their line wipers in engagement with any bank contact, except the one that is left uncovered or unguarded by the bushing 82 of the master switch D. It will therefore be evident that if, after the line switch C has seized the trunk line leading from the first set of contacts, as shown in Fig. 1, and if subsequently and before the switch C is released two other subscribers of the same group with the subscriber A make a call, the master switch D will then be advanced two steps and caused to rest with these wipers on the fourth contact. It will be evident, therefore, that the unguarded or unprotected contact in that event will be this fourth contact. Therefore, if the subscriber A releases when the master switch D is at this point, the rotary magnet 45 of the line switch C being thrown into connection with the private wiper 51, as already explained, will become energized by a flow of current from ground G⁹ at the master switch D to the first master switch contact, thence to the first private bank contact of the line switch C, private wiper 51, brush 54, side switch wiper 44, and through the interrupter springs of the rotary magnet 45, thence through said rotary magnet to the battery lead 148, and through battery B to ground G, as shown. The rotary magnet will operate to advance the shaft wipers, and among them, of course, the private wiper 51, onto the second contact. Again the energizing circuit will be established through the rotary magnet 45, which will carry the wipers onto the next or third contact, and finally the rotary magnet 45 is energized once more and the wipers are carried onto the fourth contact, which latter contact being unprotected—that is, disconnected from ground G⁹, or from any other ground connection—the circuit through the rotary magnet 45 is broken and the wipers caused to come to rest on this trunk. Of course, when any other subscriber calls after the switch C has come to rest the line switch of the calling subscriber will then put ground on this fourth contact, driving all other switches of the group, including the master switch D, onto the next contact, if the said next contact is not in use. However, if the said contact is in use it will be impossible for the master switch D to remove the ground connection maintained by the line switch that is monopolizing this contact, and consequently all switches, including the master switch D, will be advanced to the sixth contact, and so on. Evidently, then, after a subscriber has used his line switch and hangs up his receiver, all of the switches which he has brought into use will

be released, including the line switch, which line switch will then operate and put itself in connection with the idle trunk held uncovered by the master switch.

5 From the foregoing it will be seen that I provide a group of subscribers' lines with movable line wipers or terminals which are all normally connected in multiple to an idle trunk or line. Consequently, when a sub-
 10 scriber calls, his line wipers are not advanced or disturbed in any manner whatever, but are allowed to remain in engagement with the idle trunk or line. In this way the trunks or lines are selected ahead of the
 15 calls, each calling subscriber being given a preselected idle trunk or line, and at the same time automatically selecting another idle trunk or line for the next call—that is to say, for use by the subscriber who makes
 20 the next call. With my improved arrangement the group of subscribers' lines are not normally connected with the preselected or waiting trunk line, but are normally disconnected therefrom, notwithstanding the
 25 fact that the step-by-step-operated line wipers allotted to the subscribers' lines are normally connected in multiple to the preselected idle trunk line. However, as soon as a calling subscriber automatically closes connection between his line and his allotted
 30 line wipers, then the line wipers of all other subscribers in the same group are immediately and automatically driven off from the trunk line upon which they were all resting, and are advanced into connection with the
 35 idle trunk line next in order after the one last put in use. With such arrangement the line wipers of the subscribers' lines always rotate in one and the same direction—that is to say, do not rotate in a forward and
 40 back direction, and consequently the trunk line which any calling subscriber uses is always the first idle trunk line next in order after the one last put in use. This mode
 45 of operation tends to simplify and increase the speed with which connections are made, with apparatus of this kind, as the connection of a calling subscriber's line to an idle trunk line does not wait upon the automatic
 50 selection of such line, and does not wait upon the step-by-step advancement of any line wiper or other similar element to select an idle trunk. In other words, the subscriber's line terminal is already in engagement with
 55 the previously selected idle trunk line, and all that is necessary is for the subscriber in starting to make a call to automatically close connection between his line and the said line terminal, thus immediately seizing the trunk
 60 line with which his individual line switch was already in connection. The step-by-step operations of the subscribers' line switches, to select and connect with idle trunks, are of such character that each subscriber only operates the shaft wipers of the other sub-

scribers of the same group, and not his own. Consequently, each calling subscriber automatically advances the shaft wipers of all
 65 idle subscribers' line switches in the same group, but leaves his own shaft wipers exactly where they were before he called, simply closing connection between his line and the said shaft wipers. The effect of the long
 70 impulse on the forward movement of the dial is to ground the rotary line and, therefore, to energize the rotary line relay of the connector, which in turn operates to close an energizing circuit through the private mag-
 75 net, but the operation of the private magnet at this stage of the call is without effect, since the side switch is retained locked in the first position until the switch shaft is given a vertical step.

What I claim as my invention is:—

1. A telephone system comprising a group 85 of subscribers' lines, traveling terminals for said subscribers' lines, and an idle line to which said terminals are all normally connected in multiple.
2. A telephone system comprising a group 90 of subscribers' lines, traveling terminals for said subscribers' lines, and an idle trunk to which said terminals are all normally connected in multiple.
3. A telephone system comprising a group 95 of subscribers' lines, a step-by-step-actuated line wiper for each subscriber's line, an idle line, and as many multiple terminals for said idle line as there are subscribers' lines, each line wiper normally engaging one of the 100 terminals of said idle line.
4. A telephone system comprising a group of subscribers' lines, a step-by-step-actuated line wiper for each subscriber's line, an idle trunk, and as many multiple terminals for 105 said idle trunk as there are subscribers' lines, each line wiper normally engaging one of the terminals of said idle trunk.
5. A telephone system comprising a group of lines, traveling terminals for said lines, 110 and an idle line to which said terminals are all normally connected in multiple.
6. A telephone system comprising a group of lines, traveling terminals for said lines, and an idle trunk to which said terminals 115 are all normally connected in multiple.
7. A telephone system comprising a group of lines, a step-by-step-actuated line wiper for each line, an idle line, and as many multiple terminals for said idle line as there 120 are lines in said group, each line wiper normally engaging one of the terminals of said idle line.
8. A telephone system comprising a group of lines, a step-by-step-actuated line wiper 125 for each line, an idle trunk, and as many multiple terminals for said idle trunk as there are lines in said group, each line wiper normally engaging one of the terminals of said idle trunk. 130

9. A telephone system comprising a group of subscribers' lines, movable terminals for said subscribers' lines, and an idle line to which said terminals are all normally connected in multiple, said movable terminals being normally disconnected from the said group of lines.

10. A telephone system comprising a group of subscribers' lines, movable terminals for said subscribers' lines, and an idle trunk to which said terminals are all normally connected in multiple, said movable terminals being normally disconnected from the said group of lines.

11. A telephone system comprising a group of subscribers' lines, a step-by-step-actuated line wiper for each subscriber's line, an idle line, and as many multiple terminals for said idle line as there are subscribers' lines, each line wiper normally engaging one of the terminals of said idle line, and said wipers being normally disconnected from the said group of lines.

12. A telephone system comprising a group of subscribers' lines, a step-by-step-actuated line wiper for each subscriber's line, an idle trunk, and as many multiple terminals for said idle trunk as there are subscribers' lines, each line wiper normally engaging one of the terminals of said idle trunk, and said wipers being normally disconnected from the said group of lines.

13. A telephone system comprising a group of lines, movable terminals for said lines, and an idle line to which said terminals are all normally connected in multiple, said movable terminals being normally disconnected from the said group of lines.

14. A telephone system comprising a group of lines, movable terminals for said lines, and an idle trunk to which said terminals are all normally connected in multiple, said movable terminals being normally disconnected from the said group of lines.

15. A telephone system comprising a group of lines, a step-by-step-actuated line wiper for each line, an idle line, and as many multiple terminals for said idle line as there are lines in said group, each line wiper normally engaging one of the terminals of said idle line, and said wipers being normally disconnected from the said group of lines.

16. A telephone system comprising a group of lines, a step-by-step-actuated line wiper for each line, an idle trunk, and as many multiple terminals for said idle trunk as there are lines in said group, each line wiper normally engaging one of the terminals of said idle trunk, and said wipers being normally disconnected from the said group of lines.

17. A telephone system comprising a group of subscribers' lines, movable terminals for said subscribers' lines, an idle line to which said terminals are all normally connected in multiple, said movable terminals being normally disconnected from the said group of lines, and automatic auxiliary switches for closing connection between the lines of said group and their respective movable line terminals.

18. A telephone system comprising a group of subscribers' lines, movable terminals for said subscribers' lines, an idle trunk to which said terminals are all normally connected in multiple, said movable terminals being normally disconnected from the said group of lines, and automatic auxiliary switches for closing connection between the lines of said group and their respective movable line terminals.

19. A telephone system comprising a group of subscribers' lines, a step-by-step-actuated line wiper for each subscriber's line, an idle line, as many multiple terminals for said idle line as there are subscribers' lines, each line wiper normally engaging one of the terminals of said idle line, and said wipers being normally disconnected from the said group of lines, and automatic auxiliary switches for closing connection between the lines of said group and their respective wipers.

20. A telephone system comprising a group of subscribers' lines, a step-by-step-actuated line wiper for each subscriber's line, an idle trunk, as many multiple terminals for said idle trunk as there are subscribers' lines, each line wiper normally engaging one of the terminals of said idle trunk, and said wipers being normally disconnected from the said group of lines, and automatic auxiliary switches for closing connection between the lines of said group and their respective wipers.

21. A telephone system comprising a group of lines, movable terminals for said lines, an idle line to which said terminals are all normally connected in multiple, said movable terminals being normally disconnected from the said group of lines, and automatic auxiliary switches for closing connection between the lines of said group and their respective movable line terminals.

22. A telephone system comprising a group of lines, movable terminals for said lines, an idle trunk to which said terminals are all normally connected in multiple, said movable terminals being normally disconnected from the said group of lines, and automatic auxiliary switches for closing connection between the lines of said group and their respective movable line terminals.

23. A telephone system comprising a group of lines, a step-by-step-actuated line wiper for each line, an idle line, as many multiple terminals for said idle line as there are lines in said group, each line wiper nor-

5 mally engaging one of the terminals of said idle line, and said wipers being normally disconnected from the said group of lines, and automatic auxiliary switches for closing connection between the lines of said group and their respective wipers.

10 24. A telephone system comprising a group of lines, a step-by-step-actuated line wiper for each line, an idle trunk, as many multiple terminals for said idle trunk as there are lines in said group, each line wiper normally engaging one of the terminals of said idle trunk, and said wipers being normally disconnected from the said group of lines, and automatic auxiliary switches for closing connection between the lines of said group and their respective wipers.

15 25. A telephone system comprising a group of trunk lines for talking purposes, a step-by-step-operated line wiper normally connected with one of said trunk lines, and automatic means for advancing said wiper into connection with another trunk line when the said trunk line with which it is normally connected is put in use for talking purposes.

20 26. A telephone system comprising a group of trunk lines, multiple terminals for said trunk lines arranged in banks, a line wiper for each bank of trunk line terminals, said wipers all normally engaging multiple terminals of the same trunk line, and automatic means for advancing all idle wipers to another trunk line whenever one wiper is used for talking purposes.

25 27. In a telephone system, the combination of a plurality of trunk lines, a plurality of subscribers' lines, terminals for the subscribers' lines, and automatic means by which any calling subscriber connects the terminals of all idle subscribers' lines in multiple to an idle trunk line.

30 28. In a telephone system, the combination of subscribers' lines, a group of trunks less in number than the subscribers' lines, movable terminals for the subscribers' lines, automatic means by which any calling subscriber connects the movable terminals of all idle subscribers' lines in multiple with an idle trunk line, and automatic means by which the calling subscriber closes connection between his line and his allotted line terminal.

35 29. In a telephone system, the combination of one group of lines, another group of lines, movable line terminals for the first group of lines, and automatic means for connecting all idle line terminals in multiple to an idle member of said second group of lines when a member of the first group of lines is in use by a calling subscriber.

40 30. A telephone system comprising subscribers' lines, a line switch for each subscriber, trunk lines common to a group of line switches, a contact for each trunk line

allotted to each line switch, wipers for each line switch adapted to engage the said contacts, automatic means for normally maintaining the wipers of all idle line switches in engagement with the multiple contact of an idle trunk line, and means by which a calling subscriber's line is connected to the idle trunk line without operating the wipers of the line switch allotted to the calling subscriber.

75 31. In a telephone system, a subscriber's telephone, a line switch, a line terminating in said telephone at the subscriber's station, and in said line switch at a central station, a side switch allotted to said line switch, a private magnet for controlling said side switch, means at the subscriber's station for sending a preliminary impulse for energizing the said private magnet, a trunk line terminating in said line switch, a set of contacts for said trunk line, and wipers for said line switch normally in engagement with said trunk line, whereby when the subscriber sends in a preliminary impulse the private magnet is operated and the side switch tripped and the line switch wipers and trunk line connected to the subscriber's line.

80 32. A telephone system comprising a plurality of subscribers' lines, a line switch for each line, a plurality of trunk lines common to all of the switches, means whereby all except one of said trunk lines are normally maintained with guarding potential, means whereby all line switches are normally in connection with the unguarded trunk line, means whereby if a line switch is operated the said unguarded trunk line is seized and made busy and the next idle trunk line deprived of guarding potential and all idle line switches advanced to the said next idle line.

85 33. A telephone system comprising a plurality of subscribers' lines, a line switch for each line, a plurality of trunk lines common to all of the switches, a master switch allotted to said line switches, means whereby all except one of the said trunk lines are normally maintained with guarding potential by the said master switch, means whereby all line switches are normally in connection with the unguarded trunk line, means whereby if a line switch is operated the unguarded trunk line is made busy by the said calling line switch and the next idle trunk line deprived of guarding potential by the master switch and all idle line switches advanced to the said next idle line.

90 34. A telephone system comprising subscribers' lines, a line switch for every line, lines common to the line switches, a private wiper for each line switch, a side switch for each line switch having a first and a second position, a rotary magnet for each line switch for operating the private wiper, means whereby normally all the private wipers are maintained in connection with

the same line, and automatic means whereby one line switch may operate all the other line switches to cause their private wipers to be shifted while their side switches remain in first position.

35. In a telephone system, a plurality of trunks, a trunk selector switch, a private magnet, and a release magnet for switching the line from the private magnet to the release magnet, as set forth.

36. In a telephone system, a plurality of trunks, a trunk selector switch provided with a cut-off relay, a release magnet, a private magnet, and an energizing circuit for said private magnet controlled by the said cut-off relay and said release magnet.

37. In a telephone system, a rotary switch provided with a release magnet, an energizing circuit for said release magnet, releasing relays, a subscriber's telephone, a plurality of energizing circuits for the release magnet, one of which circuits is directly controlled by the said release relays, another of which circuits is directly controlled by the subscriber's telephone, and both of which circuits are controlled by the release magnet itself.

38. In a telephone system, a master switch provided with a rotary switch shaft, a rotary magnet, a multiple terminal wiper provided with three engaging arms for controlling the energizing circuit of said rotary magnet, and switches controlled by said master switch, as set forth.

39. In a telephone system, a master switch provided with a private bank, a multiple terminal wiper for removing guarding potentials from the private bank contacts, a rotary switch, a rotary magnet, a wiper having a plurality of terminals for controlling the energizing circuit of said rotary magnet, a rotary switch shaft for operating said wipers, said switch shaft adapted to be rotated by said rotary magnet, whereby the guarding-potential-controlling wiper may be properly operated, and trunk selectors governed in their operations by said master switch.

40. In a telephone system, a trunk line, a group of subscribers' lines provided with line terminals normally connected in multiple to said trunk line, means by which any subscriber in the group may seize the trunk line for talking purposes, and automatic means for substituting a new trunk line for the idle subscribers each time a subscriber calls.

41. In a telephone system, a group of subscribers' lines, a group of trunk lines less in number than the subscribers' lines, said subscribers' lines provided with line terminals normally connected in multiple to an idle and preselected one of said trunk lines, means by which any calling subscriber temporarily excludes all other subscribers from

the preselected trunk line, and automatic means for substituting or selecting another idle trunk line each time a subscriber calls.

42. A telephone system comprising a group of subscribers' lines, traveling terminals for said subscribers' lines, an idle line to which said terminals are all normally connected in multiple, another group of subscribers' lines, and automatic means for connecting said other group to said idle line, said connecting means including a switch having vertical motion to select groups and rotary motion to connect with the called line in the selected group.

43. A telephone system comprising a group of subscribers' lines, a step-by-step-actuated line wiper for each subscriber's line, an idle line, as many multiple terminals for said idle line as there are subscribers' lines, each line wiper normally engaging one of the terminals of said idle line, another group of subscribers' lines, and automatic means for connecting said other group to said idle line, said connecting means including a switch having vertical motion to select groups and rotary motion to connect with the called line in the selected group.

44. A telephone system comprising a group of lines, traveling terminals for said lines, an idle line to which said terminals are all normally connected in multiple, another group of subscribers' lines, and automatic means for connecting said other group to said idle line, said connecting means including a switch having vertical motion to select groups and rotary motion to connect with the called line in the selected group.

45. A telephone system comprising a group of lines, a step-by-step-actuated line wiper for each line, an idle line, as many multiple terminals for said idle line as there are lines in said group, each line wiper normally engaging one of the terminals of said idle line, another group of subscribers' lines, and automatic means for connecting said other group to said idle line, said connecting means including a switch having vertical motion to select groups and rotary motion to connect with the called line in the selected group.

46. A telephone system comprising a group of subscribers' lines, movable terminals for said subscribers' lines, an idle line to which said terminals are all normally connected in multiple, said movable terminals being normally disconnected from the said group of lines, another group of subscribers' lines, and automatic means for connecting said other group to said idle line, said connecting means including a switch having vertical motion to select groups and rotary motion to connect with the called line in the selected group.

47. A telephone system comprising a group of subscribers' lines, a step-by-step-

actuated line wiper for each subscriber's line, an idle line, as many multiple terminals for said idle line as there are subscribers' lines, each line wiper normally engaging one of the terminals of said idle line, said wipers being normally disconnected from the said group of lines, another group of subscribers' lines, and automatic means for connecting said other group to said idle line, said connecting means including a switch having vertical motion to select groups and rotary motion to connect with the called line in the selected group.

48. A telephone system comprising a group of lines, movable terminals for said lines, an idle line to which said terminals are all normally connected in multiple, said movable terminals being normally disconnected from the said group of lines, another group of subscribers' lines, and automatic means for connecting said other group to said idle line, said connecting means including a switch having vertical motion to select groups and rotary motion to connect with the called line in the selected group.

49. A telephone system comprising a group of lines, a step-by-step-actuated line wiper for each line, an idle line, as many multiple terminals for said idle line as there are lines in said group, each line wiper normally engaging one of the terminals of said idle line, said wipers being normally disconnected from the said group of lines, another group of subscribers' lines, and automatic means for connecting said other group to said idle line, said connecting means including a switch having vertical motion to select groups and rotary motion to connect with the called line in the selected group.

50. A telephone system comprising a group of subscribers' lines, movable terminals for said subscribers' lines, an idle line to which said terminals are all normally connected in multiple, said movable terminals being normally disconnected from the said group of lines, automatic auxiliary switches for closing connection between the lines of said group and their respective movable line terminals, another group of subscribers' lines, and automatic means for connecting said other group to said idle line, said connecting means including a switch having vertical motion to select groups and rotary motion to connect with the called line in the selected group.

51. A telephone system comprising a group of subscribers' lines, a step-by-step-actuated line wiper for each subscriber's line, an idle line, as many multiple terminals for said idle line as there are subscribers' lines, each line wiper normally engaging one of the terminals of said idle line, said wipers being normally disconnected from the said group of lines, automatic auxiliary

switches for closing connection between the lines of said group and their respective wipers, another group of subscribers' lines, and automatic means for connecting said other group to said idle line, said connecting means including a switch having vertical motion to select groups and rotary motion to connect with the called line in the selected group.

52. A telephone system comprising a group of lines, movable terminals for said lines, an idle line to which said terminals are all normally connected in multiple, said movable terminals being normally disconnected from the said group of lines, automatic auxiliary switches for closing connection between the lines of said group and their respective movable line terminals, another group of subscribers' lines, and automatic means for connecting said other group to said idle line, said connecting means including a switch having vertical motion to select groups and rotary motion to connect with the called line in the selected group.

53. A telephone system comprising a group of lines, a step-by-step-actuated line wiper for each line, an idle line, as many multiple terminals for said idle line as there are lines in said group, each line wiper normally engaging one of the terminals of said idle line, said wipers being normally disconnected from the said group of lines, automatic auxiliary switches for closing connection between the lines of said group and their respective wipers, another group of subscribers' lines, and automatic means for connecting said other group to said idle line, said connecting means including a switch having vertical motion to select groups and rotary motion to connect with the called line in the selected group.

54. A telephone system comprising a group of trunk lines for talking purposes, a step-by-step-operated line wiper normally connected with one of said trunk lines, automatic means for advancing said wiper into connection with another trunk line when the said trunk line with which it is normally connected is put in use for talking purposes, another group of subscribers' lines, and automatic means for connecting said other group to said trunk lines, said connecting means including a switch having vertical motion to select groups and rotary motion to connect with the called line in the selected group.

55. A telephone system comprising a group of trunk lines, multiple terminals for said trunk lines arranged in banks, a line wiper for each bank of trunk line terminals, said wipers all normally engaging multiple terminals of the same trunk line, automatic means for advancing all idle wipers to another trunk line whenever one wiper is used for talking purposes, another group of sub-

scribers' lines, and automatic means for connecting said other group to said trunk lines, said connecting means including a switch having vertical motion to select groups and rotary motion to connect with the called line in the selected group.

56. The combination of a subscriber's telephone line, an idle trunk line, a normally closed switch intermediate of the two lines, a normally open switch intermediate of the subscriber's line and the normally closed switch, other lines terminating at said normally closed switch, another group of subscribers' lines, and automatic means for connecting said other group to said idle line, said connecting means including a switch having vertical motion to select groups and rotary motion to connect with the called line in the selected group.

57. A telephone system comprising subscribers' lines, a line switch for each subscriber, trunk lines common to a group of line switches, a contact for each trunk line allotted to each line switch, wipers for each line switch adapted to engage the said contacts, automatic means for normally maintaining the wipers of all idle line switches in engagement with the multiple contact of an idle trunk line, and electrically controlled means by which a calling subscriber's line is connected to the idle trunk line without operating the wipers of the line switch allotted to the calling subscriber.

58. In a telephone system, a subscriber's telephone, a line switch, a line terminating in said telephone at the subscriber's station, and in said line switch at a central station, a side switch allotted to said line switch, a private magnet for controlling said side switch, circuit controlling means at the subscriber's station for sending a preliminary impulse for energizing the said private magnet, a trunk line terminating in said line switch, a set of contacts for said trunk line, and wipers for said line switch normally in engagement with said trunk line, whereby when the subscriber sends in a preliminary impulse the private magnet is operated and the side switch tripped and the line switch wipers and trunk line connected to the subscriber's line.

59. A telephone system comprising a plurality of subscribers' lines, a line switch for each line, a plurality of trunk lines common to all of the switches, automatic means whereby all except one of said trunk lines are normally maintained with guarding po-

tential, automatic means whereby all line switches are normally in connection with the unguarded trunk line, automatic means whereby if a line switch is operated the said unguarded trunk line is seized and made busy and the next idle trunk line deprived of guarding potential and all idle line switches advanced to the said next idle line.

60. A telephone system comprising a plurality of subscribers' lines, a line switch for each line, a plurality of trunk lines common to all of the switches, a master switch allotted to said line switches, automatic means whereby all except one of the said trunk lines are normally maintained with guarding potential by the said master switch, automatic means whereby all line switches are normally in connection with the unguarded trunk line, automatic means whereby if a line switch is operated the unguarded trunk line is made busy by the said calling line switch and the next idle trunk line deprived of guarding potential by the master switch and all idle line switches advanced to the said next idle line.

61. A telephone system comprising subscribers' lines, a line switch for every line, lines common to the line switches, a private wiper for each line switch, a side switch for each line switch having a first and a second position, a rotary magnet for each line switch for operating the private wiper, automatic means whereby normally all the private wipers are maintained in connection with the same line, and automatic means whereby one line switch may operate all the other line switches to cause their private wipers to be shifted while their side switches remain in first position.

62. In a telephone system, a group of subscribers' lines, a group of trunk lines less in number than the subscribers' lines, said subscribers' lines provided with line terminals normally connected in multiple to an idle and preselected one of said trunk lines, automatic means by which any calling subscriber temporarily excludes all other subscribers from the preselected trunk line, and automatic means for substituting or selecting another idle trunk line each time a subscriber calls.

Signed by me at Chicago, Cook county, Illinois, this 30th day of April, 1907.

EDWARD D. FALES.

Witnesses:

HARRIETT M. MERRIAM,
ARTHUR B. SPERRY.