A. L. PIPER.

AUTOMATIC PARTY LINE TELEPHONE SYSTEM.

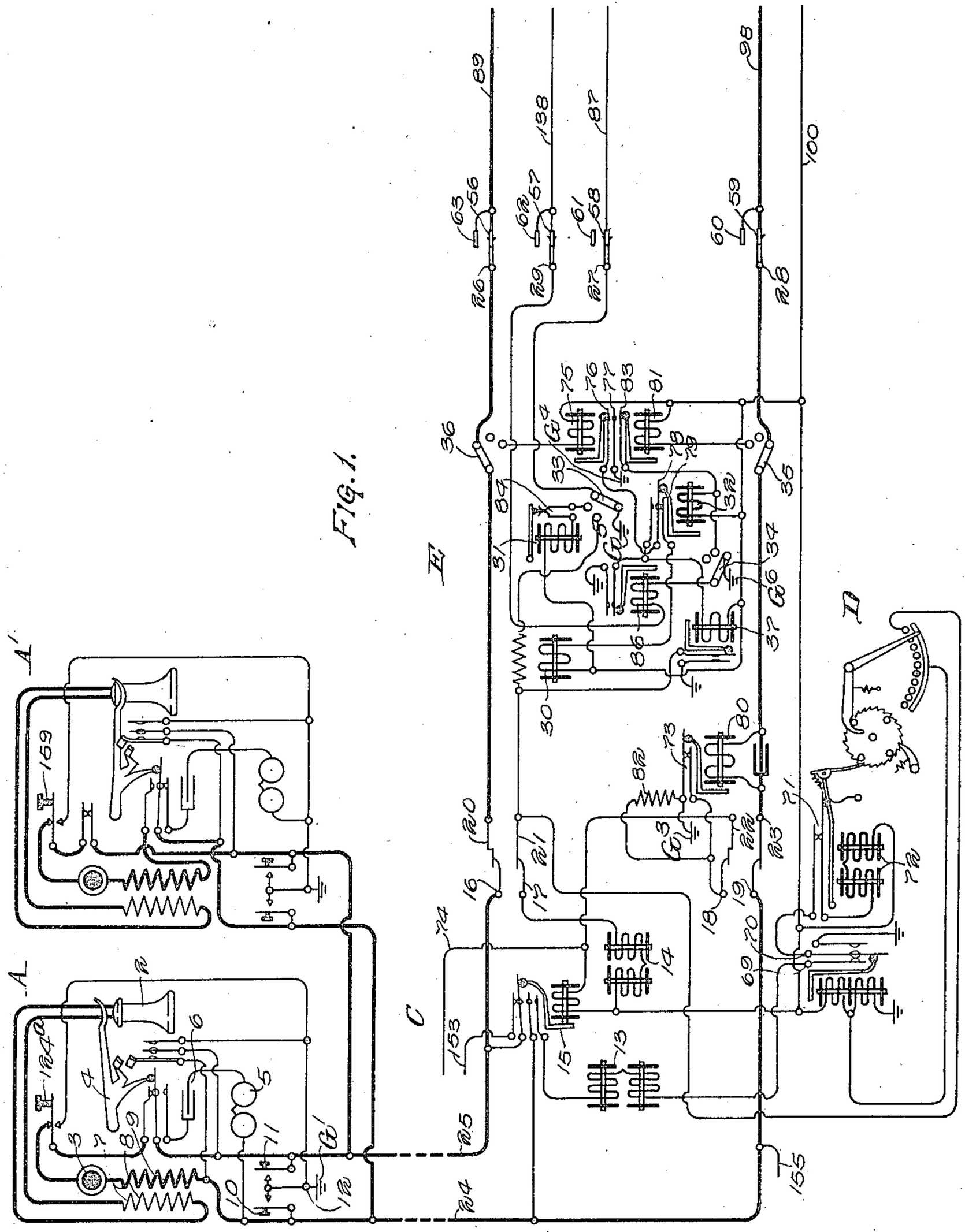
APPLICATION FILED SEPT. 20, 1913.

1,284,924.

Patented Nov. 12, 1918.

2 SHEETS—SHEET 1.

FIG. 1.



WITNESSES

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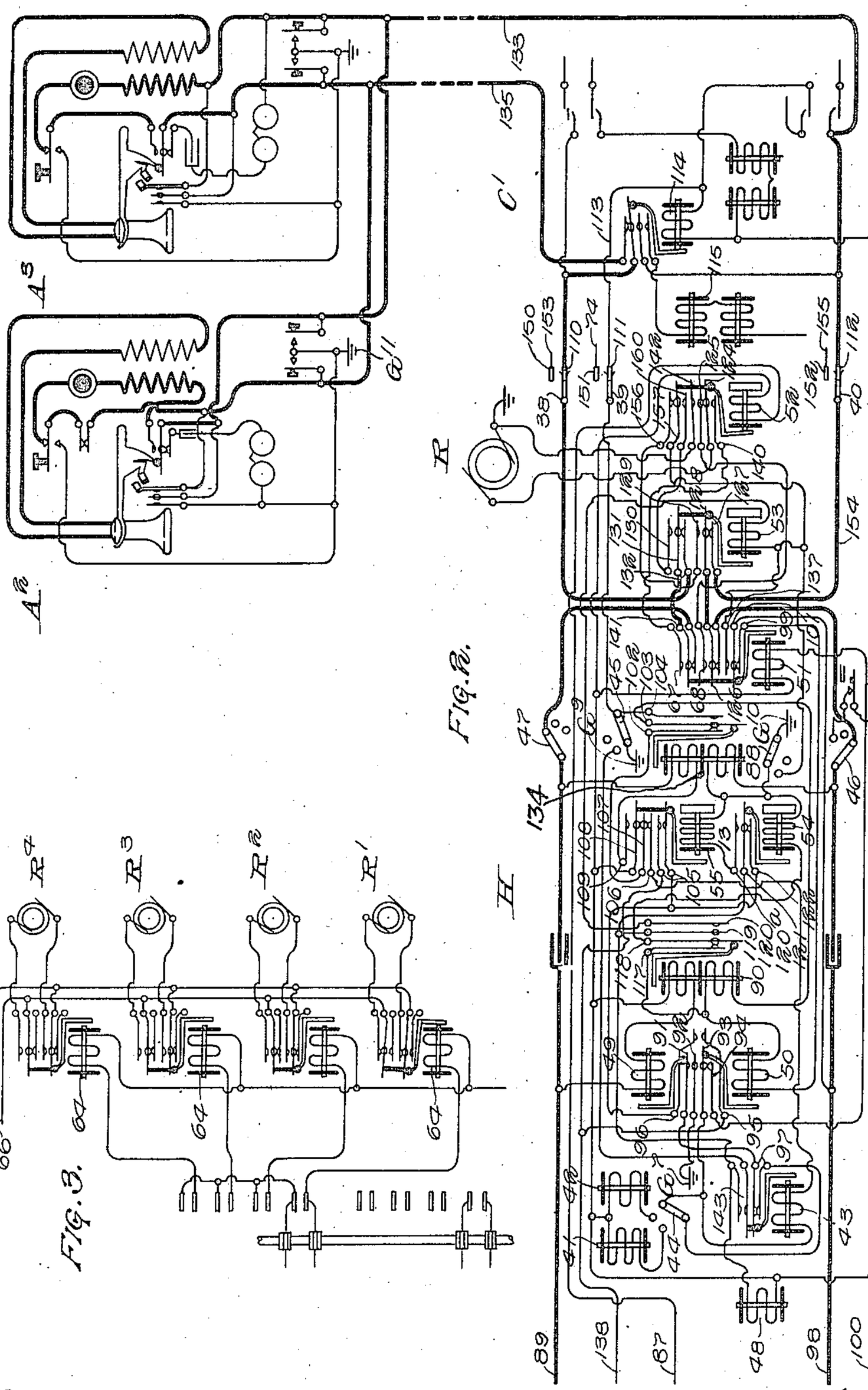

FIG. 2.

FIG. 3.

WITNESSES

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ARTHUR L. PIPER, OF SAN FRANCISCO, CALIFORNIA, ASSIGNOR TO AUTOMATIC ELECTRIC COMPANY, OF CHICAGO, ILLINOIS, A CORPORATION OF ILLINOIS.

AUTOMATIC PARTY-LINE TELEPHONE SYSTEM.

1,284,924. Specification of Letters Patent. Patented Nov. 12, 1918.

Application filed September 20, 1913. Serial No. 790,824.

To all whom it may concern:

Be it known that I, ARTHUR L. PIPER, a citizen of the United States of America, and resident of San Francisco, in the county of San Francisco, California, have invented certain new and useful Improvements in Automatic Party-Line Telephone Systems, of which the following is a specification.

My invention relates to an improvement in automatic party-line telephone systems.

It has for its object a party-line system in which each party line is accessible through only one group of connectors. Each group of connectors, however, is accessible through a plurality of paths or calling branches. I then provide means in the connector for applying a particular kind or arrangement of current to the called line, dependent upon the calling branch which is employed in extending a connection to the connector, and in this manner I am enabled to selectively signal the stations on the party line.

Further specific objects of my invention are the provision of means whereby one party can signal another on the same line. Means are also provided whereby, after a connection is established, it can only be disconnected by the calling party.

My invention will be more clearly understood by reference to the accompanying drawings, in which I have illustrated diagrammatically certain specific embodiments of my invention.

In the accompanying drawings Figures 1 and 2 taken together represent diagrammatically a complete circuit connection between a calling substation A and a called substation A^2 in a system embodying the principles of my invention.

The automatic system represented herein is of a well-known type, and, as shown, comprises a polystation subscriber's line, together with its individual switch C at the central office, a master switch D, a selector switch E, a connector switch H and a called polystation subscriber's line with its individual switch C′. The polystation subscriber's line, as shown in Fig. 1, consists of two substations, namely, A and A′. The substation A is arranged to be signaled metallically—that is, the bells are bridged across the substation trunk lines—while the substation A′ is arranged to be signaled grounded—that is, the bells are connected to ground at one side of the substation trunk line. It will therefore be readily seen that by the proper arrangement one generator may be made to signal either one of the two substations.

Fig. 3 is a diagrammatical arrangement showing the method for using a plurality of ringing generators to ring a corresponding number of substations.

The subscribers' substations A, A′, A^2 and A^3 may be of any suitable or approved type. Referring to substation A, it comprises the usual receiver 2, transmitter 3, switch hook 4, ringer 5, condenser 6 and induction coil 7, the latter comprising the windings 8 and 9. Being a so-called automatic substation it is provided with an impulse transmitter or calling device, which is herein represented by two push buttons 10 and 11 and a ground post 12. Such a calling device is well known in the art and it is not thought necessary to give a detailed description of the same.

The line switch C is similar to that shown in British patent to R. W. James No. 26,301 of 1906. In its general form it comprises a trip magnet 13, a release magnet 14 and a bridge-cut-off relay 15. The trip magnet is designed to operate the usual plunger for pressing the bank springs 16, 17, 18 and 19 into engagement with their corresponding bank contacts 20, 21, 22 and 23. The plunger is so arranged that when in normal position it is under the control of the master switch D, whereby the said plunger may always be removed from opposite a seized trunk to a position opposite an idle trunk. The release magnet operates to restore the plunger to normal position. The bridge-cut-off relay operates to disconnect the line switch from the trunk line conductors 24 and 25. Although only one set of springs (16—23) is shown in connection with the line switch C, each line switch is provided with a plurality of such sets, each set forming the terminal of a trunk line leading to a first selector E. Each trunk line is connected in multiple with the corresponding springs of all the line switches of the group which is controlled by the master switch D.

The master switch D is of the same general type as that disclosed in British patent to R. W. James No. 26,301 of 1906, above referred to. The function of the master switch, as is well known, is to maintain the

plungers of all the idle line switches in position to engage the terminal of an idle trunk line.

The selector E is of the general type disclosed in United States Letters Patent No. 815,321, granted March 13, 1906, to Keith, Erickson and Erickson. In general it comprises the usual shaft (not shown) carrying the wipers 26, 27, 28 and 29 and is controlled by a vertical magnet 30 and a rotary magnet 31. The private magnet 32 controls the side switch carrying the wipers 33, 34, 35 and 36 in the usual manner. The release of the switch mechanism is provided in the release magnet 37.

The connector switch H is of the same general type as disclosed in United States Letters Patent No. 815,176, granted March 13, 1906, to Keith, Erickson and Erickson. Like the selector E it comprises a shaft (not shown) and shaft wipers 38, 39 and 40. The vertical motion of the shaft is controlled by the vertical magnet 41 and the rotary motion by the rotary magnet 42. The private magnet 43 controls the side switch carrying the wipers 44, 45, 46, 88 and 47 in the usual manner. The release of the connector is provided in the release magnet 48. The operations of the switch are controlled by the calling subscriber through the medium of the two line relays 49 and 50. The connector is also provided with a ringer relay 51 and the slow acting relays 52, 53, 54 and 55.

The individual switch C′ is in all respects similar to the individual switch C.

For the purpose of supplying battery current for operating the central office apparatus and for talking purposes, there is shown a battery B having one terminal grounded at G. The busy signaling machine L, as represented herein, comprises an induction coil or transformer, the primary winding of which is included in a local circuit with a battery and an interrupter. Through the medium of this interrupter an interrupted current is supplied to the primary winding, which induces a current in the secondary winding, whereby when said winding is connected with the subscriber's line a buzzing sound is heard in the receiver.

The system shown herein is a party line system and, as shown, in the complete circuit connection the apparatus is adapted to accommodate two substations on each line. Each group of party lines is accessible through only one group of connector switches, this group of connector switches, however, being accessible through different levels of the selector E. Referring to Fig. 1, the bank contacts 56, 57, 58 and 59 belong to the first level of the selector E, while the bank contacts 60, 61, 62 and 63 belong to the second level of the selector E. The line bank contacts 59 and 56 of the first level are multiplied to the line bank contacts 60 and 63 of the second level. This is also true of the upper private bank contacts 57 and 62 of the first and second levels, while the lower private bank contacts of the first and second levels are not multiplied, but are independent. It will readily be seen that if the selector switch E is raised to the first level, the relay 52 of the connector switch H, controlling the generator, will be energized and apply ringing current to the called line in a different manner (when the connection is completed) than when the selector switch E is raised to the second level, which will have no effect upon the generator controlling relay 52. Referring now to Fig. 3, it is obvious from the foregoing that the lower private bank contacts of the different levels of the selector E could connect with the different generator controlling relays 64, each controlling relay adapted, when energized, to connect its corresponding ringing current generator with the common conductors 65 and 66. For example, if the shaft and wipers of the selector E are raised to the third level, the controlling relay 64 connected to the private bank contact of said level is energized and operates to connect the generator R^3 with the common conductors 65 and 66. The said common conductors could then be connected to the springs 67 and 68 of the ringing relay 51, so that when said ringing relay is energized ringing current from the particular generator connected to said springs would be applied to the called line. If it is desired to alter the number of substations on each line, it is only necessary to correspondingly alter the number of ringing current generators, the number of generator controlling relays for the same in each connector and the number of levels in the selector banks through which each group of connectors is accessible. It is also obvious that each group of selectors E may have access to a plurality of groups of contacts—that is, certain levels of said selector banks may have access to one group of subscribers' lines through the connectors, while certain other levels of said selector banks may have access to another group of subscribers' lines.

Having given a general description of the apparatus involved in the system, in order to give a complete understanding of my invention I will first describe how the calling subscriber A may extend connection to the called subscriber A^2. It will also be described how the subscriber A may make a reverting call—that is, call a subscriber upon his own line. We will assume that the number of the called subscriber A^2 is 120.

When the calling subscriber, after removing his receiver from the switch hook, operates his calling device for the first digit 1, the preliminary impulse sent over the ro-

tary conductor 24 passes from ground G′ through contact of the springs 12 and 10, over the said rotary conductor, springs of the cut-off relay 15, through the trip magnet 13, springs 69 and 70, springs 71 and the motor magnet 72 to battery B, thence through battery B to ground G. Although the circuit includes the motor magnet 72, the said magnet does not operatively energize and the trip magnet alone operates. The magnet 13, upon energizing, releases the plunger of the line switch C, allowing it to enter its bank, whereby the line conductors 24 and 25 are extended through the line switch bank springs 16 and 20 and 19 and 23 to the selector E. After the line switch C has operated, its master switch D operates in a well-known manner to advance the plungers of the remaining line switches of the group to which the switch C belongs to an idle trunk line. The engagement of the bank springs 18 and 22 closes an energizing circuit for the cut-off relay 15 of the line switch C. The said circuit extends from ground G^3 through contact of the springs 73, bank springs 18 and 22 and the said relay 15 to the battery lead 100. The relay 15, upon energizing, disconnects the line switch C from the substation trunk lines 24 and 25. The engagement of the bank springs 22 and 18 also extends a guarding potential from ground G^3 over the above-traced circuit and the conductor 74 to the private bank contacts of the calling line in the banks of all the conductors which have access to said line.

The foregoing operations have taken place while the dial was being rotated by the subscriber for the first digit. As the dial returns to normal position after being released, the spring 11 is forced into engagement with the spring 12 once momentarily, after which the spring 10 is once more forced into contact with the spring 12. Each time the spring 11 engages the spring 12 a circuit is closed from ground G′ through the said springs, vertical line 25, bank springs 16 and 20, side switch wiper 36 (in first position) and the vertical line relay 75 to the battery lead 100. The relay 75, upon energizing, completes a circuit from ground G^4 through the contact of springs 76 and 77, springs 78 and 79 and the vertical magnet 30 to the battery lead 100. Since only one impulse is delivered to the vertical line relay 75, the vertical magnet also receives only one impulse and operates in response thereto to raise the switch shaft and wipers one step. The final engagement of the spring 10 with the spring 12 at the substation causes a single impulse to be transmitted form ground G′ through the contact of said springs, over the rotary line conductor 24, bank springs 19 and 23, relay 80, side switch wiper 35 (in first position) and the rotary line relay 81 to the battery lead 100. The energization of the relay 80 is functionless at this time, as the bridge-cut-off relay remains held up through the resistance 82. The relay 81, upon energizing, closes a circuit from ground G^4 through the contact of springs 77 and 83 and the private magnet 32 to the battery lead 100. The private magnet, upon energizing and deënergizing, permits the side switch to pass from first to second position. The side switch wiper 33, upon reaching second position, completes a circuit from ground G^5 through said side switch wiper (in second position), interrupter springs 84 and the rotary magnet 31 to the battery lead 100. The rotary magnet thereupon begins to operate in a manner similar to that of a buzzer to rotate the wipers 26, 27, 28 and 29 over the contacts in the first row or level of the selector bank. The rotary magnet continues to advance the wipers step by step as long as the side switch remains in second position. If the first trunk line in the second level is idle, the side switch will be stepped from second to third position by the first operation of the rotary magnet. This is accomplished by a finger on the armature of the rotary magnet which presses down the armature of the private magnet when the rotary magnet is energized. If the first trunk is busy, however, the side switch is not tripped to third position upon the first energization of the rotary magnet, because the private bank contact of said busy trunk will be provided with a guarding potential, and as soon as the wiper 29 engages the said contact a circuit is closed from this guarded contact through the said wiper, relay 86, side switch wiper 34 (in second position) and the private magnet 32 to the battery lead 100. The armature of the private magnet, therefore, remains held up after the rotary magnet deënergizes and locks the side switch in second position. The relay 86, which is included in the locking circuit of the private magnet, is not operatively energized, due to the comparatively high resistance of the magnet 32. The side switch being locked in second position, the rotary magnet will continue to advance the wipers step by step until the private wiper 29 passes off the last guarded contact, whereupon the private magnet 32 deënergizes and permits the side switch to pass to third position, thereby breaking the circuit of the rotary magnet and allowing the wipers 26, 27, 28 and 29 to come to rest upon the contacts of an idle trunk. The engagement of the side switch wipers 35 and 36 with their third-position contact points extends the line connection through the selector E to the connector H. The side switch wiper 34, upon reaching third position, extends a guarding potential from ground G^6 through the wiper 34 (in third position),

relay 86, private wiper 29 to all the selector private bank contacts of the trunk line in the first and second levels. The said guarding potential is for the purpose of preventing any other first selector from obtaining connection with said trunk line. The lower private wiper 27, upon engaging the bank contact 58, completes a circuit through the generator controlling relay 52 at the connector H. The said circuit extends from ground G^5 through the side switch wiper 33 (in third position), conductor 87 and the said relay 52 to the battery B. This operation determines which party upon any one of the party lines to which the connector H has access is to be signaled.

The apparatus is now in readiness to receive the impulses for the last two digits of the number to be called. As the dial is drawn down to call the next digit, an impulse is sent over the rotary line and through the rotary line relay 50 of the connector switch H. This preliminary rotary impulse, as well as all succeeding preliminary rotary impulses, is without function, however, because in switches of the type shown herein the side switch cannot leave first position until after the vertical magnet has been energized once, and it cannot leave second position until after the switch shaft has been rotated one or more steps. As the substation dial returns to normal the vertical line is grounded twice, after which one impulse is sent over the rotary line. The vertical impulses for the digit pass from the substation over the vertical trunk line 25, conductor 89, vertical line relay 49 and the upper winding of the relay 90 to battery B. The relay 49, upon energizing, completes a circuit from ground G^7 through contact of the springs 92 and 91, private magnet springs 97, side switch wiper 44 (in first position) and the vertical magnet 41 to battery B. The digit called being 2, the vertical magnet receives two impulses over this circuit and operates to raise the switch shaft and wipers two steps. The rotary impulse passes from the substation over the rotary trunk line 24, conductor 98, contact of springs 99 and 101, rotary line relay 50, lower winding of the relay 90, springs 103 and 102 and springs 107 and 108 to battery B. The relay 50, upon energizing, completes a circuit from ground G^7 through contact of the springs 92 and 93, private relay 43, springs 106, 107 and 108 to battery B. The private magnet, upon energizing and deënergizing, causes the side switch to pass from first to second position. When the calling device is operated for the last digit 0, ten impulses are transmitted over the vertical line, followed by one impulse over the rotary line. The relay 49, upon energizing in response to the impulses for this digit, operates to complete the circuit of the rotary magnet 42, instead of the vertical magnet 41 as before, because the side switch wiper 44 is now in engagement with its second-position contact point. The rotary relay 50, upon energizing, completes the circuit of the private magnet in the same manner as before, thereby causing the side switch to pass from second to third position if the called substation is idle. The operations of the rotary magnet in response to the impulses for the third digit rotates the wipers 38, 39 and 40 onto the contacts 110, 111 and 112 of the desired line. The side switch wiper 45, upon reaching third position, closes a circuit extending from ground G^9 through the private wiper 39, conductor 113 and the cut-off relay 114 of the line switch C′ to battery B. The cut-off relay, upon energizing, disconnects the trip magnet 115 from the substation trunk lines. The side switch wiper 88, upon engaging its third-position contact point, closes a circuit extending from ground G^{10} through the side switch wiper, relay 54, springs 118 and 117, lower winding of the relay 90, springs 103 and 102 and the springs 107 and 108 to battery B. The relay 54, upon energizing, closes a circuit which extends from ground G^{10} through the side switch wiper 88 (in third position), relay 55, springs 120^a and 121 and the release magnet 48 to battery B. The relays 54 and 55 are both high resistance slow acting relays and do not permit the release magnet 48 to operatively energize when connected in series. The relay 55, upon energizing, opens the contact between springs 108, 107 and 106 and closes contact between the springs 108 and 109, thereby cutting off the battery supply to the relays 50 and 54. The relay 54, however, does not deënergize, as it now receives battery current through the substation talking circuit. The said circuit extends from ground G^{10} through the side switch wiper 88, relay 54, springs 118 and 117, relay 50, springs 99 and 101, over the heavy trunk conductor 98, through the substation A, over the return heavy trunk conductor 89, relay 49 and the upper winding of the relay 90 to battery B. The relay 54 is of such high resistance that the relays 50, 49 and 90 do not receive sufficient current to operatively energize. The circuit of the release magnet being held open at the springs 122 and 121, the connector switch H is prevented from releasing.

It now remains to signal the called subscriber. As soon as the ringing key 124^a is pressed, the circuit through the substation A is interrupted and the vertical line conductor 25 is grounded. This immediately closes a circuit through the relays 49 and 90 in series. The said circuit extends from ground G′ through the contacts of the key 124^a, over the vertical trunk conductor and through the said relays to battery. The

relay 90, upon energizing, completes a holding circuit for the relay 54 through contact of the springs 118 and 119. The relay 49, upon energizing, completes a circuit through the ringer relay 51. The said circuit extends from ground G[7] through the contact of springs 92 and 91, springs 97, side switch wiper 44 (in third position), springs 93 and 94 and the said relay 51 to battery B. The ringer relay, upon energizing, operates to disconnect the calling line from the called line and to connect the generator R with the called line over the following path: from the non-grounded terminal of the generator R through the contact of springs 124 and 125 (the relay 52 being energized), springs 68 and 126 of the ringing relay, springs 128 and 127 to the rotary line wiper 40, thence over the rotary line conductor 133 and through the substation condenser and bell to ground G[11], thus signaling the subscriber at substation A[2]. When the called subscriber answers, the substation talking circuit is bridged across the conductors 133 and 135, thus energizing the relay 134, which supplies talking battery current for the called subscriber. The relay 134, upon energizing, closes a circuit which extends from ground G[9] through the side switch wiper 45 (in third position), contact of springs 104 and 103, lower winding of the relay 90, rotary line relay 50, springs 99 and 101, through the calling subscriber's substation, over the return conductor 89, vertical line relay 49 and the upper half of the relay 90 to battery B.

When the conversation is completed the subscriber A, upon replacing his receiver upon the switch hook, grounds both the vertical and rotary line conductors momentarily, which immediately energizes the vertical and rotary line relays, the said rotary line relay, upon energizing, closing a circuit through the ringer relay 51. The ringer relay, upon energizing, immediately completes a circuit extending from ground over the rotary line conductor, through the contact of springs 101 and 137, relay 53, springs 120 and 119 and the release magnet 48 to battery B. The relay 53, upon energizing, operates to disconnect the line wipers 38 and 40 from the springs of the ringer relay 51, thus preventing a momentary impulse ringing current from being applied to the called line. Then as soon as the bridge across the calling line is open, the vertical and rotary line relays and the relay 90 deënergize, which immediately opens the circuit of the slow acting relay 54 at the springs 119 and 118. The relay 54, upon deënergizing, completes a circuit which extends from ground G[6] at the selector E, through the side switch wiper 34, release relay 86, conductor 138, springs 105, springs 122 and 121 and the said release magnet to battery B. The release magnet receives sufficient current over the circuit to operatively energize and, upon energizing, restores the switch shaft and wipers to normal. At the same time the relay 54 closes the circuit of said release magnet it also opens the circuit of the relay 55. The said relay being slow acting deenergizes in a short interval of time and opens the said release circuit at the spring 105. The release relay 86 of the selector E, upon energizing, closes a circuit through the release magnet 37. The release magnet 37, upon energizing, restores the switch shaft and wipers to normal and also closes a circuit through the release magnet 14 of the line switch C. The release magnet 14, upon energizing, restores the plunger of said line switch C to normal position.

It will now be explained how the subscriber at the substation A may call the subscriber A[3], whose substation is attached to the same trunk lines to which the substation A[2] is attached. We will assume the number of the substation A[3] to be 220. The calling subscriber will operate his dial in the same manner as before, operating the first selector E to raise its switch shaft and wipers two steps and to then connect its wipers 26, 29, 27 and 28 with the bank contacts 63, 62, 61 and 60, respectively, thus completing the connection to the connector switch H. It will be seen that in this case the lower private bank contact does not have a conductor leading to the connector H. The calling subscriber calls the remaining digits and the connection is completed in the same manner hereinbefore described. But in this case, when the ringing relay 51 energizes, the path of the ringing current extends from the non-grounded side of the generator R through the contact of springs 124 and 140, springs 67 and 141, springs 131 and 132, over the vertical trunk conductor 135, through the condenser and bells of the substation A[3], over the rotary conductor 133, springs 127 and 128, springs 126 and 68 and the springs 125 and 142 to ground at the generator R. The subsequent operations of the apparatus is the same as hereinbefore described. If the substation A′ had been the calling substation, the operation of the apparatus would have been exactly the same.

It having been explained how one subscriber establishes connection and releases the same, it will now be explained how a connection is prevented from being made with a busy line and how the calling subscriber receives a busy signal when calling a busy number. If the number called for is busy, there will be a guarding ground potential upon the connector private bank contact, just as explained in connection with the line switch C. Therefore, if the called line is busy, the private wiper 39 of the connec-

tor will be resting upon a grounded contact at the time when the last rotary impulse is delivered to the connector. As has been explained, this last rotary impulse causes the energization of the private magnet 43 of the connector H, thus completing a circuit extending from ground through the said private wiper, side switch wiper 45 (in second position), springs 143 of the relay 43 and the release magnet 48 to battery B. The release magnet, upon energizing, restores the connector switch shaft and side switch in the manner hereinbefore explained. The connector H being released, the side switch wiper 46 will be in contact with its first-position contact point, thereby connecting the busy signaling machine L with the calling line to give the calling subscriber the busy signal. The calling subscriber, upon receiving the busy signal, replaces his receiver upon the switch hook, and in so doing both sides of the line are grounded momentarily, causing the relays 49 and 50 of the connector H to energize, as hereinbefore explained. The line relays 49 and 50, upon energizing, complete a circuit extending from ground G^6 (selector E) through the side switch wiper 34, release relay 86, conductor 138, springs 93 and 96, springs 122 and 121 and the release magnet 48 to battery B. The release relay 86, upon energizing, causes the selector E and the line switch C to restore to normal, as hereinbefore explained.

It having been explained how one subscriber establishes and releases connection with another subscriber on a different line, it will now be explained how a subscriber on one line may establish connection with another subscriber upon his own line. We will assume that the subscriber A desires to call subscriber A′, whose substation number is 130. The subscriber A removes his receiver and calls the first digit 1, operating the line switch C and the selector E in the manner explained above. The subscriber then calls the next digit 3, which causes the connector switch to raise its switch shaft wipers three steps opposite the third row or level of bank contacts. The connector switch is then rotated ten steps in response to the impulses for the last digit and rotates its wipers onto the bank contacts 150, 151 and 152, which are connected to the normals of the calling line. Whenever a line is calling or being called, there is a guarding ground potential upon the private bank contact corresponding to said line, as has been explained heretofore. Therefore, it is readily seen that unless special means are provided, when one party on a polystation line attempts to call another substation upon the same line, the connection will be released on the rotary impulse following the last digit called and the calling subscriber is given a busy signal. The said special means are provided in the following manner: A relay 80 is placed in series with the rotary line conductor between the line switch C and the selector E. The relay 80 responds to each rotary impulse and operates to cause its springs 73 to separate, thus disconnecting the direct ground from the private bank contact 151 and placing a ground upon said contact through the resistance 82. The resistance 82 is such that it permits the connector switch to pass from second to third position without releasing, and yet does not permit the bridge-cut-off relay 15 of the line switch C to deënergize. The operations of the connector switch H are the same as hereinbefore explained, except that the signaling of the substation A′ takes place in the following manner: The ringing key 124^a, upon being depressed, opens the substation talking circuit and grounds the vertical conductor 25, energizing the vertical line relay 49 of the connector H and causing the ringing relay 51 to operate in the same manner as heretofore explained. The path of the ringing current extends from the non-grounded side of the generator R through the contact of springs 124 and 125 (the relay 52 being energized), springs 68 and 126, springs 128 and 127, over the rotary conductor 154, wiper 40, conductor 155, rotary line conductor 24, condenser and the bells of the called substation A′ to ground. A further result due to the energization of the ringer relay 51 is that the springs 101 break contact with the spring 99 and make contact with the spring 137, thus preventing the rotary line relay 50 from receiving ringing current and at the same time completing a circuit through the relay 53. This circuit extends over the above-traced circuit to the conductor 155 and from there over the rotary conductor 98, through the contact of springs 101 and 137, relay 53, springs 120 and 119 and the release magnet 48 to battery B. The resistance of the relay 53 is such that it does not permit the release magnet 48 to operatively energize. The relay 53, upon energizing, forms a new circuit for the ringing current of the generator R. The said circuit extends from the non-grounded side of the generator R through the contact of springs 124 and 125, springs 68 and 126, springs 128 and 129, springs 156 and 157 and springs 137 and 101 to the rotary conductor 98 and over said conductor through the substation A′ to ground. When the subscriber at the substation A ceases pressing the ringing key 124^a and the subscriber A′ answers, the subsequent operations of the connector are similar in all respects to those hereinbefore described.

There still remains one feature to describe—that is, when the substation A′ calls

the substation A upon his own line. We will assume the number of the substation A to be 230. The operations of the selector E and connector H will be the same as hereinbefore described. The subscriber A′, upon pressing the ringing key 159, causes the ringing relay 51 to energize, as explained above, which operation causes the substation A to be signaled in the following manner: The ringing relay 51, upon energizing, closes a circuit which extends from ground at the generator R through the springs 142 and 125, springs 68 and 126, springs 128 and 127, rotary conductor 154, normal conductor 155, conductor 98, springs 101 and 137, relay 53, springs 120 and 119 and the release magnet 48 to battery B. The relay 53, upon energizing, removes ground from the rotary conductor 154 and forms a locking circuit for itself extending from the non-grounded side of the generator R through the contact of springs 124 and 140, springs 67 and 141, 131 and 130, springs 160 and 157 and the relay 53, springs 120 and 119 and the release magnet 48 to battery B. The substation A is signaled over the following path: from the non-grounded side of the generator R through the contact of springs 124 and 140, springs 67 and 141, 131 and 130, 160 and 157, 137 and 101, over the rotary conductor 98 and through the bells and condenser at the substation A, over the vertical line 25, through the ringing key 159 of the substation A′ to ground. The subsequent operations of the apparatus are the same as hereinbefore described.

While I have illustrated and described certain embodiments of my invention, it will be understood that I do not wish to so limit myself, but that various modifications and changes may be made without departing from the scope of my invention.

What I claim as my invention is:—

1. In an automatic party-line telephone system having a series of party-lines, two separate stations on each party-line, telephone receiving and transmitting devices in each station, means by which a station may be telephonically connected with any other station in the system, and means by which the telephonic connection can be broken only by the receivers of both stations being hung on their respective hooks.

2. In a telephone system, a party line, an automatic connector switch at the exchange for extending a connection to said line, and means including a relay in said connector and circuits controlled thereby for signaling one of the stations on said line over the two sides thereof in series and for signaling the other station on said line over one side of said line and ground return.

3. In a telephone system, a party line, an automatic connector switch at the exchange for extending a connection to said line, means including a relay in said connector and circuits controlled thereby for signaling one of the stations on said line over the two sides thereof in series and for signaling the other station on said line over one side of said line and ground return, and a selector switch having access to said connector over two different paths, the path over which the connection is extended determining which of the said stations is to be signaled.

4. In a telephone system, means including a selector and a connector for connecting a calling and a called line, the said selector having access to said connector over a plurality of paths, a corresponding plurality of stations on the called line, means for performing a selective signaling operation on the called line, and a single relay deënergized if the connection includes one of said paths and energized automatically independent of the calling subscriber if the connection includes the other of said paths for controlling the selective signaling.

5. In a telephone system, means including a selector and a connector switch for connecting a calling and a called line, two separate contact sets in the bank of said selector associated with said connector either of which may be included in the connection, a plurality of stations on the called line, a single relay in said connector for determining which of said substations is to be signaled after the connection is completed, and a local energizing circuit for said relay closed automatically by said selector when a particular one of said contact sets is seized during the establishment of the connection.

Signed by me at San Francisco, San Francisco county, California, this 11 day of September, 1913.

ARTHUR L. PIPER.

Witnesses:
W. W. Healey,
G. M. Page.