

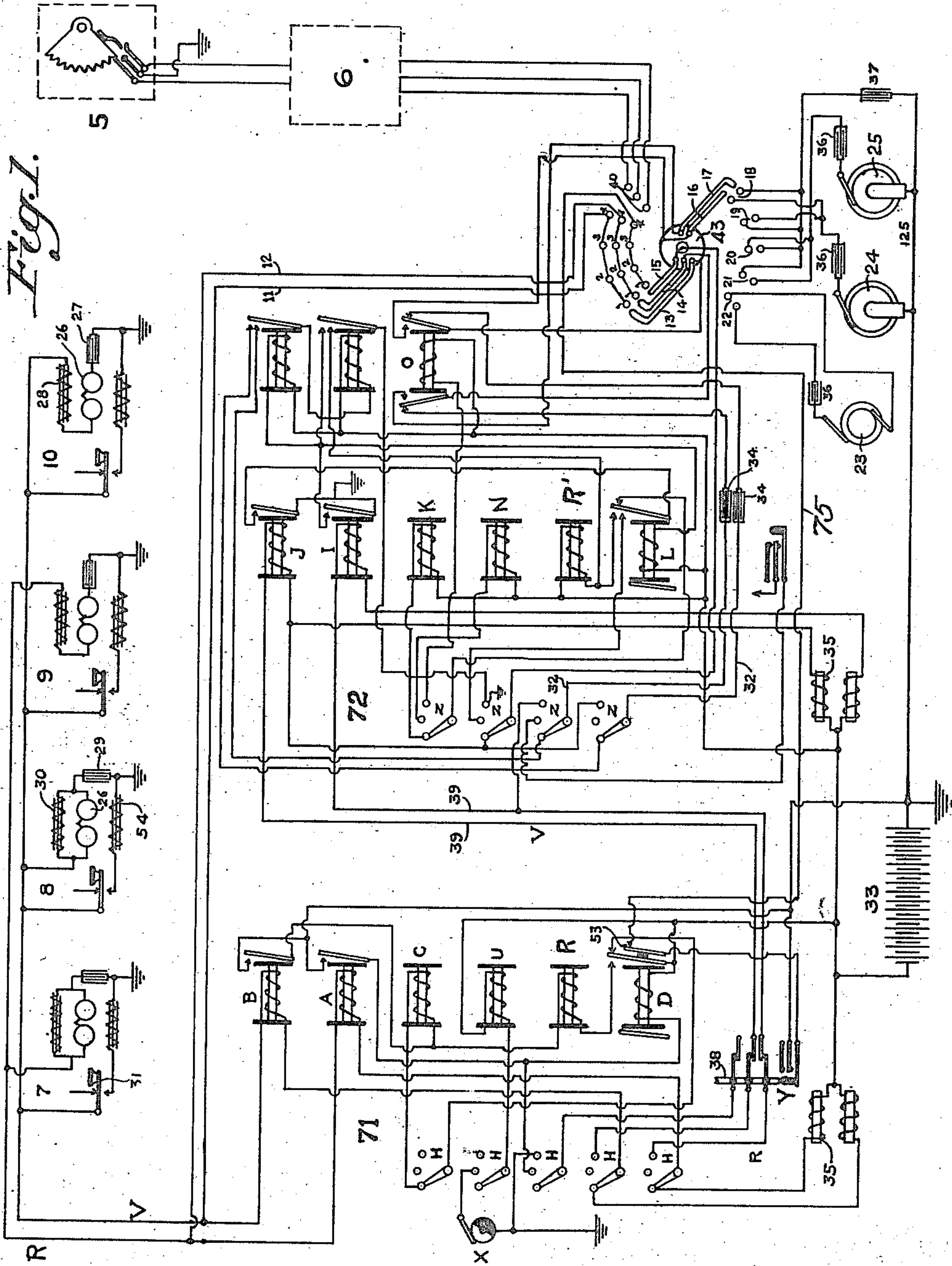
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O. M. LEICH & C. E. HAGUE.
SIGNALING SYSTEM.
APPLICATION FILED FEB. 17, 1905.

1,154,929.

Patented Sept. 28, 1915.

2 SHEETS—SHEET 1.



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FIG. 3.

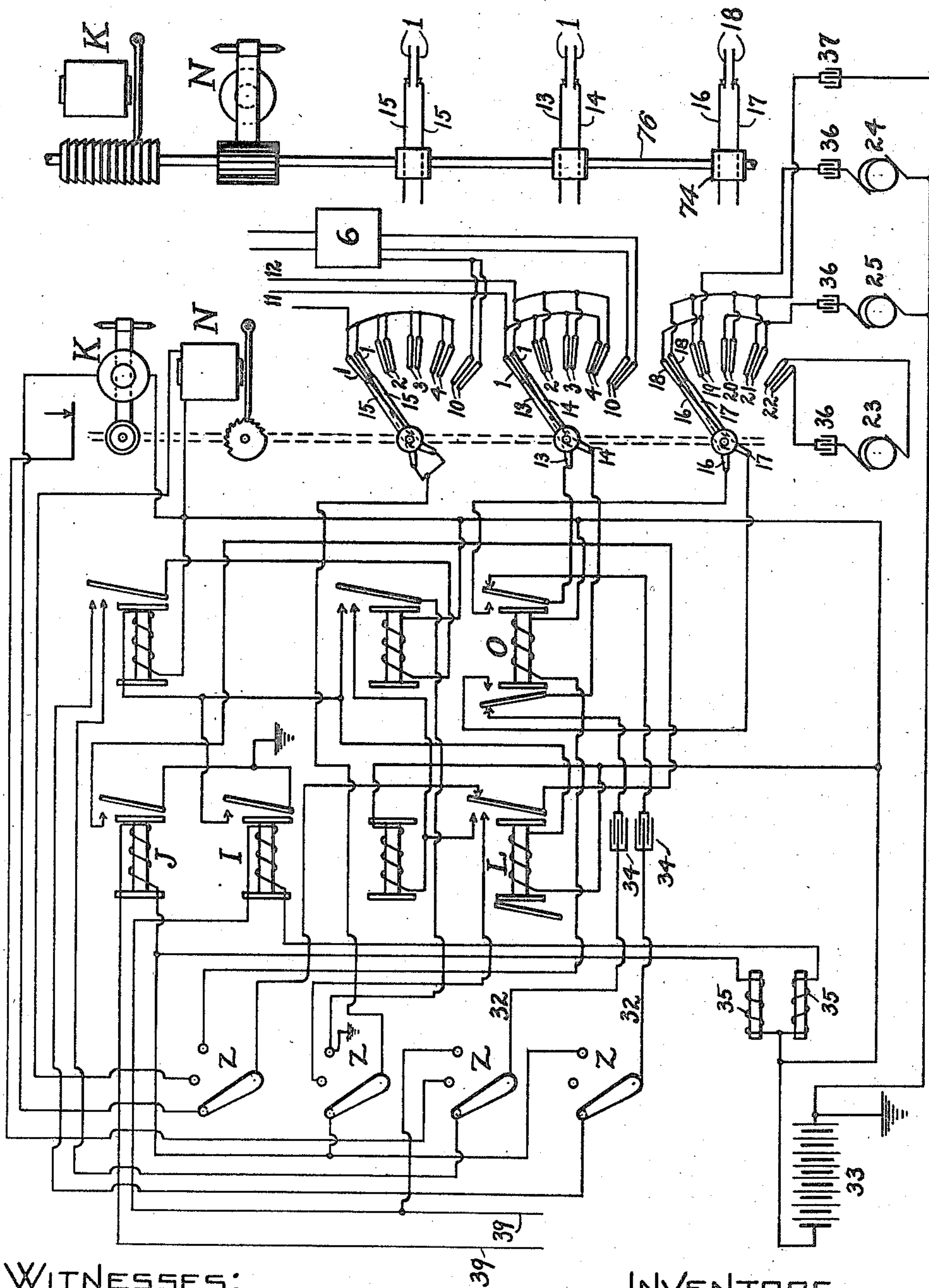


FIG. 2.

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SIGNALING SYSTEM.

1,154,929.

Specification of Letters Patent. Patented Sept. 28, 1915.

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To all whom it may concern:

Be it known that we, OSCAR M. LEICH and CHARLES E. HAGUE, citizens of the United States, residing at Rochester, in the county of Monroe and State of New York, have invented a certain new and useful Improvement in Signaling Systems, of which the following is a full, clear, concise, and exact description, reference being had to the accompanying drawing, forming a part of this specification.

Our invention relates to signaling systems, and has for its object provision of improved means for selectively calling sub-stations of an exchange. More particularly is our invention applicable in connection with those systems in which more than one sub-station is placed on a single circuit and in which means must be provided for selectively calling these sub-stations if no more than one sub-station is to be called at a time. Our invention is well adapted for use in connection with those systems in which automatic selectors are used for interconnecting subscribers' lines. The general plan of a system of this kind of course consists in having a number of sub-stations which are connected by means of an electric circuit, or circuits, with the central exchange in which automatic selecting switches are provided and associated with the various lines, means being provided at each sub-station whereby these selectors may be operated to connect the said line electrically with any of the other lines or circuits entering this exchange. Our invention contemplates the provision of a plurality of sub-stations on these circuits leaving the exchange, and further contemplates the provision of means whereby the automatic selectors aforesaid may be used not only to interconnect various electric circuits, but may furthermore be used to cause a selective operation of the signals on those lines or circuits which are connected to a plurality of sub-station instruments.

We will explain our invention more in detail by referring to the accompanying drawing, illustrating one embodiment thereof.

Figure 1 is a diagram of a system embodying the invention; Fig. 2 is a diagram of the connector; and Fig. 3 is a view illustrating certain mechanical details of the connector.

Fig. 1 shows two lines as entering the central exchange, one line being a single sub-

scriber's line and the other a four-party line. In the illustration we have shown the apparatus in connection with the first selector at the lefthand side of the drawing, this apparatus comprising six coils and operating relays, as shown, together with the ordinary side switches and the first selector switch, which in this instance is shown at 71. It will be readily apparent to those skilled in the art that this first selector 71 may be any suitable switching mechanism, which is adapted by virtue of three contacts mounted on a spindle 38 to connect the circuit of the subscriber's line as it passes into the first selector on to a certain unused trunk circuit, in this instance shown as comprising the wires 39, 39, these trunk wires being in direct association with a trunk connector 72 comprising again six of the operating relays and coils, together with the trunk selector switch mechanism 43, as shown in the righthand side of this drawing. The switch mechanism 43 forms part of the trunk connector switch 72 and is more clearly illustrated in Fig. 2. The ringing relays which ordinarily go with the last trunk connector in automatic exchange equipment are likewise in this instance associated with the same trunk connector 72, and in addition we add to the trunk connector switch the ringing contact mechanism 43. The operation of the last trunk connector is the same as the operation of the last trunk connector in the well known Strowger system and is well known.

It will be observed that we add to the last trunk connector, contact mechanism comprising a shaft upon which are mounted contacts 16 and 17 which contacts are mounted on a rotatable hub 74. The rotatable hub 74 is associated with the shaft 76 of the trunk connector switch 72 through the interposition of a key, a key seat provided in said shaft 76 whereby said hub 74 is only rotatable in a horizontal plane when shaft 76 rotates but is not movable vertically with said shaft 76. When said shaft 75 is operated vertically through the action of the relay K there are of course in connection with the switch 72 ten distinct rows of line contacts mounted vertically one above the other, only one set being shown diagrammatically in the illustration of Fig. 2. There is, however, but one set of ringing contacts which are selectively associated with the contact springs 16 and 17. Thus the first character

of line contacts in each horizontal row of multiple taps in this switch 72 irrespective of which row is chosen, is always in association when operated, with the ringing contacts 18. The second set of connectors of each horizontal row of line taps is always in association with ringing contacts 19 and so on. Thus in each horizontal row of multiple line contacts of which there are ten horizontal rows, the line taps which are in the same vertical plane, are adapted for association with the same character of ringing current. No additional features need be added to this system, except that the ringing circuit which in the ordinary Strowger system leads directly from the ringing relay to the ringing generator is under the control of the switch mechanism 43 which is interposed in this circuit, and which for different angular positions of the shaft 76, changes the character of the current which the ringing relay is adapted to project on to the called subscriber's line. Of course in connection with this trunk connector there are additional relays which are used for ringing and other purposes.

The trunk connector of course is provided with the multiple taps of 100 subscribers' lines, and is shown in this instance as being provided with the multiple taps 40, 40, 40 leading to the single line sub-station 5 through the interposition of first selector and trunk connector mechanism, as indicated, but not shown, at 6. This interconnecting mechanism would of course be somewhat similar to that shown in the drawing and is therefore omitted for the sake of clearness, it being thought that with the present development of the automatic system this equipment, so far as the mechanism of itself was concerned, would be well understood without further explanation.

Of course we have only indicated one particular type of automatic system, namely, the Strowger, but our invention is applicable for use with a great number. To indicate, in a measure, the operation of the automatic system as specified, we will describe the operation of the system as it would follow if a subscriber removed his receiver and attempted to make interconnection between his line and some other line which enters the same exchange. The operation of the subscriber calling a party line subscriber would be substantially as follows:—The subscriber removes his receiver from the hook, and by means of a step by step impulse mechanism in the subscriber's instrument, of either one of the instruments 7, 8, 9 or 10, sends impulses to ground over the vertical side of the line, which impulses operate the vertical relay "B." This impulse mechanism is shown more clearly at subscriber's sub-station 5. We have lettered the vertical side of the line "V" in the drawing, and the

rotary side "R." The operation of the vertical relay "B" in turn operates the vertical step mechanism which is controlled by the magnet "C," the magnet "C" serving to raise the spindle 38 of the selector mechanism of the first selector in correspondence to the number of impulses as sent over the vertical side of the line by the hand switch impulse mechanism provided in the telephone for causing this operation. As shown more clearly at the sub-station 5, when the impulse mechanism at the sub-station returns to its normal position after having effected the sending of these impulses over the vertical side of the line, there is given one impulse over the rotary side of the line to ground, thereby operating the rotary relay "A." This in turn operates the private magnet or relay "D," which mechanically moves a series of side switches "H" from their first to their second position. Of course the first impulse which elevated the spindle 38 of the first selector mechanism 71 caused thereby a closure of the contacts of the switch "Y," thereby throwing a ground on the private contact of this particular line throughout the series of multiple taps. This movement of the switches "H" connects the interrupter "X" to the rotary step mechanism comprising the relay "U," which by a series of impulses delivered by this interrupter "X" causes a rotation of the spindle 38 until a contact is found by means of the private or third wiper, which is not grounded, thus indicating a vacant trunk. At this point the rotary movement of the selector stops and the subscriber's line has been carried through the first selector and is then connected by means of a metallic circuit to a trunk connector, in this instance 72. The number of trunk selectors of course depends upon the ultimate capacity of the switchboard. We have here merely shown one series of trunk selectors. The last trunk selector connects to a trunk connector. A second movement of the impulse mechanism at the subscriber's instrument causes operation of the vertical relay "J," which by its impulses in turn operates the vertical step mechanism "K," and at the end of said impulses one impulse on the rotary side of the line to ground is given thereby operating the rotary relay "I," which in turn operated the private relay "L," thereby moving the series of switches "Z" from their first to their second position. This connects the rotary step mechanism "N" to the contact of the vertical relay "J." Another series of impulses is given to the vertical relay "J," which in turn operates the rotary step mechanism "N," thereby selecting the particular line with which a connection is desired. At the end of these last impulses of the relay "J" one impulse is given on the rotary side of the line which operates the private relay

"L" and moves the switches "Z" from their second to their third position, thereby completing the connection to the desired line, which, for illustration, would be one of the sets of contacts on the particular horizontal bank provided in connection with the trunk connector mechanism 72 with which switch 43 is mechanically associated. These contacts may be either numbers 1, 1, 1, 2, 2, 2, 3, 3, 3, 4, 4, 4, or 40, 40, 40.

It is the object of our invention to provide means whereby the four subscribers which are connected with the numbers 1, 2, 3, 4 respectively may be placed on one line and rung selectively by means of selective generators. To accomplish this object we electrically connect the four sets of contacts 1, 2, 3 and 4, thus making them practically one line, and uniting them by means of line wires 11, 12 with a subscriber's line comprising sub-station 7, 8, 9 and 10. It will now be seen that when the rotary trunk connector mechanism 72 arrives at either set of contacts 1, 2, 3 or 4 that a connection is made with the line 11, 12, as stated, and if the said connector stops over the set of contacts 40, connection will be made with the line connected to the substation 5. Sub-station 5 is shown in this instance as being the only station on this particular line. The trunk connector mechanism of course makes contact by means of the strips 13, 14, 15, as shown, and at the same time the contacts 13, 14, 15 are associated with either set of contacts 1, 2, 3 or 4, wiper contacts 16 and 17 are making connection with a series of contacts 18, 19, 20, 21 or 22. Series of contacts 18 to 22 are associated with ringing generators as follows:—There are three generators, generator No. 23, which provides the regular low frequency current for calling a telephone; generator No. 24, which provides an alternating current of the proper frequency, giving an alternating current in the neighborhood of 60 cycles, and generator No. 25, which provides alternating ringing current having a frequency of approximately 125 cycles per second. It will now be observed that if, for instance, a connector 72 and switch 43 of said trunk connector 72 is stopped and makes connection with a series of contacts 1 the ringing wipers 16 and 17 have stopped at contacts 18. By reason of stopping at contacts 18, 60-cycle current from the generator 24 is adapted for connection between the vertical side of the subscriber's line to ground when the ringing relay "O" is operated, as will be more fully set forth hereinafter. If the trunk connector has stopped and made connection with the series of contacts 2, then through the interposition of the ringing relay "O" and the contacts 19 the same generator furnishing 60-cycle current is adapted for connection between the rotary side of the line and

ground upon actuation of the ringing key. In like manner sets of contacts 3 and 4 respectively permit of the sending of high frequency 125-cycle ringing generator between the vertical side of the line and the rotary side of the line to ground upon actuation of the ringing key. It will thus be seen that we have four different conditions for ringing subscribers on the same line, namely, 60-cycle ringing current on either rotary or vertical side to ground, and 125-cycle ringing current on either the rotary or vertical side to ground.

In order to cause the bells at the subscribers' instruments to operate selectively we have provided the following conditions:—The ringing circuit at sub-station 10 comprises an ordinary polarized bell 26 in series with a condenser 27 and an impedance coil 28, the impedance coil 28 is of such dimensions that it will permit the 60-cycle current to pass therethrough to ring the bell, but it will not permit enough of the 125-cycle current to pass it to operate the bell. This, it will be understood, by virtue of the fact that an impedance coil changes its impedance in accordance with a change in the frequency of an alternating current, so that a high frequency current has much more difficulty, and is even choked and prevented from going through a coil, whereas the same coil may permit a low frequency alternating current to pass readily therethrough. It will be seen that this ringing circuit at sub-station 10 is connected between the vertical side of the line and ground, while the ringing circuit at sub-station 9, whose apparatus is identical with that shown at sub-station 10, is connected between the rotary side of the line and ground. Now sub-station 8 is provided with an ordinary polarized ringer 26, a condenser of very small capacity 29, and an impedance coil 30. The low frequency or 60-cycle current, which is capable of operating the signals at stations 9 and 10, is of such frequency that not a sufficient amount of this current will pass through the low capacity condenser 29 to operate the call bell 26. To further guard against any false operation of the call bell 26 by the said 60-cycle current, the impedance coil 30 is provided in a shunt circuit around said call bell. This impedance coil shunts away a portion of the low frequency currents which do find their way through the condenser 29. Sub-station 8 is connected between the vertical side of the line and ground, and sub-station 7, whose ringing apparatus is identical with that shown at sub-station 8, is, on the contrary, connected to the rotary side of the line and ground. Now, as has been explained in connection with the generators 24 and 25, by virtue of the contacts 18 to 21 inclusive, ringing current of either high or low frequency is adapted for projection over

vertical or rotary side of line whenever the ringing relay "O" is actuated, the character of current and the side of the line upon which it is impressed depending upon the set of contacts 18 to 21 upon which the ringing connectors 16 and 17 are stopped. The ringing relay merely closes the ringing circuit on to the line which is to be called and breaks away the line which is calling. The means for operating the ringing relay comprise the button 31, which projects current by means of the battery 33 over the vertical side of line to ground, thereby closing a circuit through the ringing relay "O" by virtue of the fact that the switches "Z" are in their third position. They are in the drawing shown as being in their first position. It will thus be seen that any one of the four sub-stations 7, 8, 9 and 10 which are on the same line may be selectively called. The ringing wipers 16 and 17 are of course shown connected to the front contacts associated with the armatures of the ringing relay "O," while the armatures themselves are directly connected with the subscriber's line. If it is desired to call a single line instrument, as illustrated at station 5, the ringing contacts 22 are in connection with the ringing wipers 16 and 17, which should be associated with these contacts when the trunk connector has established connection with the desired line, these contacts being connected to the regular ringing generator 23 after the relays "I" and "J" have performed their function and operated the trunk connector 72 and switch 43 and the switches "Z" have been placed in their third position. The line through the conductors 32, 32 is completed through the armatures of the ringing relay "O," and from there to the contacts on the trunk connector associated with the line which it is desired to call. Condensers 34, 34 are interposed in this connection between the ringing relay and the switches "Z," for the reason that when step mechanism 72 connects with wires 11 and 12 relays "A," "B," "J" and "I" are short circuited by wires 11 and 12 preventing their operation when button 31 is operated or when both sides of lines "V" and "R" are grounded to release mechanism. A contact 53 has been provided on relay "D" which will remove the ground on the private wire of the first selector 71 of the party line so that when the connector makes connection to the contact 1, 1, 1, 2, 2, 2, 3, 3, 3, and 4, 4, 4, this connector will not show busy and will allow the connection to be made.

Contact 53 operates with every operation of the relay A and therefore removes the ground from the private wire of this selector at all times, but there is no fault in this, as it does not effect any operation excepting when calling back on this line for another

station on this same line, the line will not appear busy to itself and therefore allows connection to be made which would otherwise be prevented.

We have put in this drawing the operation of calling a subscriber on the same party line, as this is the most complicated and difficult to perform. It is somewhat more simple to connect one subscriber on one line with a subscriber on another line, as will be readily apparent. The impedance coil 54 in the ringing branch at the subscriber's instrument is used so that when the ringing current is impressed on the same side of a line as the calling instrument, said ringing current is not short circuited through its shunt ringing path. The relays "A," "B," "J" and "I" are connected to the battery 33 through the interposition of impedance coils 35, 35, these impedance coils of course preventing a short circuit of the rotary and vertical side of the line. When the calling subscriber presses his ringing button which operates the relay "O" the relay "B" will also operate, but this does not cause any trouble as the actual operating relays under the control of the operating relay "B" are disconnected from the battery by virtue of the side switches "H" having been moved in their third or final position. It will of course be seen that if the sets of contacts 1, 2, 3 and 4, previously to being connected, represented four different subscribers' lines, namely, 7341, 7342, 7343 and 7344, they can maintain this same number, as the operation of placing the trunk in association with the desired contact does not depend in any way upon the electrical connection which has now been made between these sets of contacts. Of course it is not necessary that the four adjacent contacts in one bank of the trunk connector be used for the same party line, as the jumper wires which are here shown between these sets of contacts would serve the purpose just the same if made between connectors 1, for instance, in this bank and some other set of connectors in another bank and still two sets of 3 and 4 contacts in two different banks of two different bank connectors. Thus any line or any contact can be changed to meet the requirements for partly line service, and without the change of any number which the subscriber may have and desires to keep. In ringing a subscriber on the same party line it will be seen that a grounding of the line through the impedance coil 54 operates the relays "B" and "J," relay "J" in turn operating the relay "O," as stated. Relays "B" and "J" are not affected by the ringing current which comes past them, as they are held by battery current through the impedance coils 35, 35. When ringing on the opposite side of the line relays "A" and "I" are not affected, likewise on account of the im-

pedance coil and the use of high frequency ringing current. To further offset the effects of this alternating ringing current on these relays any well known expedient such as copper shells may be provided if desired. It will be seen, of course, that if it were not for the improvements which we have provided relays "B" and "J," if operated at the same time as relays "A" and "I," would cause the release of the whole line. To prevent the relays "B" and "J" from being short circuited through the connection when selecting on your own line, condensers 34, 34 are inserted. To further prevent any difficulties that might occur, such, for instance, that would occur if the relays "B" and "J" were prevented from releasing by the battery current passing through the generator when the subscriber releases his ringing button, we include condensers 36, 36 in these generator ringing circuits. We provide a condenser 37, which is used to shunt out the bell of the subscriber's instrument, which is connected to the opposite side of the line when the subscriber on that line removes his receiver, thus preventing cross ringing.

Furthermore, we have provided signals at the sub-stations which are operated by a character of current which is not liable to operate the ordinary properly constructed relays of the automatic connecting mechanism. However, as previously pointed out, copper shells may be added to the cores of these relays which act as short circuited secondaries and further prevent their operation by currents adapted to operate the sub-station signals.

To recapitulate the operation of the system in its entirety, suppose the subscriber at either stations 7, 8, 9 or 10 operates his calling device: Impulses are sent over the line V, which operates the relay B, and operation of the relay B sends impulses through the magnet C, which magnet steps up the central station first selector switch to the required horizontal group. When the substation selector mechanism returns to its normal position, it sends one impulse over the rotary side of the line, thus to operate the relay A, whereby circuit is established through relay D, which upon drawing up and releasing its armature moves the side switches H one notch, so that the magnet U, which rotates the first selector switch mechanism, will operate due to the interrupter X, and upon the first energization of magnet U, due to a well known arrangement, the armature of relay D is moved to its attracted position and held there. the said magnet U continuing to operate until the armature of relay D falls back into its normal position, the falling back of the armature of the relay D moving the side switches to their third or last position. The relay D remains energized and draws current from battery 33 so

long as the private wire associated with the spindle 38 touches the grounded contact of a selector, and will only fall back when this private wire does not touch a ground, and will thereby remain in connection with an unbusy trunk. Moving the side switches into the third position grounds the private wire on the spindle 38 at the third side switch H, as shown. It will furthermore be apparent when the switching mechanism Y short circuits the two springs, which is done at the first upward movement of the spindle 38, that a ground including the spring 53 is thrown upon the private wire 75, thus to indicate that the particular line on which are mounted stations 7, 8, 9 and 10 are busy, so that any other line attempting connection therewith will be properly apprised, as is well understood in the art. Now it will be apparent that when this same line wishes to connect with itself; that is, for instance, a subscriber 7 wishes to call subscriber 9—instrumentalities should be provided so that the line will not appear busy to itself, and thus whenever the relay A operates to start the rotary motion of the switch to select an unbusy trunk, said relay A operates relay D, which through the agency of the contact 53 removes this ground at all times from this same line temporarily while its switch is operating, so that the line can connect with its own contacts. The circuit is thus completed through the switch 71 to the last connector 72 and sending impulses now over the vertical side of the line will operate the relay J and will also operate relay B, although the magnet C, which was formerly associated with relay B will not operate. Operation of relay J will step up the switch 72 to a desired horizontal bank, and then the one impulse over the rotary side of the line will operate relay I, which causes an operation of relay L, which thereby moved the side switches over one notch. Now additional impulses over the vertical side of the line will again operate relay J, but this time the operation of relay J operates magnet N, thus to rotate the switch mechanism into its proper position. The final impulse as the substation switch mechanism returns, over the rotary side of the line will operate relays I and A and D, which again actuates relay L and thereby moves the side switches Z into their last position. Depressing the ringing key 31 will operate the relay O under these conditions, thus to signal the called for line. When both sides of the line are grounded at the substation, for instance, as when hanging up, the relay R, which is the release magnet, operates because both relays A and B are pulled up and this releases the mechanism serially with magnet R'.

While we have illustrated our invention as embodied in a particular structure, it is to be understood that it may be adapted for

use with other automatic systems as for instance the well known Strowger system as disclosed in the English patent to Hadden No. 18,747 of 1902, or to any system in which
5 automatic switches are used for connecting subscribers.

With all these advantages which are possible through the invention herein disclosed, we have perfected a system which will operate non-interfering partly lines on automatic
10 telephone systems.

While we have herein shown and particularly described one embodiment of our invention, we do not wish to limit ourselves
15 to the precise construction and arrangements as herein set forth, but

Having thus described one embodiment thereof, what we claim as new and desire to secure by Letters Patent is:—

20 1. A signaling system comprising two or more distinct electric circuits entering a switching station, switching mechanism at said station for interconnecting said circuits, a sub-station having a signal connected to one
25 of said electric circuits, two or more sub-stations having signals connected to a remaining circuit, electromagnetic means operated from the first aforesaid sub-station to operate said switching mechanism to connect the circuit
30 of said first aforesaid sub-station to a remaining circuit having a plurality of substations, a plurality of line contacts on said switching mechanism for each of said remaining circuits having a plurality of substations, the line contacts for each said circuit
35 connected in multiple arrangement, generating mechanism for furnishing different characters of current selectively to operate signaling mechanism of party line substations, and a ringing relay for breaking both
40 sides of the line and for interconnecting generating mechanism with said multiple contacts.

45 2. In an automatic exchange system for party line telephones, exchange mechanism for connecting subscribers' lines, multiple line contacts provided in said exchange mechanism for each party line subscriber's circuit, ringing mechanism, electromagnetic
50 mechanism for associating ringing mechanism with said multiple line contacts, switch contacts and means for causing a definite electrical condition thereof whereby normally a circuit when in use will appear
55 "busy" to any other circuit attempting connection therewith, and prevent such connection, and switching means associated with said exchange mechanism, to suspend the operation of said "busy" switch contacts when a calling party line subscriber's
60 apparatus calls a party line subscriber's apparatus on the same line.

3. A signaling system comprising two or
65 more distinct electric circuits entering a switching station, switching mechanism at

said station for interconnecting said circuits, a sub-station having a signal connected to one of said electric circuits, two or more sub-stations having signals connected to a remaining circuit, electromagnetic means operated from the first aforesaid sub-station
70 to operate said switching mechanism to connect the circuit of said first aforesaid sub-station to a remaining circuit having a plurality of substations, a plurality of line contacts on said switching mechanism for each
75 of said remaining circuits having a plurality of substations, the line contacts for each said circuit connected in multiple arrangement, generating mechanism for furnishing different characters of current selectively to operate signaling mechanism of party line
80 sub-stations, and electromagnetic mechanism for breaking both sides of the line and for interconnecting generating mechanism with said multiple contacts.

4. A signaling system comprising two or more distinct electric circuits entering a switching station, switching mechanism at said station for interconnecting said circuits, a sub-station having a signal connected
90 to one of said electric circuits, two or more sub-stations having signals connected to a remaining circuit, electromagnetic means operated from the first aforesaid sub-station to operate said switching mechanism to connect the circuit of said first aforesaid sub-station to a remaining circuit having a plurality of substations, a plurality of line contacts on said switching mechanism for each
95 of said remaining circuits having a plurality of substations, the line contacts for each said circuit connected in multiple arrangement, generating mechanism for furnishing different characters of current selectively to operate signaling mechanism of party line sub-stations, and electromagnetic mechanism comprising a relay and serial ringing contacts for interconnecting generating mechanism with said multiple contacts.
110

5. A signaling system comprising two or more distinct electric circuits entering a switching station, switching mechanism at said station for interconnecting said circuits, a sub-station having a signal connected
115 to one of said electric circuits, two or more sub-stations having signals connected to a remaining circuit, electromagnetic means operated from the first aforesaid sub-station to operate said switching mechanism to connect the circuit of said first aforesaid sub-station to a remaining circuit having a plurality of substations, a plurality of line contacts on said switching mechanism for each
120 of said remaining circuits having a plurality of substations, the line contacts for each said circuit connected in multiple arrangement, generating mechanism for furnishing different characters of current selectively to operate signaling mechanism of party line sub-
130

stations, and a ringing relay for interconnecting generating mechanism with said multiple contacts.

6. A signaling system comprising two or more distinct electric circuits entering a switching station, switching mechanism at said station for interconnecting said circuits, a sub-station having a signal connected to one of said electric circuits, two or more sub-stations having signals connected to a remaining circuit, electromagnetic means operated from the first aforesaid sub-station to operate said switching mechanism to connect the circuit of said first aforesaid sub-station to a remaining circuit having a plurality of substations, a plurality of line contacts on said switching mechanism for each of said remaining circuits having a plurality of substations, the line contacts for each said circuit connected in multiple arrangement, generating mechanism for furnishing different characters of current selectively to operate signaling mechanism of party line substations, and an electromagnetic mechanism for interconnecting generating mechanism with said multiple contacts.

7. In an automatic exchange system for party line telephones, exchange mechanism for connecting subscribers' lines, multiple line terminals provided in said exchange mechanism for each party line subscriber's circuit, ringing mechanism, electromagnetic mechanism for associating ringing mechanism with said multiple line terminals, switch contacts and means for causing a definite electrical condition thereof whereby normally a circuit when in use will appear "busy" to any other circuit attempting connection therewith, and prevent such connection, and automatic means associated with said exchange mechanism, to suspend the operation of said "busy" switch contacts when a calling party line subscriber's apparatus calls a party line subscriber's apparatus on the same line.

8. In an automatic exchange system for party line telephones, exchange mechanism for connecting subscribers' lines, multiple line terminals provided in said exchange mechanism for each party line subscriber's circuit, ringing mechanism for furnishing currents of different electrical character, electromagnetic mechanism for associating ringing mechanism selectively with said multiple line contacts, thus to send selective signaling currents over said party line subscriber's circuit.

9. A signaling system comprising two or more distinct electric circuits entering a switching station, switch mechanism including wipers at said station for interconnecting said circuits, a substation having a signal connected to one of said electric circuits, a plurality of substations connected to each of the remaining circuits, electromagnetic

means operating from the first aforesaid substation to operate said switching mechanism to connect the circuit of said first aforesaid substation to a remaining circuit, generating mechanism for furnishing currents of different frequency, selectively to operate signaling mechanism of said remaining circuits having a plurality of substations, and electromagnetic mechanism comprising a relay and ringing contacts for interconnecting generating mechanism through the switch wipers with said remaining circuit having a plurality of substations thereon.

10. In an automatic exchange system for party-line telephones, exchange mechanism including wipers for connecting subscribers' lines, line terminals provided in said exchange mechanism for each party line subscriber's circuit, ringing mechanism for furnishing currents of different frequency, electromagnetic mechanism and circuit connections for connecting ringing mechanism selectively through said wipers to the line terminals of a party line subscriber's circuit, thus to send selective signaling currents over said party line subscriber's circuit, and means at the telephones for operating said electromagnetic mechanism.

11. In an automatic exchange system for party line telephones, exchange mechanism for connecting subscribers' lines, line terminals provided in said exchange, exchange operating mechanism for each party line subscriber's circuit, calling mechanism, electromagnetic mechanism for associating calling mechanism with said line terminals, automatic means whereby normally a circuit when in use will appear busy to any other circuit attempting connection therewith, and prevent such connection, and additional automatic means associated with said exchange mechanism to suspend the operation of said first aforesaid automatic means when a calling party line subscriber's apparatus calls a party line subscriber's apparatus on the same line.

12. A telephone system, comprising party lines, connector switches for connecting to any of 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 calling the sub-stations of said lines selectively, and means for associating the ringing mechanism for calling the desired sub-station of a called line selectively, with the multiple terminals of said line.

13. In a telephone system, the combination with a connector switch, a calling device connected thereto, a telephone line having a plurality of sub-stations, multiply connected line terminals at said connector, one for each sub-station, ringing terminals for said sub-stations, there being a certain terminal

adapted for association with a certain sub-station, ringing currents for calling said sub-stations selectively, connected with said terminals, means operated by said calling device for transmitting current impulses to connect said connector with the line terminal of the desired sub-station, and means actuated responsive to certain of said impulses whereby the ringing terminal of said sub-station is associated with said line terminals.

14. In a telephone system, the combination with a calling telephone line, of a connector switch associated with said line, a called line having a plurality of substations, a line terminal at said connector for each sub-station, multiply connected to said called line, ringing terminals for said sub-stations there being a certain terminal adapted for association with a certain substation, ringing currents, for calling said sub-stations selectively, each station's current being associated with its ringing terminal, driving mechanism for operating said connector to connect with the terminals of the desired sub-station of the called line, and means for associating the ringing terminal of the desired sub-station with the line terminal of said sub-station.

15. In a telephone system, the combination with a calling telephone line, of a connector switch associated with said line, a called line having a plurality of sub-stations, a line terminal at said connector for each sub-station, multiply connected to said called line, ringing terminals for said sub-stations there being a certain terminal adapted for association with a certain substation, ringing currents, for calling said sub-stations selectively, each station's current being associated with its ringing terminal, driving mechanism for operating said connector to connect with the terminals of the desired sub-station of the called line, and a switch contact also operated by said driving mechanism, for associating the ringing terminal of the desired sub-station with the line terminal of said sub-station.

16. A telephone system comprising party lines, central exchange multiple terminals therefor, a link circuit for connecting to said terminals, ringing apparatus for furnishing calling currents of different electrical character for signaling the sub-stations on said lines selectively and means associated with said link circuit, for associating said signaling currents with a called line selectively.

17. A telephone system comprising a calling telephone line, and connector switch associated therewith, a called party-line, a line terminal at said connector switch for each sub-station of said party-line, said terminals being multiply connected thereto, ringing current for calling said substations selectively, ringing terminals for said substations

associated with said ringing currents, driving mechanism for operating said connector to connect with the terminals of the desired substation of the party-line, and means responsive to said driving mechanism for associating the ringing terminal and associated ringing current of the desired substation with the line terminal thereof.

18. A party line connector switch comprising sets of multiply connected line terminals, ringing terminals corresponding to the line terminals of said sets, motor mechanism for operating said switch to select any contact of a desired set, and means responsive to said motor mechanism for selecting the corresponding ringing terminal of the selected substation.

19. A party line connector switch comprising sets of multiply connected line terminals, ringing terminals corresponding to said line terminals, ringing currents of different characters associated with said ringing terminals, cooperating wipers for said line terminals, cooperating wipers for said ringing terminals, and mechanism for simultaneously operating said line and ringing wipers to select a line terminal and corresponding ringing terminal.

20. In a telephone exchange system, means for selective party-line ringing comprising a connector switch element and a generator switch concurrently operated, a series of contacts in said generator switch each connected to a distinctive source of current, each party line having a terminal in the connector switch corresponding to and connected by successive steps with one or more of the generator terminals, whereby distinctive current of several varieties may be supplied to the same line as required, substantially as described.

21. In an automatic telephone exchange system, means for selective party-line signaling comprising a connector switch having broad line terminals and a generator switch actuated step by step concurrently with the connector switch, said generator switch having a plurality of contacts each connected to a source of characteristically different calling currents, two or more of said generator contacts being successively swept over and connected to the ringing relay of the connector switch during the period of passage of the latter over the single party-line contact, substantially as described.

22. A telephone system comprising party telephone lines, automatic switch mechanisms having contact makers for interconnecting said lines, signaling currents, and means for connecting said currents through certain of the contact makers for operating the substation call bells of the party lines selectively.

23. A telephone system comprising party telephone lines, signaling bells at the sub-

stations of said lines responsive to different frequencies of ringing current, automatic switches for interconnecting said lines, signaling apparatus including call generators of different frequencies corresponding to the substations, and means for connecting such generators to ring the substation call bells selectively.

24. A telephone system comprising party telephone lines, having substation signals responsive to different frequencies of current, selector and connector switches for interconnecting said lines, multiply connected terminals at said connector switches for said lines, there being a multiple terminal at the connectors for each substation on each line, signaling apparatus including call generators of different frequencies corresponding to the substations, and means for connecting such generators to the proper terminals to ring the substation call bells selectively.

25. A telephone system comprising party lines having substation signals responsive to different frequencies of current, selector and connector switches for interconnecting said lines, multiply connected terminals at said connector switches for said lines, there being a particular contact for each substation of each line included in said multiple terminals, signaling apparatus including call generators of different frequencies corresponding to the substations, and means for interconnecting such generators and terminals to signal the substations selectively.

26. A telephone system comprising party lines, call bells responsive to currents of different frequencies at the substations of said lines, selector and connector switches for interconnecting said lines, multiply connected terminals at the connector switches for said lines, there being a particular contact for each substation of a line included in said multiple terminals, signaling currents of different frequencies corresponding to the

substations, and means for interconnecting such currents and terminals to ring the substation bells selectively.

27. A telephone system comprising party telephone lines, a call bell included in a circuit of each substation on each line, said bells being responsive to different predetermined frequencies of signaling current, automatic switch mechanisms for interconnecting said lines, signaling currents of different frequencies corresponding to the substations, and means for applying said currents for operating said call bells selectively.

28. A telephone system comprising a party telephone line, a plurality of substations upon said line, a connector switch for extending connection to said line, an auxiliary switch for selecting ringing current for ringing the substations upon said line, and means for operating the said switches for establishing connection with the said line and for selectively signaling the desired substation upon the said line.

29. A telephone system comprising a called subscriber's line provided with line terminals, a plurality of substations connected to said line, an automatic connector switch provided with wipers for connection with said called line, ringing current generators for signaling said substations, means associated with said switch for selecting a desired one of said ringing current generators, and means for operating said connector switch to establish said connection and for connecting the desired one of said ringing current generators through said wipers to the said called line.

In witness whereof we hereunto subscribe our names this 5th day of December, 1904.

OSCAR M. LEICH.

CHARLES E. HAGUE.

Witnesses:

MAX W. ZABEL,

F. B. BOICE.