

1,164,662.

G. E. MUELLER.
PARTY LINE TELEPHONE SYSTEM.
APPLICATION FILED AUG. 14, 1911.

Patented Dec. 21, 1915.

4 SHEETS—SHEET 1.

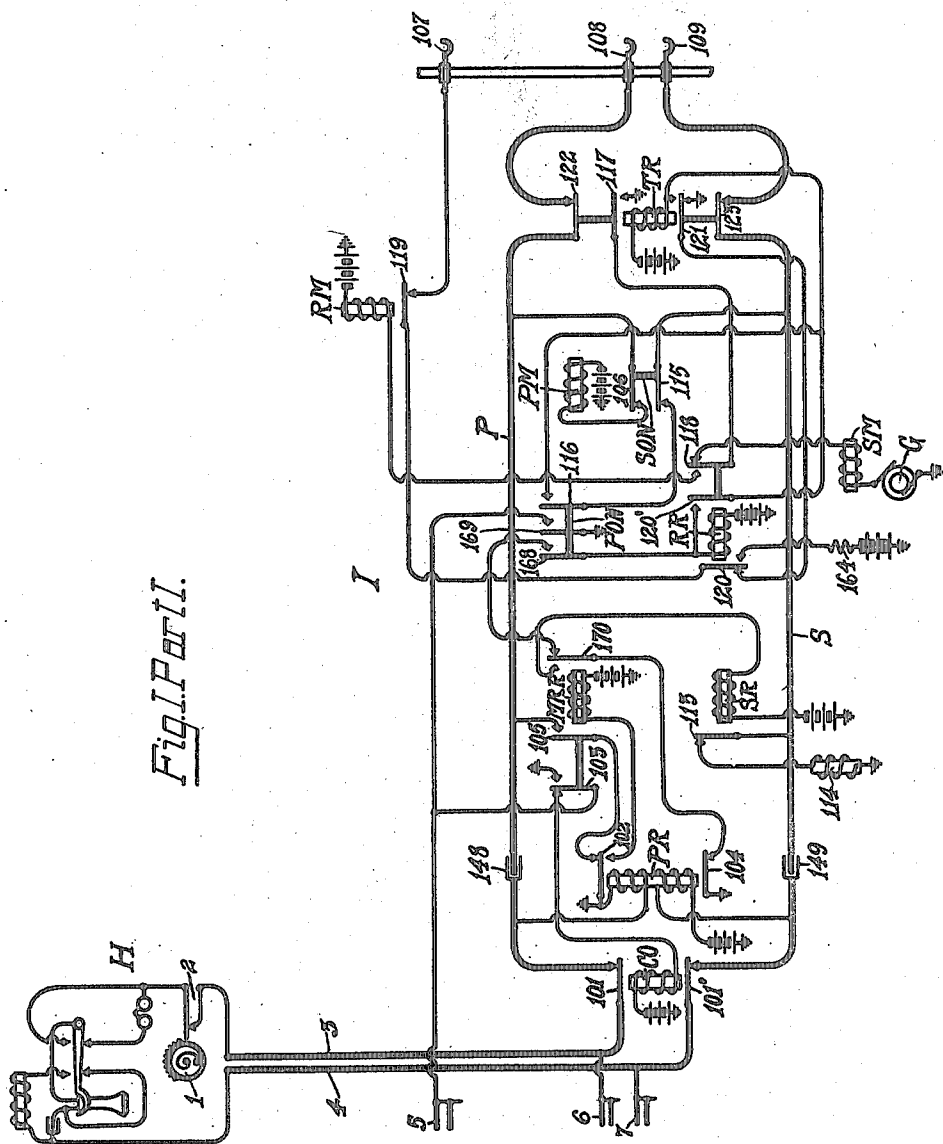


Fig. 1 Part I.

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4 SHEETS—SHEET 2.

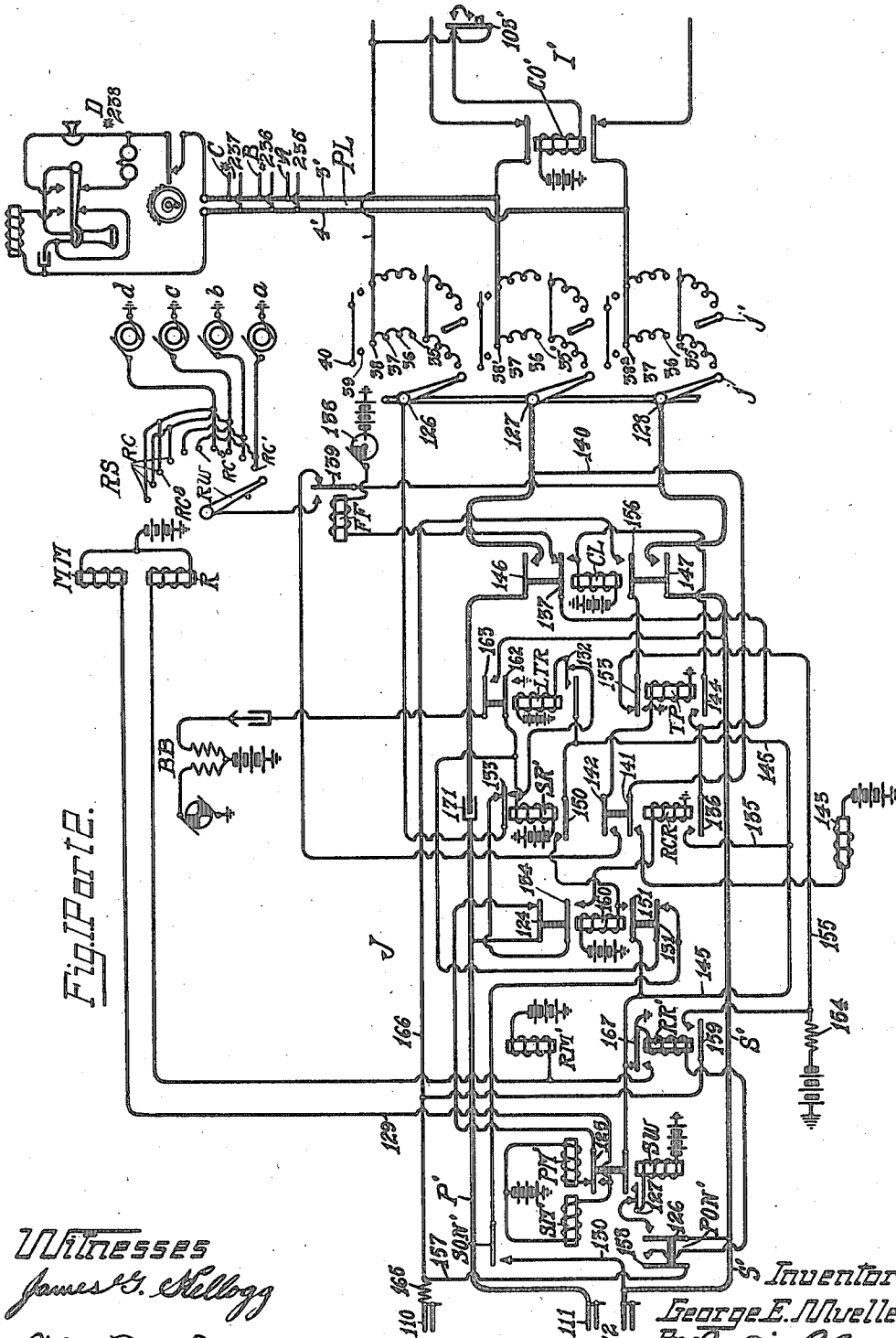


Fig. 1 Part 2.

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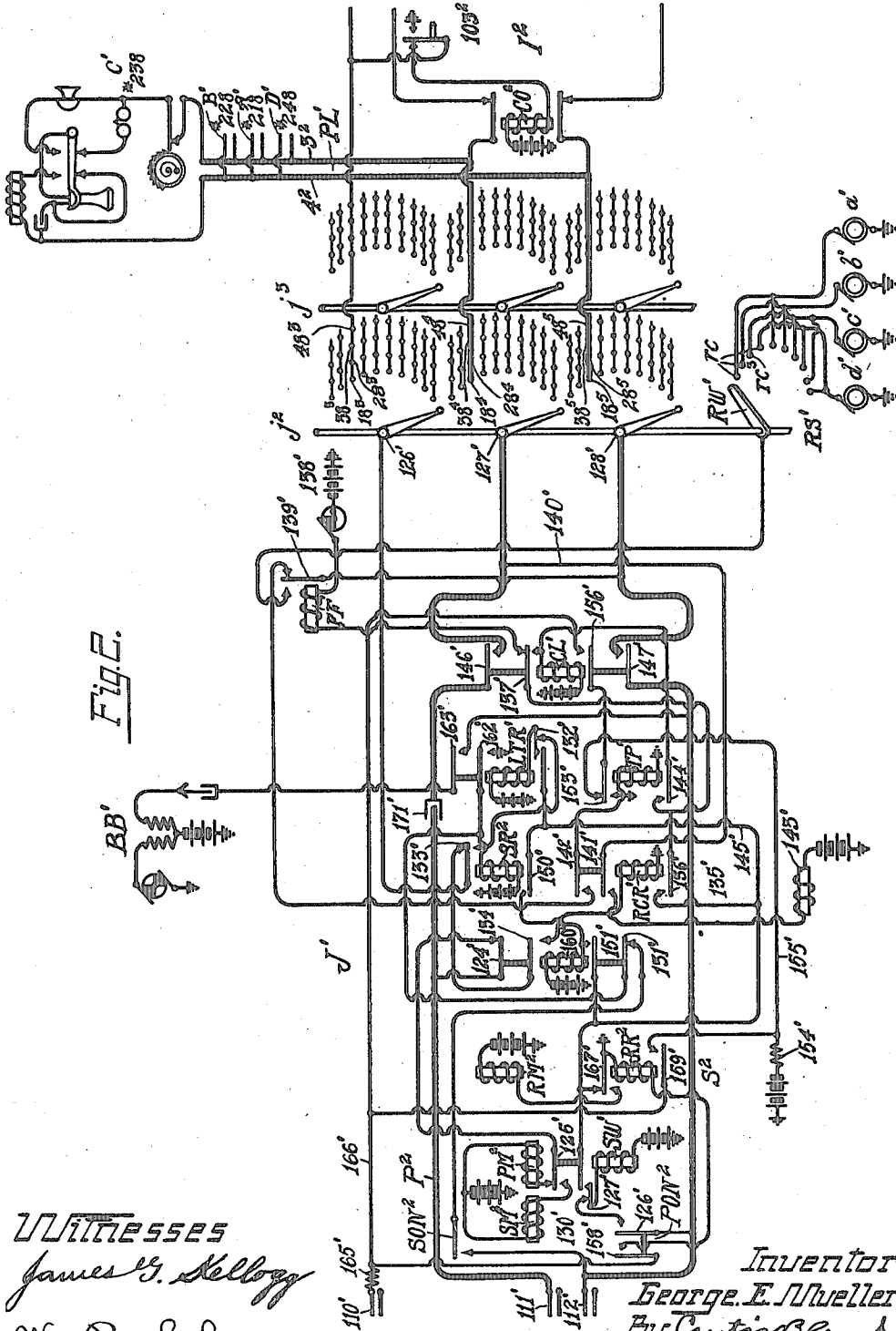


Fig. 2.

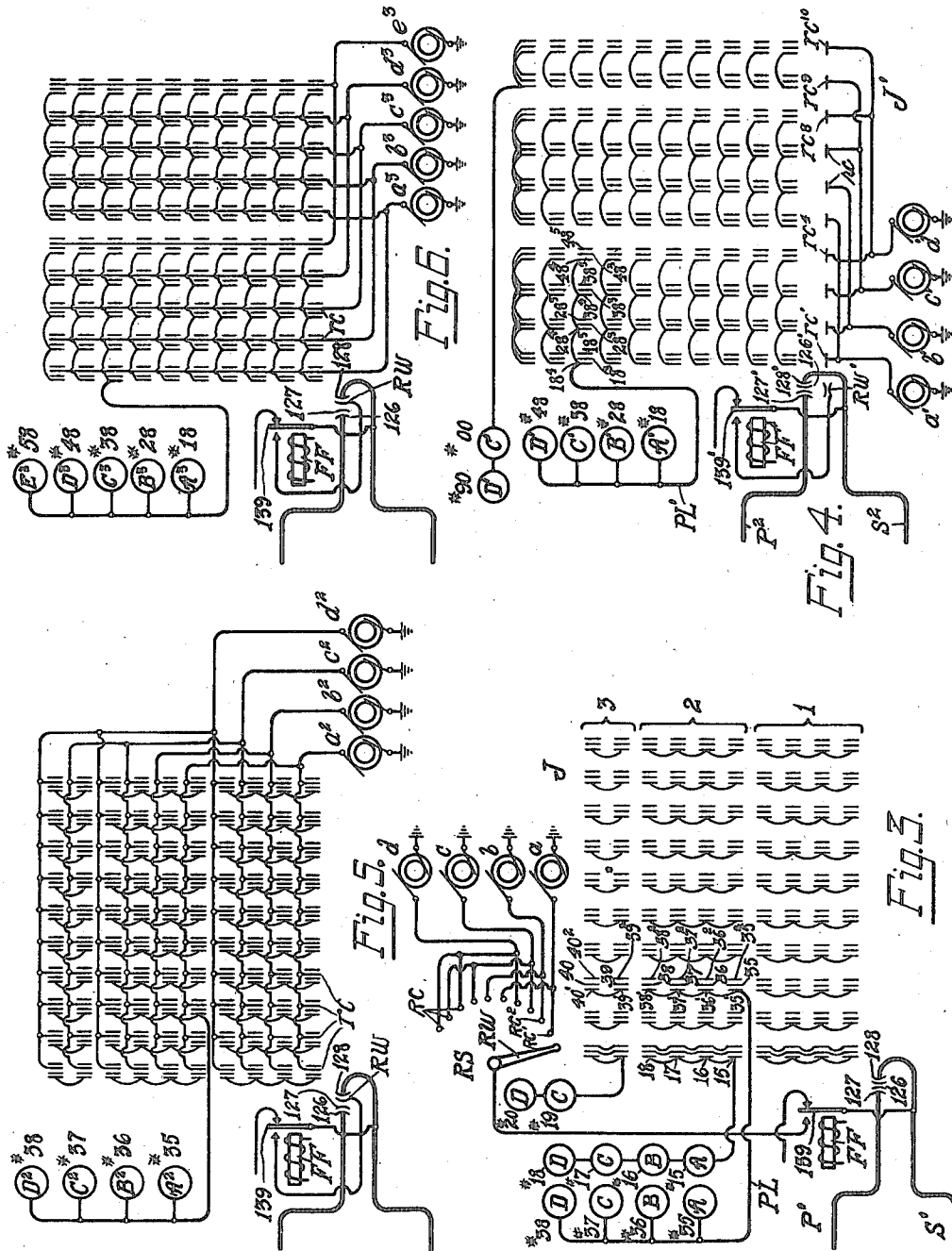
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4 SHEETS—SHEET 4.



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UNITED STATES PATENT OFFICE.

GEORGE E. MUELLER, OF LA GRANGE, ILLINOIS, ASSIGNOR TO KELLOGG SWITCHBOARD & SUPPLY COMPANY, OF CHICAGO, ILLINOIS, A CORPORATION OF ILLINOIS.

PARTY-LINE TELEPHONE SYSTEM.

1,164,662.

Specification of Letters Patent.

Patented Dec. 21, 1915.

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To all whom it may concern:

Be it known that I, GEORGE E. MUELLER, a citizen of the United States, residing at La Grange, county of Cook, State of Illinois, have invented certain new and useful Improvements in Party-Line Telephone Systems, of which the following is a specification.

My invention relates to signaling systems for use in connection with telephone systems in which directly controlled switches are employed for establishing connection between calling and called subscribers and more particularly to the class of systems in which a connector switch is adapted to connect with substations equal in number to the sets of terminal contacts of the switch, or the number of connecting positions to which the wipers may be moved, an object being to provide an improved method of associating the proper one of a number of ringing currents of different electrical character with line terminals of the called substation, other features of my invention being more particularly pointed out in the appended claims.

While I have preferably illustrated my invention as operating in connection with a full automatic telephone system it is to be understood that it is also applicable to semi-automatic telephone systems and to all systems in which directly controlled switches are used for connecting with a called substation telephone line.

For a more complete understanding of my invention reference is to be had to the accompanying drawings in which like reference characters indicate like parts and in which the parts are shown in their normal position.

In the accompanying drawings Figure 1 which consists of Parts 1 and 2 illustrates diagrammatically an automatic telephone system embodying one form of my invention; Fig. 2 illustrates another form of connector switch adapted to be used in place of the connector switch of Fig. 1, Part 2; Fig. 3 illustrates diagrammatically the method of wiring the bank contacts of a connector switch such as illustrated in Fig. 1, Part 2; Fig. 4 illustrates the arrangement of the bank contacts and method of wiring of a connector switch such as is illustrated in Fig. 2; Figs. 5 and 6 illustrate modified forms of bank wiring for the connector

switch of Fig. 2 but providing a ringing terminal individual to each set of line terminals instead of common ringing terminals such as shown in Figs. 2 and 4.

For use in connection with the circuits or system as illustrated in the accompanying drawings an automatic switch such as is shown in the patent to William Kaisling, for a switch, No. 975,530, is adaptable, although it is to be understood that I do not limit the application of my invention to the use of the particular switch referred to. The switch in the patent referred to comprises in general, one hundred sets of bank contacts divided into ten rows of ten contact sets each. The rows are formed in an arc of a circle and arranged in a vertical plane, while the ten rows are arranged in an arc of a circle, that is, the contact ends are disposed as though projecting through the inner surface of a hollow sphere. A set of wipers are provided for cooperation with the contact sets and a primary magnet and associated mechanism is adapted to rotate the wipers in a primary direction to select a row of contacts and a secondary magnet and associated mechanism is provided for rotating the wipers in a secondary direction to connect with a contact in the selected row. A set of so-called primary off normal contacts are adapted to be moved to an alternate position upon the first primary step of the wipers and a set of so-called secondary off normal contacts are provided which are adapted to be moved to an alternate position upon the first secondary step of the wipers. In adjusting the wipers during the operation of the switch, they are stepped ahead against spring tension, and to release the switch a release magnet is provided which upon energization withdraws the retaining pawls, thus allowing the wipers to be restored by the tension springs. In the restoration of the switch, the wipers first restore from their secondary movement wiping back over the contacts over which they had been advanced and upon being restored from this secondary adjustment they are automatically restored from their primary adjustment by a second tension spring. Upon their restoration from the secondary adjustment the secondary off normal springs are restored to normal and upon restoration of the wipers from their primary movement the primary off normal springs are restored.

The above description of the switch is given that a general understanding thereof may be had, but for a more complete understanding the patent above named may be referred to.

Referring now more particularly to the drawing Fig. 1, Parts 1 and 2, the system there illustrated includes a calling substation H and a called line PL to which is connected four substations A, B, C and D. The system as illustrated is adapted for one thousand substations, although it is to be understood that the size of the exchange is immaterial so far as the application of my invention is concerned. Connected to each line in the exchange is a first selector switch I, the lines being divided into groups of one hundred substations and there being ten connector switches J provided for each one hundred substations.

I preferably have illustrated a so-called two-wire or metallic line system in which the switches are directionally controlled responsive to interruptions of the metallic circuit of the calling line. Each substation comprises a well known substation telephone together with a calling device including a dial 1 and impulse springs 2, the operation being such that to cause interruptions of the metallic circuit of the telephone line the dial 1 is rotated in a clockwise direction until the proper number of teeth have passed downward below the upper contact spring 2. In this forward motion of the dial the contact of impulse springs 2 is not interrupted, but when the dial is released by the operator it is restored by the spring shown thereon and in its return movement the impulse springs are interrupted according to the number of impulse teeth which were initially moved beyond the upper spring 2. The line conductors 3 and 4 connect the substation with its first selector I.

Each first selector includes one hundred sets of bank contacts and a set of cooperating wipers. A primary magnet PM is provided for adjusting the wipers in a primary direction and a secondary magnet SM is provided for giving the wipers a secondary adjustment. A release magnet RM is adapted when energized to allow restoration of the wipers. Upon the first primary step of the wipers the primary off normal switch PON moves to its alternate position while upon the first secondary step of the switch the secondary off normal contacts SON are moved to their alternate position. The primary relay PR is connected in bridge of the telephone line, the said relay being energized upon initiation of a call, and being adapted when its circuit is interrupted, due to the operation of the calling device, to transmit impulses corresponding in number to the interruptions, these impulses serving to operate the wiper adjusting magnets. A

main release relay MRR, which is a slow acting relay, is adapted upon initiation of a call to be energized, and to maintain its armature in an attracted position until the receiver is replaced at the calling substation. A secondary relay SR, which is also a slow acting relay, is adapted to transmit a so-called secondary impulse which follows each set of primary impulses. A release relay RR is provided for controlling the operation of release magnet RM when the calling subscriber replaces his receiver, and a test relay TR is also provided for controlling the selection of an idle connector switch. For connecting to the line of substation H as a called line, terminals 5, 6 and 7 are provided, said terminals being multiply connected bank contacts of connector switches having access to the line of substation H. While I have shown a line of substation H as a single party line, it is to be understood that this line may be a party line and arranged as the line shown in Fig. 1, Part 2.

The connector switches J comprise one hundred sets of bank contacts, and a set of cooperating wipers, said wipers being adapted to be advanced in a primary direction to select a group of contacts, by means of a primary magnet PM', and thereafter are advanced in a secondary direction to step into engagement with terminals of the called line by means of a secondary magnet SM'. A switching relay SW is also provided for disconnecting the primary magnet PM' after it has been operated, and connecting the secondary magnet SM' in circuit so that it may be operated by the last set of impulses. The release relay RR' is adapted when energized to effect the operation of a release magnet RM' which controls the restoration of the connector switch wipers to normal. A line-test-relay LTR is adapted after the wipers have connected to the terminals of the desired line, to test them to determine their idle or busy condition, whereby if busy, a busy signal is transmitted to the calling subscriber from busy-back apparatus BB, and if idle a ringing control relay RCR is energized, which effects the operation of a so-called flip-flop relay FF, which is periodically energized and deenergized to intermittently connect ringing current to the terminals of the called line. Upon response of the called subscriber a so-called tip relay TP is energized thereby causing disconnection of the ringing current.

As shown in Fig. 1, Part 2, the telephone line PL is a so-called party line having four substations A, B, C and D connected thereto, the call bells of the said substations being of the well known harmonic type, their rate of vibration being in harmony with the frequency of the four generators

a, *b*, *c* and *d*, respectively. Each four-party line such as PL is multiply connected to four sets of bank terminals at 35, 36, 37 and 38 so that connection to said line PL may be made through any of the four said sets of contacts, but to select a proper ringing current to ring the bell of the desired substation on the line, a ringing switch RS is provided. The switch RS comprises ten contacts RC, equal in number to the sets of bank contacts in the rows, and a cooperating wiper RW, the said wiper being mounted upon a shaft in a suitable manner, said shaft carrying a suitable ratchet wheel. To rotate the wiper RW a motor magnet MM and associated pawl mechanism is provided which is adapted to act upon the ratchet wheel and thereby step the wiper RW into successive engagement with its associated ringing contacts RC. A tension spring is associated with the wiper shaft as is also a check pawl, the shaft being advanced against the tension of said spring, and to release the wiper a release magnet R is provided which is adapted when energized to withdraw the retaining pawl allowing the wiper RW to be restored by the spring, all of the above mechanism being of well known construction.

The last set of impulses which step the connector switch wipers into engagement with the terminals of the desired substation on the called line, also effect the operation of magnet MM, part of the current passing through secondary magnet SM and part through motor magnet MM, so that the ringing wiper RW is advanced a number of steps equal to the number of secondary steps taken by the connector switch wipers, so that this last set of impulses determines the selection of a generator *a*, *b*, *c* or *d* of the proper frequency which will be connected to the terminals of the called line and is adapted to ring selectively the bell of the desired substation.

Connector switches J are each provided with sets of bank contacts, preferably one hundred sets as previously stated, each contact set being for a definite substation. The substation telephones are divided into groups of one hundred and there are ten connector switches J for each such group. In Fig. 1, Part 2, I have shown my invention as embodied in a so-called four party line telephone system, that is, in which there are four substations as A, B, C and D connected to a so-called party-line PL, and each such party-line as PL is multiply connected to the ten connector switches having access thereto, in the illustration, the contact sets *j* and *j'* representing bank contacts of two such connector switches J. Furthermore, each party line PL is multiply connected at each connector switch J having access thereto, to bank contact sets, equal

in number to the substations connected to the line, there being four such substations and four contact sets illustrated in Fig. 1, Part 2. The relative position in the bank, of these multiple contacts, determines the last two digits of the numbers of the substations on a line, as is well known and as may be pointed out more clearly in Fig. 3, the said figure representing more clearly the multiple connections of the bank contacts of connector switch J.

In Fig. 3 substations A, B, C and D are shown connected to a line PL which is multiply connected to contact sets 35, 36, 37 and 38, thus these four substations A, B, C and D have assigned to them, as the last two digits of their telephone numbers, the numbers 35, 36, 37 and 38, respectively, the other digits of their number of course being determined by the hundred group with which they are associated, as is well known. Thus it will be seen, that in operating the connector switch to connect with any one of the substations #35, #36, #37 or #38, the wipers are advanced three steps to select the third group of contacts which includes the terminals of the four substations referred to, and thereafter if it is desired to connect to telephone #35 for instance, five secondary steps of the wipers are effected, thereby connecting them to contact set 35', thus the last number of impulses or steps determining the contact set connected with. Referring now to the other four substations shown in Fig. 3, #15, #16, #17 and #18, to connect with the terminals of substation 15 for instance, a single step of the wipers is first effected to select the first group of bank contacts, and thereafter five secondary steps of the wipers are effected to connect with the contact set 15. From the above it will readily be seen how the numbering of the substations corresponds with the relative position of the contact sets in a bank. Although in Fig. 3 I have shown but one of the contact sets, as 15, 16, 17, 18, having its three contacts multiply connected, it is to be understood that the three contacts in each set are multiply connected according to the multiple connection of the single contact as shown. Thus with ten connector switches J having access to each four-party line and each four-party line being multiply connected to four sets of contacts at each switch, it will be seen that each such party line is multiply connected to forty sets of contacts, and connection may be made to such a line from any one of the multiply connected contacts.

The ringing switch RS has its first four contacts RC connected to the generators *a*, *b*, *c*, *d*, the second set of four contacts RC being also connected to said generators, while the last two ringing contacts RC are connected to ringing generators *d*, *c*. As

the ringing switch wiper RW travels a number of steps corresponding to the secondary travel of the connector switch wipers 126, 127, 128, it will be seen that the first four ringing contacts RC are adapted for association with any one of the ten lower sets of multiple bank contacts in group 1, the next four ringing contacts RC are adapted for association with the ten bank contact-sets of group 2, and the last two ringing contacts RC are adapted for association with the ten bank contact-sets group 3. From the diagram, Fig. 3, it will be seen that the multiplied contact sets, groups 1 and 2 are adapted for four party line service, while the multiple contact-sets of the group 3 are adapted for two party line service.

In the approved telephone systems of the present day, that is, systems in which directionally controlled connector switches are used for establishing connection with a called line, it is the practice to use one hundred sets of bank contacts, divided into ten groups of ten contact sets each, and in the successful harmonic ringing systems of the present time four frequencies are generally used, 16, 33, 50 and 66 cycles. Upon reference to Fig. 3, it will be noted that but four different frequencies are used and the contacts being divided into groups of ten sets each, there are two sets of four contacts to each group, leaving two sets of contacts in each group which are also multiply connected. Thus in applying my invention as shown in Fig. 3, each group of ten contact sets are adapted for two four-party lines and the remaining two contact sets are adapted for connection as a two party line or in any other desirable manner. Therefore, with a multiple arrangement as in Fig. 3 a connector switch is adapted to connect with twenty four-party lines and ten two-party lines.

The different substations and ringing generators which are adapted for association are designated by like reference letters, the substations being designated by the capitals, such as A, B, C and D, and the generators being designated by the small letters a, b, c, and d.

Operation of Fig. 1.—Having described in general the system of Fig. 1, its method of the operation will now be given. Assuming now that the subscriber at substation H desires connection with substation D whose telephone number is 238, the subscriber at H first removes his receiver from its switchhook, thereby closing the upper switchhook contacts and establishing a circuit for the primary relay PR traced from ground through the upper winding of said relay PR, contact 101, line conductor 3, substation H, returning over line conductor 4, normal contact 101; and the lower winding of

relay PR to battery. Said relay PR is therefore energized establishing a circuit for main release relay MRR traced from ground, through alternate contact 102 and the winding of relay MRR to battery, energizing the said relay, closing alternate contact 103, thereby connecting ground to the multiple contacts 5 rendering them busy and preventing any connector switch from making connection with the line of substation H. The subscriber at H now operates the dial 1 to cause two interruptions of the impulse springs 2, thereby interrupting the energizing circuit of relay PR two times, causing two retractions of its armature. Responsive to the first deenergization of relay PR, a circuit for secondary relay SR is established from ground through normal contact 104, alternate contact 170 and said relay SR being a slow relay maintains its armature attracted until the cessation of the primary impulses, due to impulses over the circuit just traced. Relay MRR also being a slow acting relay maintains its armature attracted during the interruptions of its circuit while relay PR is vibrating. Also responsive to the two interruptions of the circuit of relay PR, two current impulses are transmitted through primary magnet PM traced from ground at normal contact 102 of relay PR, alternate contact 105 which it will be remembered is maintained closed, conductor P, normal contact 106 of secondary off normal switch SON, and the winding of magnet PM to battery, resulting in two energizations and deenergizations of said primary magnet and effecting two steps of the wipers 107, 108 and 109 to select the second group of bank contacts which includes contacts 110, 111 and 112, which are the contacts leading to connector switches associated with the second hundreds group and which have access to the line of substation D. After the final primary impulse has been transmitted from relay PR, the said relay remains energized by current over the line as before, thus maintaining contact 104 open long enough for relay SR to deenergize, thereby closing its normal contact 113. This closing of contact 113 effects the energization of test relay TR traced from ground through impedance coil 114, normal contact 113, conductor S, normal contact 115, alternate contact 116 of primary off normal switch PON, which had moved to its alternate position upon the first primary step of the wipers, through the winding of relay TR to battery. Relay TR is thereupon energized, closing a circuit for the secondary magnet SM traced from ground through alternate contact 117, normal contact 118 and the winding of magnet SM to alternating current generator G. Responsive to the first impulse of current from said generator G, magnet SM steps the wipers 107, 108 and

109 into engagement with the first set of contacts 110, 111 and 112, respectively of the second selected group, and assuming these contacts lead to a busy connector switch J there will be a ground potential upon the test contact 110. Therefore, a maintaining circuit for test relay TR is established from the grounded contact 110, wiper 107, normal contact 119, normal contact 120, alternate contact 121 and the winding of relay TR to battery, maintaining test relay TR energized and therefore magnet SM advances the wipers another step, and continues to advance said wipers until an idle set of contacts 110, 111 and 112 is connected with. Such an idle set has no ground potential upon its test contact 110, as its associated connector switch is in the condition as shown in Fig. 1, Part 2, and therefore relay TR deenergizes, interrupting the circuit from magnet SM and preventing any further advance of the wipers 107, 108, 109. During the secondary movement of the said wipers, the line wipers 108, 109 are maintained disconnected due to the opening of contacts 122, 123 of relay TR.

Upon deenergization of relay TR normal contact 121 thereof is closed, thus connecting ground through wiper 107 to multiple contacts 110, maintaining it busy and preventing any other first selector switch from connecting with the selected connector switch J. The line of substation H has now been extended to the connector switch. The subscriber at H now operates dial 1 to cause three interruptions of the circuit of relay PR, thereby transmitting three current impulses through normal contact 102 and also again energizing secondary relay SR maintaining said relay energized until the cessation of said impulses. The three impulses from ground through normal contact 102 are traced through alternate contact 105, conductor P, normal contact 122, wiper 108, contact 111, conductor P', normal contact 124, normal contact 125 and the winding of primary magnet PM' to battery, effecting three distinct energizations of magnet PM' and causing three primary steps of wipers 126, 127 and 128 to select the third group of bank contacts which includes the terminals of the line of substation D. Following the primary impulses, as before, a secondary impulse is transmitted from ground through normal contact 113 of relay SR, conductor S, normal contact 123, wiper 109, contact 112, conductor S', alternate contact 126, normal contact 127 and the winding of switch relay SW to battery, energizing the said relay which establishes a locking circuit for itself through alternate contact 127 to ground and normal contact 167. Upon energization of relay SW, contact 125 is moved to its alternate position, thereby disconnecting the primary magnet PM' and connecting the sec-

ondary magnet SM' and magnet MM of the ringing switch RS to the primary conductor P'.

The next step in establishing the connection, is the operation of dial 1 to cause eight interruptions of the circuit of relay PR, corresponding in number to the last digit of the number 238, which is the telephone number of the called substation. Responsive to the eight interruptions of the circuit of relay PR relay SR is energized and maintained energized until the cessation of said impulses, as before, while eight impulses are transmitted from ground through normal contact 102 over the previously described path to conductor P' of connector switch J, normal contact 124 to alternate contact 125, dividing at this point, part of the current flowing through secondary magnet SM' to battery and part of the current over conductor 129 and the winding of motor magnet MM to battery. Eight distinct operations of magnet MM are effected by the said eight impulses, thereby stepping the ringing-wipers RW into engagement with ringing-contact RC's, while the eight impulses through magnet SM' effect eight steps of the wipers 126, 127 and 128 to engage the contacts 38, 38', and 38" which are terminals of substation D on the line PL.

In the operation of the system as just described it will be seen that the last set of impulses connects the connector wipers to the terminals corresponding to the desired substations of the called line and also operates the ringing switch RS to pick out the ringing machine of the proper electrical character, in this instance generator *d*, which is adapted to signal selectively, the called substation D.

Called line idle.—The next step is to test the terminals of the called line to determine its idle or busy condition, this being effected by the last secondary impulse which follows the last set of primary impulses, said secondary impulse being traced from ground through normal contact 113 of relay SR over the previously described path to bank contact 112, conductor 130, secondary off normal contact SON', which has moved to its alternate position upon the first secondary step of the connector switch wipers, normal contact 131 and the winding of relay SR' to battery energizing the said relay.

Upon energization of relay SR', a path for current through relay 160 is closed at alternate contact 150, being traced from battery through said relay 160, alternate contact 150, conductor 145, to ground at normal contact 167, causing the energization of relay 160 which is locked up, through contact 151 and opening its contacts 124, 131, thereby disconnecting the stepping magnets SM', MM, and relay SR' from the conductors P' and S', respectively. Also responsive to en-

energization of relay SR' the line test relay LTR is connected to the test contact 38, over a path retraced from battery through the winding of relay LTR, normal contact 132, alternate contact 133, test wiper 126, and the multiple test contact 38. Assuming the line PL of substation D is idle, there will be no ground connection to its test terminal 38, but the said test terminal will be in the condition shown in Fig. 1, Part 2, that is, connected through normal contact 103' to battery through the winding of cut-off relay CO'. Therefore, there being no path for a flow of current through the winding of relay LTR, said relay does not energize, and due to the interruption of the circuit of relay SR' by the opening of contact 131 of relay 160, relay SR' deenergizes retracting its armature and closing normal contact 133, connecting ringing control relay RCR to the test terminal 38. This connection causes the energization of said relay RCR and of the cut-off relay CO', the energizing path being traced from ground through the winding of said relay RCR, alternate contact 134, normal contact 133, wiper 126, contact 38, normal contact 103' through the winding of relay CO' to battery. The energization of relay CO' removes the substation control of the first selector switch I', while the energization of relay RCR is effective to start relay FF to intermittently connect ringing current to the terminals of the called line, this being accomplished in the following manner: Upon energization of relay RCR a circuit for relay FF is established from ground through normal contact 167 of relay RR', conductors 145, 135, alternate contact 136, normal contact 137, winding of relay FF and interrupter 138 to battery. Due to the interruptions of the last traced circuit by the interrupter 138, the so-called flip-flop relay FF is alternately energized and deenergized, thereby alternately closing normal and alternate contacts 139 thereof.

Upon the first energization of relay FF, ringing current is applied to the terminals of the called line, being traced from generator Z through contact RC', wiper RW, alternate contact 139, wiper 128, terminal 38', conductor 4', through the condenser and call bell of substation D, returning over conductor 3', terminal 38', wiper 127, conductor 140, alternate contact 141, impedance coil 143 and battery to ground. Although the bells of the other three substations A, B and C are in bridge of the line PL, only the bell of substation D is rung for the reasons previously set forth. Relay FF continues in its operation, thus causing the intermittent ringing of the call bell of substation D.

Returning now to the ringing control relay RCR, upon its energization as previously referred to, alternate contacts 141 and 142 are closed, the closing of alternate contact

141 connecting battery through impedance coil 143 to the wiper 127 and terminal 38', while the closing of alternate contact 142 connects the grounded tip relay TP through normal contact 139 of wiper 128 and terminal 38', the relay TP and battery being thus connected in bridge of the called line PL, but a flow of current through relay TP is prevented, due to the condenser which is in bridge of the line at each substation. Upon each energization of relay FF the relay TP is disconnected from the line terminal 38', being again connected upon each deenergization of relay FF.

Upon response of the called subscriber who removes the receiver from its switchhook at substation D, the upper switchhook contacts are closed, thereby establishing a path for direct current through substation D, so that upon the first deenergization of relay FF after such removal of the receiver at the called substation, relay TP is energized by current traced over the following path, from ground through the winding of relay TP, contact 142, normal contact 139, the wiper 128, contact 38', over the line and substation D back to terminal 38', wiper 127, conductor 140, alternate contact 141 and impedance coil 143 to battery. The so-called tip relay TP is therefore energized and by means of its alternate contact 144 closes the circuit for the circuit-closing relay CL traced from ground at normal contact 167, conductor 145, conductor 135, alternate contact 136, alternate contact 144, the winding of relay CL to battery, energizing relay CL and due to the opening of its normal contact 137 it interrupts the circuit of relay FF which therefore remains inert. The relay CL upon its energization also establishes a locking circuit for itself through alternate contact 137 over a path which is in multiple with the initial energizing circuit through contact 144, to ground at normal contact 167, thus removing the control of relay CL by the contact 144 of the tip relay TP. The closing of alternate contacts 146-147 of relay CL, establishes the continuity of the talking circuit between the calling and called substation, this circuit being traced over the heavily marked conductors and having the condensers 148, 149, 171, interposed therein. The talking battery for the substation H is supplied through the winding of the primary relay PR while talking battery for the called substation D is supplied through impedance coil 143 and the tip relay TP over the previously described path.

Should connection be desired with one of the other substations on the line PL, for instance substation A whose number is 235, the calling subscriber would proceed as before, but the last set of impulses would be five in number instead of eight, the last five impulses stepping the wipers 126, 127 and

128 into connection with terminals 35, 35' and 35² and stepping the ringing wiper RW into connection with ringing contact RC⁵. This is followed by the last secondary impulse as before and if the line PL is idle the relays operate as previously described, the relay FF in this instance connecting generator *a* to the terminals of line PL, the said generator being of a frequency to ring only the bell of substation A without affecting the other call bells in bridge of the line PL. From this it will be seen that in the application of my invention as disclosed in Fig. 1, Part 2, and Fig. 3, that the impulses which control the operation of connector switch J also control the selection of a ringing machine of the proper electrical character to call the desired substation selectively.

Release of switches.—After the subscribers have finished conversation, by replacing their receivers upon their respective switchhooks, the release of the switches used in establishing the connection is effected, the calling subscriber controlling the release of first selector I and the called subscriber controlling the release of connector J. Assuming the calling subscriber at H to be the first to replace his receiver upon its switchhook, the circuit of relay PR is interrupted, thereby causing its deenergization, and due to the opening of its alternate contact 102 the circuit of relay MRR is interrupted. Relay MRR being a slow-acting relay maintains its armature momentarily attracted after the opening of its circuit and a circuit for relay SR is momentarily established from ground at normal contact 104 of relay PR through alternate contact 170 and the winding of relay SR to battery, energizing said relay and disconnecting ground from the secondary conductor S, due to the opening of normal contact 113, relay SR thereafter having its circuit interrupted when relay MRR deenergizes, allowing relay SR to retract its armature. This operation of relay SR at this time is incidental and has no effect upon the circuit. Also due to the relay MRR maintaining the armature attracted after deenergization of relay PR, ground is connected to the primary conductor P through normal contact 102 and alternate contact 105, this also being an incidental operation and not affecting the proper operation of the circuits.

Upon retraction of the armature of relay MRR, its normal contact 103 is closed, establishing a circuit for the relay CO from ground at contact 169, causing the energization of relay CO, which is maintained energized until the switch I has restored to normal, whereby contact 169 is opened, interrupting its circuit, allowing relay CO to deenergize and restoring the control of first selector I to the substation H. Also upon the retraction of the armature of relay

MRR, a circuit for release relay RR is established from ground at normal contact 104 of relay PR, normal contact 170, alternate contact 168 and the winding of relay RR to battery, causing its energization whereby its contact 120' is closed, establishing a circuit for relay TR, causing its energization. Also upon energization of relay RR battery is momentarily connected to the wiper 107 through resistance 164, alternate contact 120 and normal contact 119, but this battery connection to wiper 107 and contact 110 has no effect upon release relay RR' of connector switch J, as at this time the winding of said relay RR' is shunted by the direct ground traced through alternate contact 153 of the tip relay TP, alternate contact 156, conductor 166 to the contact 110, this shunt preventing an energization of relay RR' at this time. This connection of battery to the wiper 107 and terminal 110 is effective to cause the release of connector switch J when connected to a busy line, or should a called subscriber fail to respond. Responsive to said energization of relays RR, TR, a circuit for release magnet RM is established from ground through alternate contact 117 of relay TR, alternate contact 118, the winding of magnet RM to battery, causing its energization and effecting the withdrawal of the retaining pawls and allowing the restoration of wipers 107, 108 and 109. Upon restoration of said wipers, switch SON is first restored and thereafter switch PON is restored and due to the opening of its contact 168 the circuit for relays RR and TR is interrupted, causing their deenergization, followed by the deenergization of release magnet RM, due to the opening of its circuit at said relays. The opening of contact 169 of switch PON removes the ground connection from the test terminals 5, also allowing deenergization of relay CO as previously stated. First selector I having been restored to normal, is available for use in establishing other connections, and the line of substation H is now also in condition for use. The called subscriber at D now replacing his receiver upon its switchhook, interrupts the previously described circuit from battery through impedance coil 143 over line PL and back through tip relay TP to ground, causing the deenergization of relay TP. Upon deenergization of relay TP, a circuit for release relay RR' is established from ground through the winding of said relay RR', alternate contact 158, conductor 157, conductor 166, alternate contact 156, normal contact 153, conductor 155, protective resistance 154 to battery, resulting in the energization of relay RR' which establishes a locking circuit for itself by the closing of its contact 159, this circuit being traced from battery through said resistance 154, contact 159, conductors 166, 157, contact 158, and the wind-

ing of relay RR' to ground. This circuit is maintained until the connector J is restored, whereby switch PON' is restored, causing the interruption of the said circuit of relay RR' at contact 158. Also upon energization of relay RR' its normal contact 167 is interrupted, thereby interrupting the locking circuit for relays SW, 160 and CL, allowing the said relays to deenergize, the deenergization of relay 160 by the opening of its contact 134, interrupting the circuit for relays RCR and CO', allowing these relays to also restore. Thus all of the relays of connector switch J, with the exception of RR' are at normal. Upon the closing of alternate contact 167 of release relay RR', a circuit for release magnets RM' and R is established, resulting in the energization of said release magnets which therefore withdraw their respective associated retaining pawls, allowing restoration of connector switch J and ringing switch RS. Upon restoration of switch J, off normal contact SON' and PON' are restored, the restoration of PON' causing the interruption of the circuit for relay RR' as previously referred to, resulting in its deenergization and the consequent deenergization of release magnets RM' and R. The switch J having been restored to normal is available for use in establishing other connections and cut-off relay CO' having been restored, the line of substation D is now available for use in establishing other connections.

After finishing conversation, should the subscriber at sub-station D be the first to replace his receiver, the circuit for the tip relay TP is interrupted as before, allowing it to deenergize and due to the closing of its contact 153 a circuit for release relay RR' is established, said relay RR' also locking itself through its contact 159 as before. The energization of relay RR', due to the opening of its contact 167 results in the operation of magnets RM', R, and the deenergization of relays SW, 160 and CL, the deenergization of relay 160 due to the opening of its contact 134 interrupting the circuit of relays RCR and CO', causing their deenergization all as before. Now the calling subscriber at H not having restored his receiver as yet, relays PR and MRR are still energized and therefore the secondary conductor S and S' is connected to ground through contact 113 and impedance coil 114 at first selector I. Therefore when relay SW of switch J deenergizes, due to the interruption of its locking circuit by relay RR', as just stated, there being a ground connection to conductor S', and primary off normal contact 126 being closed, the relay SW will vibrate during the release of the connector switch wipers, that is, until contact 126 is opened, but this is only for an instant, as

these wipers restore very quickly. The secondary off normal switch SON' also being closed, the ground connection to conductor S' as referred to, is traced through said contact SON', normal contact 131 and the winding of relay SR' to battery, causing an energization of said relay, but as contact SON' is opened upon the restoration of the connector switch wipers from their secondary adjustment, relay SR' is energized for only an instant. In fact when the wipers are on one of the lower bank contacts, relay SR' may not be energized at all, due to the short interval between the deenergization of relay 160 which closes contact 131, and the opening of contact SON'. The operation of the relays SW and SR' just referred to is only incidental and has no effect upon the successful operation of the connector switch J. Although contact 150 of relay SR' is closed during the said incidental energization of relay SR', relay 160 does not become energized.

The subscriber at H being last to replace his receiver upon its switchhook, interrupts the circuit of relay PR, resulting in the deenergization of relay MRR' and the momentary energization of relay SR as previously described. In this case the ground connection to conductor P, due to the closing of contact 102 of relay PR previous to the opening of contact 105 of relay MRR, as previously described, causes an energization of primary magnet PM' of connector switch J, this being effected by the said ground connection extending over conductor P, P', contacts 124, 125 and the winding of magnet PM' to battery. As this ground application is only momentarily, the magnet PM' is of course only momentarily energized, causing a primary step of wipers 126, 127 and 128, the switch J remaining so until a release impulse is transmitted over the test conductor from first selector I as will be described.

Returning now to the release of first selector I, it will be remembered that primary relay PR deenergized, followed by the deenergization of relay MRR, which establishes an energizing circuit for release relay RR and test relay TR as previously described. Upon energization of relay RR, its alternate contact 120 is closed, thereby connecting battery to wiper 107 as previously described, said battery then flowing over contact 110, the resistance 165, alternate contact 158 and the winding of relay RR' to ground, energizing the said relay RR' and operating release magnets RM' and R. Responsive to the energization of relays RR and TR of switch I, release magnet RM is operated, causing the release of first selector I as previously referred to. Upon energization of the release magnet RM, its contact 119 is opened thereby interrupting

the circuit for release relay RR' of connector J, causing its deenergization followed by the restoration of release magnets RM' and R. The first selector I, and connector switch J having been restored to normal are now available for use in establishing other connections.

Called line busy.—In the previous description, it was assumed that the called line PL was idle, now assuming that the line is busy, its test terminals 35, 36, 37, 38 are grounded either from alternate contacts 103' if it be a calling line, or from ground through a relay RCR of a connector switch J if the line be busy as a called line. The operation of the switches and especially the connector switch J up to the point of the last secondary impulse is the same whether connecting to an idle or busy line, but in connecting to a busy line as we have now assumed PL to be, upon the sending of the last secondary impulse from ground through normal contact 113 of relay SR, the said impulse follows the path previously described which is along the lower heavily marked conductor S, S', to bank contact 112, then over conductor 130, closed contact SON', normal contact 131 and the winding of relay SR' to battery, energizing said relay SR' which closes its alternate contact 150, thereby causing relay 160 to energize and lock up, and relay SR' also closing its alternate contact 133 connects the line test relay LTR to the test terminal 38 of line PL as before. In this case though, the terminal 38 being grounded, a path for current through relay LTR is established causing the energization of said relay, which closing its alternate contact 132, is locked up over conductor 145 to ground at normal contact 167 while the closing of its alternate contact 162 establishes a locking circuit for relay SR', maintaining it energized, after the interruption of its initial circuit by contact 131 of relay 160. Thus it will be seen that when connecting to a busy line, relays SR' and LTR are maintained energized, thus preventing the operation of the ringing control relay RCR, or relay FF and no ringing current is applied to the terminals of the called line. A busy signal is therefore transmitted to the calling subscriber notifying him that the called line is busy, the said signal being a characteristic one and traced from busy back machine BB through alternate contact 163 to the lower heavily marked secondary conductor S' S, back over said conductor, line conductor 4, the receiver of the calling substation H, returning over line conductor 3 to the upper heavily marked conductor and through the upper winding of primary relay PR to ground. The called subscriber in response to the signal received, replaces his receiver

upon its switchhook effecting the release of first selector I, and in this instance also the release of connector switch J and its associated ringing switch RS.

The replacing of the receiver upon the switchhook at the calling substation interrupts the circuit for relay PR which deenergizes, interrupting the circuit for main release relay MRR which in turn deenergizes, causing the operation of release magnet RM and the release of first selector switch I as before. The release of the connector switch in this case is effected by an impulse of current from release relay RR of first selector I in the following manner: Upon energization of relay RR of first selector I responsive to the restoration of the calling subscriber's receiver, alternate contact 120 is closed a moment before the energization of the release magnet RM, thus momentarily connecting battery through protective resistance 164, alternate contact 120, normal contact 119, wiper 107, contact 110, resistance 165, conductor 157, alternate contact 158 and release relay RR' to ground, energizing said release relay RR'. It will be remembered that in the operation of switch J when connecting to line PL as a busy line, that relay CL was not energized so that alternate contact 156 thereof is not closed, therefore no direct ground is connected to the conductor 166 leading to the resistance 165, so that in this case relay RR' is not shunted by a direct ground connection. Responsive to said energization of relay RR', normal contact 167 thereof is opened, thus allowing relays SW, 160 and LTR to deenergize, the deenergization of relay LTR opening contact 162, and allowing relay SR' to deenergize. The closing of alternate contact 167 of relay RR' causes the operation of release magnets RM' and R, thereby releasing connector switch J and its associated ringing switch RS as previously described.

Called subscriber not responding.—Should a calling subscriber extend connection to the line of a called subscriber who fails to respond to his call, the calling subscriber controls the release of the switches used in establishing connection as in the case where connection is made to a busy called line. It will be remembered that in connecting to the idle line of a called subscriber, relays SW, 160, RCR, and CO' are energized and the relay FF is operating to intermittently connect ringing current to the terminals of the called line. The subscriber having failed to respond, relays TP and CL remain inert, that is, in their deenergized position. Thus when the calling subscriber at H failing to get a response, replaces his receiver upon its switchhook, relays PR and MRR energize, resulting in the release of first selector

I as previously described, and a release impulse is transmitted from battery through alternate contact 120 of relay RR over the test wiper 107 and contact 110, resistance 165, conductor 157, contact 158, the winding of release relay RR' to ground, resulting in the energization of relay RR'. This energization of relay RR' causes the deenergization of relays SW and 160 followed by the deenergization of relays RCR and CO'. Responsive to energization of relay RR', magnets RM' and R are operated effecting the restoration of connector switch J and ringing switch RS as previously described. Thus it will be seen that should a calling subscriber extend connection to the line of a called subscriber who fails to respond, by replacing his receiver, he releases the switches used in establishing such a connection.

Figs. 2 and 4.—Fig. 2 is a diagrammatic illustration of another application of my invention, and Fig. 4 represents diagrammatically a preferred arrangement of wiring of the bank contacts of connector switch J' of Fig. 2. In the application of my invention as shown in Figs. 2 and 4 the ringing wiper RW' is mechanically associated with the connector switch shaft which controls the primary movement of wipers 126', 127' and 128', as illustrated in the Kaisling patent previously referred to, the said ringing wiper RW' being adapted to be moved into successive engagement with ringing contacts *rc*, corresponding to the primary adjustment of said connector wipers, each contact *rc* being common to an associated row of line contact or terminal sets. The relays and mechanism of switch J' proper are similar to the relays and mechanism of connector switch J proper, corresponding parts of the said switches having corresponding reference characters, but in the case of switch J' having a suffix prime, or a suffix of different numerical value than used in connector switch J. Two wiper sets j^2 and j^3 are shown with only four rows of their bank contact sets. In the system of Fig. 2, the same four-party selective harmonic ringing system as illustrated in the system of Fig. 1, Part 2, is preferably used, that is, four generators, a' , b' , c' and d' of different frequencies are provided to ring selectively the bells of four substations on a line, such as A', B', C' and D', respectively, or in the case of two-party lines, as substations D' #90 and C' #00, when generators d' , c' are adapted to be used.

In applying my invention according to Figs. 2 and 4, referring now particularly to Fig. 4, it will be noted that in using the four-party signaling, the four terminal sets as 18³, 28³, 38³, and 48³ which constitute a group, are taken one from each ten group or row of contact sets, and as eight such

rows are used, the last two rows are arranged for two-party service. Although in Fig. 4 I have shown most of the contact sets having but a single contact multiply connected, it is to be understood that the different groups of four or two contacts as the case may be, are to be multiply connected according to the arrangement as shown in the top row.

With an arrangement as in Fig. 4, the last two digits of the telephone numbers of each substation would correspond to the numerical location of its associated terminal set, this being illustrated by the four substations A', B', C', and D', the last two digits of their telephone numbers being 18, 28, 38 and 48, corresponding to the numerical location of the contact sets 18/3, 28/3, 38/3 and 48/3 respectively, as is well known. This same scheme is followed out in connecting to all the other contact sets of the bank. The scheme of lettering the substations and generators of Fig. 4, indicates the same association as was followed out in the case of Fig. 1, that is, generator a' being adapted to ring the bells of substations A' associated with the first row of contacts including sets 18³, generator b' , the bells of substations B' associated with the second vertical row of contacts including set 28³, etc.

As previously stated, the ringing contacts *rc* are adapted to be selected responsive to the primary adjustment of the wipers 126', 127' and 128', instead of responsive to the impulses which control the secondary movement of said connector switch wipers as is the case of connector switch J of Fig. 1, Part 2. Thus to selectively ring the bell of substation D' which is 48, the connector switch wipers are moved four steps to select the fourth row of contacts which include the contacts 48³, 48⁴ and 48⁵, and which are the terminals associated with substation 48, the ringing wiper RW' partaking of the same number of steps, bringing it into engagement with the ringing contact *rc*⁴. Thereafter wipers 126', 127' and 128' are advanced eight steps into engagement with the terminals 48³, 48⁴ and 48⁵, respectively, while wiper RW' remains stationary.

As another illustration of the operation of Fig. 2, should connection be desired with substation A' whose number is 18, the connector switch wipers are given a primary adjustment of one step whereby the ringing wiper RW' engages the ringing contact *rc*¹ and thereafter the connector switch wipers are advanced eight steps into engagement with the terminals 18³, 18⁴ and 18⁵ which are the terminals associated with substation 18.

Referring now to Fig. 2, the operation of connector switch J' proper is the same as the operation of connector switch J of Fig. 1.

1, Part 2. Switch J' is adapted for operation in connection with the circuit of Fig. 1 and assuming that connection is desired with substation C' whose telephone number is 238, the subscriber at H would proceed to operate calling device 1, as previously described. The second set of impulses, which are three in number as before, are effective to operate the primary magnet PM^2 to step wipers 126', 127' and 128' to select the third row of bank contacts, which includes the terminals 38³, 38⁴ and 38⁵, and which are the terminals associated with the desired substation C' of line PL' . Ringing wiper RW' partakes of the same number of steps as the primary steps of wipers 126', 127' and 128', thus moving into engagement with the ringing contact rc^3 . Following the operation of primary magnet PM^2 , a secondary impulse is transmitted from secondary relay SR of first selector I , thereby effecting the energization of switching relay SW' which locks up to ground at normal contact 167' as before. The calling device 1 is now operated to effect eight interruptions of the line circuit, thereby causing relay PR to transmit eight primary impulses through secondary magnet SM^2 , and effecting eight secondary steps of wipers 126', 127' and 128' to engage terminals 38³, 38⁴, and 38⁵ respectively, this last operation of course not affecting ringing wiper RW' . Following the last set of impulses a secondary impulse is transmitted to effect the energization of relay SR^2 of switch J' , which closes its alternate contact 150', resulting in the energization and locking up of relay 160', and by the closing of its alternate contact 133' connects line test relay LTR' to test wiper 126' and test terminal 38³ as before. Assuming the line PL' is idle there would be no ground potential upon test terminal 38³ or any of its multiples, and therefore relay LTR' would not energize, and therefore relay SR^2 deenergizes connecting ringing control relay RCR' to test terminal 38³, resulting in its energization and the energization of cut-off relay CO^2 as previously described. This is followed by the operation of flip-flop relay FF' , due to the closing of contact 136', relay FF' thereby periodically connecting the ringing generator c' of the terminal 38⁵ through ringing contact rc^3 , ringing wiper RW' and alternate contact 139', current from the said generator operating the call bell of substation C' without effecting the operation of the bells of any of the other substations A' , B' or D' in bridge of the party line PL' . Upon response of the called subscriber ringing current is disconnected, due to the operation of tip relay TP' as previously described. After the subscribers finish their conversation, they replace their receivers upon their switchhooks, effecting the release of switches I and J' as

before, the restoration of ringing wiper RW' of course being caused by the restoration of connector switch shaft which carries said wiper RW' .

Fig. 5.—Fig. 5 illustrates diagrammatically another method of applying my invention. In Fig. 5 the ringing contacts rc are individual to the bank contact-sets instead of being common to groups of them as in Figs. 3 and 4, but the association of the contact sets and the substation telephones is the same as in Fig. 1, that is, the multiplied connections extending between the contact sets are the same in Fig. 5 as in Fig. 3. In Fig. 5 the ringing wiper RW moves directly with the line and test wipers 126, 127 and 128, that is, in the case of Fig. 5, there are four wipers 126, 127, 128 and RW which are moved directly by the operating magnets PM and SM and each set of bank contacts includes four contacts instead of three as in Fig. 3. From this it will be seen that the selection of a ringing generator of the proper electrical character to ring the bell of the desired substation is controlled by the last set of impulses as was the case in Fig. 3 but in Fig. 5 instead of having a separate ringing switch RS the ringing wiper is associated directly with the talking and test wiper and the ringing contact is associated directly with the talking and test contacts.

Fig. 6.—Fig. 6 represents diagrammatically another method of applying my invention, the multiplying of the bank contact sets being the same as in Fig. 4, that is, from row to row instead of along the rows as shown in Figs. 3 and 5. In Fig. 6 a ringing contact rc is associated with each bank contact set similar to the arrangement of Fig. 5, and then the ringing contacts in each row are multiply connected and this connection extended to a ringing generator. In Fig. 6 I use five ringing generators a^3 , b^3 , c^3 , d^3 and e^3 instead of four as was used in the other system described, and I also connect five sets of bank contacts in multiple and extend the line conductor therefrom to five substations as A^3 , B^3 , C^3 , etc. The reference characters of the substations and ringing generators of Fig. 6 indicate their association as in the other systems described, that is, generator a^3 is adapted to ring selectively the substations as A^3 associated with the first row of contact sets, generator b^3 , the substations as B^3 of the second row of contact sets, etc. Thus with the arrangement as shown in Fig. 6 it will be seen that by the use of five ringing generators I secure a five party-line system which works out more evenly than in the case of the other three Figs. 3, 4 and 5, in which the party line service is split up between four and two party lines, although it is apparent that the five party-line may be applied to Figs. 3, 4 and 5, instead of the

four and two party line service as is shown. Although I have illustrated a number of batteries, these, as is well known, may be one and the same central source.

5 While I have illustrated several methods of applying my invention, it is apparent that many more changes and modifications thereof may be made, and I do not desire to be limited to the exact arrangement of my
10 invention as shown herein, but aim to cover all such changes and modifications as come within the spirit and scope of the appended claims.

What I claim as new and desire to secure
15 by Letters Patent is:

1. A telephone system comprising a connector switch, party-line substations equal in number to the terminal sets of said connector, telephone lines less in number than
20 said terminal sets for connecting said substations and said terminal sets, ringing currents for calling said substations selectively, and means comprising a switch provided with an operating magnet effective upon a
25 connecting operation of said connector to associate a ringing current for selectively calling the desired substation of the called line with said line, and a central source of talking current.

30 2. A telephone system comprising a connector switch, party-line substations equal in number to the terminal sets of said connector, telephone lines less in number than said terminal sets for connecting said substations and said terminal sets, a ringing
35 switch provided with an operating magnet, ringing currents for calling said substations selectively, associated with contacts of said ringing switch, means for operating
40 said connector switch to connect with a called line, connections whereby said ringing switch is simultaneously operated to associate a ringing current to selectively call the desired substation of the called line there-
45 with, and a central source of talking current.

3. A telephone system comprising a connector switch, party-line substations equal in number to the terminal contacting positions of the wipers of said switch, telephone
50 lines less in number than said substations connecting said substations and the terminals of said switch, and means comprising a switch provided with an operating magnet
55 effective upon a connecting operation of said connector to associate a ringing current for selectively calling the desired substation of the called line with said line, and a central source of talking current.

60 4. A telephone system, comprising party lines, connector switches, multiple terminals for said lines at said switches, ringing currents of different electrical character for calling the substations of said lines selec-
65 tively, means for transmitting current im-

pulses for operating said connector switches to connect with terminals of a called line, independent means responsive to such operating impulses for associating the proper ringing current for calling the desired sub-
70 station of a called line with terminals thereof, and a central source of talking current.

5. A telephone system comprising a party telephone line, a connector switch, terminals for said line at said connector switch, char-
75 acteristic ringing currents for calling the substations of said party line, selectively, means for transmitting current impulses whereby said connector switch operates to connect with the terminals of the called
80 line, independent means also responsive to said operating current impulses whereby a characteristic ringing current for calling the desired substation is connected to the terminals of said line, and a central source
85 of current for talking purposes.

6. A telephone system, comprising party lines, connector switches, multiply connected line terminals at each switch for each of
90 said lines, ringing mechanism for furnishing ringing currents of different electrical character for calling the substations of said lines selectively, means for transmitting current impulses for operating said connector switches to connect with terminals of said
95 lines, means comprising an operating magnet responsive to such operating impulses for associating the ringing mechanism for calling the desired substation of a called line with terminals of said line, and a central
100 source of talking current.

7. A telephone system comprising a party telephone line, a connector switch, terminals for said line at said switch, a ringing
105 switch provided with an operating magnet, characteristic ringing currents for calling the substations of said party line selectively, associated with contacts of said ringing switch, means for transmitting current impulses whereby said connector switch oper-
110 ates to connect with the terminals of the called line, the magnet of said ringing switch being also operated responsive to said operating impulses to associate a characteristic ringing current for calling the desired sub-
115 station of said line with the terminals of said line, and a central source of talking current.

8. In a telephone system, the combination with a connector switch, a calling device connected thereto, a telephone line having
120 a plurality of substations, multiply connected line terminals at said connector, one for each substation, ringing terminals for association with said substations, ringing currents for calling said substations selec-
125 tively, connected with said terminals, means operated by said calling device for transmitting current impulses to operate said connector to connect with the line terminals of the desired substation, independent
130

means actuated responsive to certain of said operating impulses whereby a ringing terminal having the proper ringing current is associated with said line terminals, and a central source of talking current.

9. A telephone system comprising metallic circuit party lines having substations free from ground, connector switches, multiple terminals for said lines at said switches, ringing currents of different electrical character for calling the substations of said lines selectively, means responsive to directive interruptions of the metallic circuit of a calling line for transmitting current impulses for operating said connector switches to connect with terminals of a called line, and independent means responsive to such operating impulses for associating the proper ringing current for calling the desired substation of a called line, with terminals thereof.

10. A telephone system comprising a party telephone line, a connector switch, terminals for said line at said connector switch, characteristic ringing currents for calling the substations of said party line selectively, a metallic circuit calling telephone line in connection with said connector switch, means responsive to interruptions of the metallic circuit of the calling line for transmitting current impulses whereby said connector switch operates to connect with the terminals of the called line, and means comprising an independently operated switch also responsive to said operating current impulses whereby a characteristic ringing current for calling the desired substation is connected to the terminals of said line.

11. A telephone system comprising party lines, a group of connector switches for said lines, multiply connected line terminals at each switch for each of said lines, ringing mechanism for furnishing ringing currents of different electrical character for signaling the substations of said lines selectively, a metallic circuit calling telephone line, means responsive to directive interruptions of the metallic circuit of the calling line for transmitting current impulses for operating said connector switches to connect with terminals of said lines, and means including an independently operated switch responsive to such operating impulses for associating the ringing mechanism for calling the desired substation of a called line with terminals of said line.

12. A telephone system comprising a party telephone line, a connector switch, terminals for said line at said switch, a ringing switch, characteristic ringing currents for calling the substations of said party line selectively and associated with contacts of said ringing switch, a metallic circuit calling telephone line, means responsive to directive interruptions of the metallic circuit of the calling line for transmitting current

impulses whereby said connector switch operates to connect with the terminals of the called line, said ringing switch having magnets also operated responsive to said operating impulses to associate a characteristic ringing current for calling the desired substation of said line with the terminals of said line.

13. A telephone system comprising a metallic control circuit, a calling device connected in circuit therewith, means for associating said control circuit with said connector switch, a telephone line having a plurality of substations, multiply connected line terminals at said connector one for each substation, ringing terminals for association with said substations, ringing currents for calling said substations selectively, connected with said terminals, means responsive to directive interruptions of said metallic circuit by said calling device for transmitting current impulses to operate said connector to connect with the line terminal of the desired substation, and means comprising an actuating magnet responsive to certain of said operating impulses whereby a ringing terminal having the proper ringing current is associated with said line terminals to call the desired substation of the called substation.

14. A telephone system comprising party lines, a connector switch, a progressive ringing switch provided with an operating magnet, multiple terminals for said lines at said connector, ringing currents of different electrical character for calling the substations of said lines selectively, connected to said ringing switch, means for simultaneously operating said connector and ringing switches responsive to current impulses controlled over a calling line for connecting with a terminal of the called line and selecting the proper ringing current for calling the desired substation, and a central source of switch operating and talking current.

15. An automatic switching system comprising line selecting devices with magnets for setting same, a current supply source for energizing said magnets, subscribers' lines, subscribers' stations, controlling devices for causing series of impulses to flow from said current supply source through the said magnets, bells at the said stations adapted to respond to different kinds of ringing current, selectors capable of selecting different kinds of ringing current for operating said bells, and magnets for actuating said selectors that operate under the control of the same impulses of the said series of impulses as the said magnets for setting the line selecting devices.

16. An automatic switching system comprising line selecting devices with magnets for setting same, a current supply source for energizing said magnets, subscribers' lines, subscribers' stations, controlling devices for

causing series of impulses to flow from the said current supply source through the said magnets, bells at the said stations adapted to respond to different kinds of ringing current, selectors capable of selecting different kinds of ringing current for operating said bells, and magnets for actuating said selectors that operate simultaneously with the said magnets for setting the line selecting devices during the impulses of one of the said series of impulses.

17. An exchange, lines terminating thereat, subscribers' stations on said lines, signal devices at said stations, respectively, responsive to signaling current of different kinds, automatic switching mechanism for connecting said lines, a current selecting device for determining the kind of signaling current applied to a called line, magnets for operating said switch mechanism and said selecting device, a divided circuit in each branch of which one of said magnets is located, and an impulse creating means for controlling simultaneously the actuation of said switching mechanism and said current selecting device.

18. An exchange, lines terminating thereat, subscribers' stations on said lines, signal devices at said stations responsive to signaling current of different kinds, automatic switch mechanism for connecting a calling to a called line, a device for selecting the kind of current for operating the signal of a called station, means for actuating said switching mechanism, means for actuating said selective device, impulse producing means for controlling the actuation of said switching mechanism and said selective device, said mechanism and said device being controlled simultaneously by the same series of current impulses.

19. An exchange, lines terminating thereat, stations on said lines, signal devices at said stations respectively, responsive to signaling current of different kinds, automatic switching mechanism for interconnecting said lines, a current selecting device for determining the kind of signaling current applied to a called line, a separate impulse controlled means for actuating said switching mechanism and said selecting device, respectively, and impulse creating means whereby said mechanism and said device are actuated simultaneously, whereby the called station will be supplied with the kind of signaling current adapted to actuate the signaling device thereat.

20. An automatic switching system comprising line selecting devices each having fixed contacts, movable contacts capable of being set onto any of the said fixed contacts, an electromagnet capable of moving the said movable contacts, subscribers' lines connected to said fixed contacts, stations connected

to the said lines, bells at the said stations adapted to respond to different kinds of ringing current, ringing current selectors associated with the said line selecting devices and capable of selecting different kinds of ringing current, magnets for operating said ringing current selectors, each of said magnets being connected in parallel with an electromagnet belonging to the said line selecting devices.

21. An exchange, lines terminating thereat, stations on said lines, signal devices at said stations respectively, responsive to signaling current of different kinds, means including a selector and a connector for interconnecting said lines, a device for selecting the kind of current to be applied to a called line, impulse controlled means for actuating said selector and connector, impulse controlled means for actuating said selecting device, and impulse creating means for controlling the operation of said selector and connector, certain of said impulses being operative to effect the actuation of said selecting device.

22. An automatic switching system comprising line selecting devices with magnets for setting same, a current supply source for energizing said magnets, subscribers' lines, subscribers' stations, controlling devices for causing series of impulses to flow from said current supply source through the said magnets, bells at the said stations adapted to respond to different kinds of ringing current, selectors capable of selecting different kinds of ringing current for operating said bells, and magnets for actuating said selectors that operate simultaneously with the said magnets for setting the line selecting devices during the last series of the said several series of impulses.

23. An automatic switching system comprising line selecting devices each having series of fixed contacts, movable contacts capable of being set on to any of the said series of fixed contacts and on to any contact of any of the series, a series selecting magnet for moving said movable contacts to any of the said series of contacts, an individual contact selecting magnet for moving the movable contact on to any fixed contact of a series of contacts, a ringing current selector capable of selecting different kinds of ringing current with a movable contact and a magnet for moving same, the magnet of the said ringing current selector being arranged to be excited simultaneously with the said individual contact selecting magnet.

24. An automatic switching system comprising line selecting devices each having series of fixed contacts, movable contacts capable of being set on to any of the said series of fixed contacts and on to any contact of any of the series, a series selecting mag-

net for moving said movable contacts to any of the said series, an individual contact selecting magnet for moving the movable contacts on to any fixed contact of a series of 5 contacts, a ringing current selector capable of selecting different kinds of ringing current with a movable contact and a magnet for moving same, the magnet of the ringing current selector being connected in parallel 10 with the said individual contact selecting magnet.

25. A telephone system comprising a party telephone line provided with a plurality of substations, a connector switch for 15 extending a connection to said telephone line, a ringing switch for selecting the desired ringing current for signaling a substation upon said line, operating mechanism for each of said switches, and means for 20 simultaneously operating the mechanism of said switches to establish connection to a

desired line and to selectively signal said substations.

26. A telephone system comprising a party telephone line provided with a plurality 25 of substations, a connector switch for extending connection to said telephone line, an auxiliary switch for selecting ringing currents for signaling said substations, operating mechanism for each of said switches, 30 and means for operating the mechanism of said switches simultaneously to establish connection to said telephone line and for selectively signaling the desired substation upon the said line. 35

Signed by me at Chicago, county of Cook, and State of Illinois, in the presence of two witnesses.

GEORGE E. MUELLER.

Witnesses:

M. R. ROCHFORD,
WM. BERGHAHN.