H. F. OBERGFELL.

RINGING CURRENT INTERRUPTER.

APPLICATION FILED MAY 22, 1912.

1,189,862.

Patented July 4, 1916.

3 SHEETS—SHEET 1.

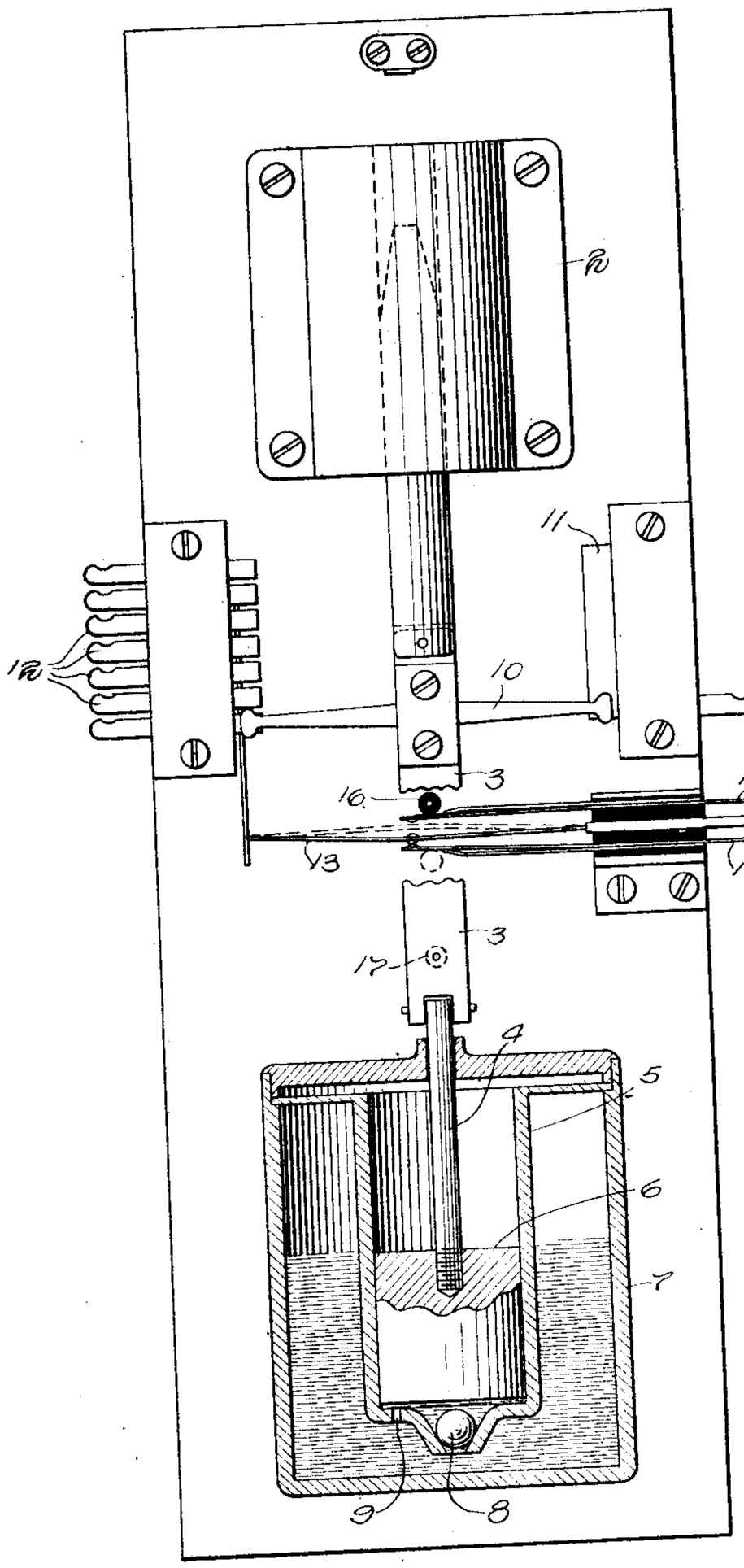

FIG. 1.

WITNESSES

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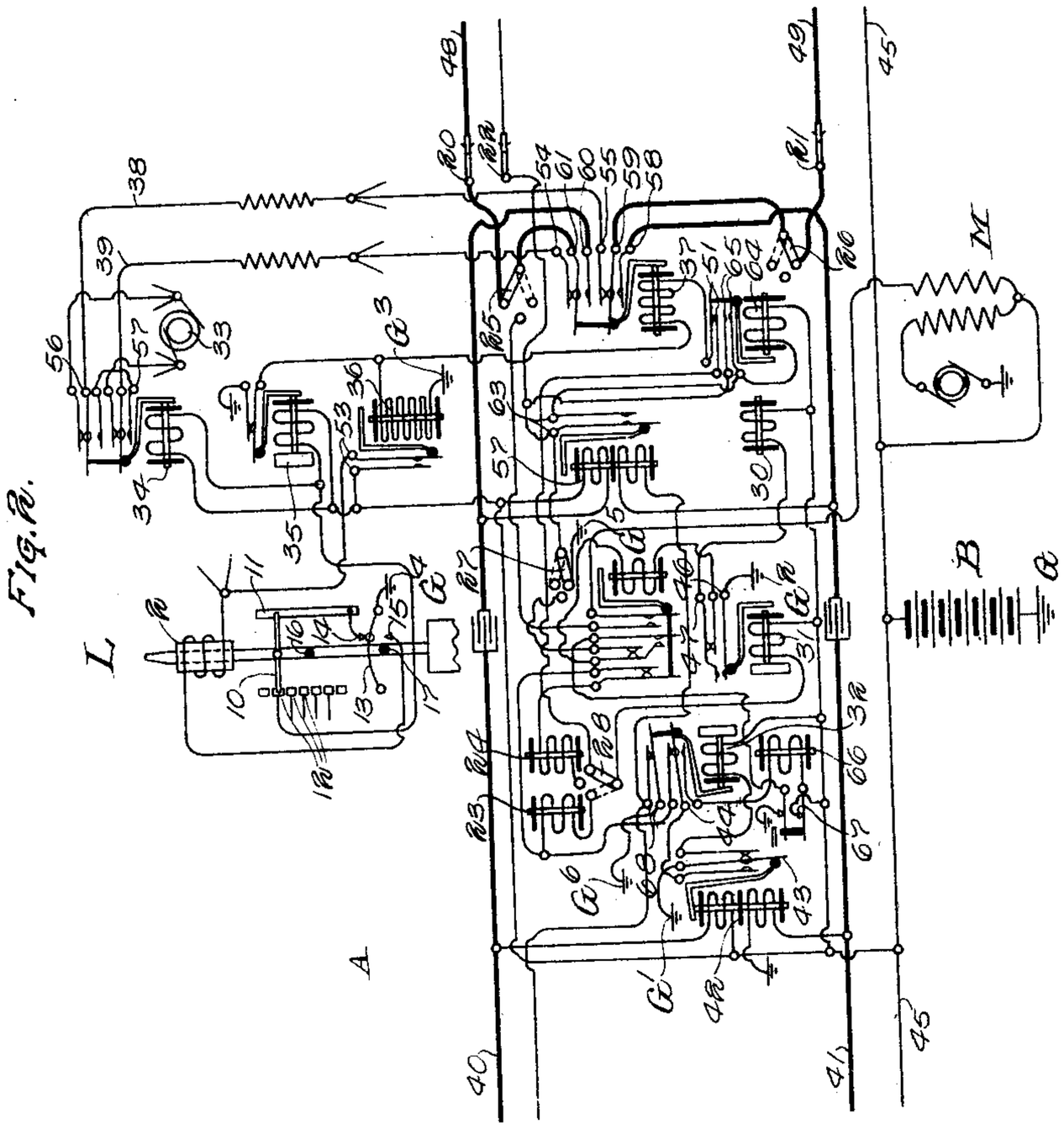
3 SHEETS—SHEET 2.

Fig. 2.



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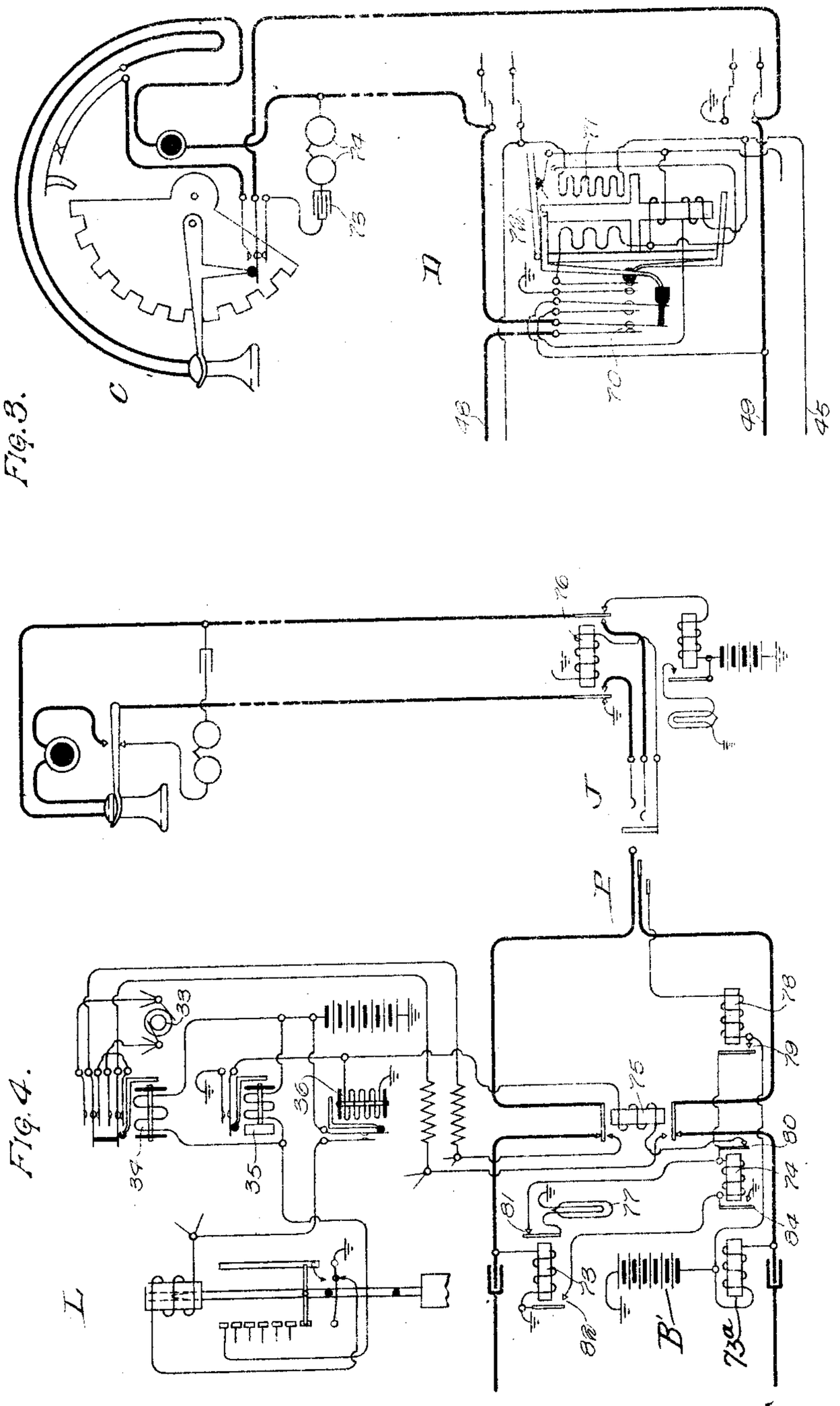

FIG. 3.

FIG. 4.

WITNESSES

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RINGING-CURRENT INTERRUPTER.

1,189,862. Specification of Letters Patent. Patented July 4, 1916.

Application filed May 22, 1912. Serial No. 698,900.

To all whom it may concern:

Be it known that I, HERBERT F. OBERGFELL, a citizen of the United States of America, and resident of Chicago, in the county of Cook, in the State of Illinois, have invented certain new and useful Improvements in Ringing-Current Interrupters, of which the following is a specification.

My invention relates to ringing current interrupters for use in connection with telephone systems. In telephone exchanges in which automatic ringing is employed it is desirable to have the ringing current interrupted for two reasons. First, a long continuous ring is objectionable, and, secondly, it is desirable to disconnect the ringing current from the line at short intervals and connect some means, such as the back-bridge relay of the connector, which may be controlled by the removal of the receiver from the switch hook at the called substation to permanently disconnect the ringing current from the line. If all the connectors in an automatic exchange, or the cord circuits in a manual exchange, are divided into a certain number of groups, and the interrupter mechanism is arranged to supply ringing current to these different groups in rotation, it will be seen that the amount of ringing current drawn from the ringing current generator will be less than if ringing current were supplied to all the groups in the exchange at the same time. With such an arrangement—that is, supplying ringing current to the different groups in rotation—it is possible to use a ringing current generator of much smaller capacity than would otherwise be the case.

Heretofore it has been customary to employ ordinary rotary alternating current generators for supplying ringing current, which generators are continuously operating. A number of commutators or interrupter wheels were geared up with the shaft of the generator, which interrupter wheels were so arranged as to supply current to only one section of the exchange at a time. This arrangement was objectionable, however, as the generators and interrupters were generally operating continuously, and they were therefore inefficient and especially so in a small exchange. It has also been proposed to employ a vibrating pole changer as a ringing current generator, together with an interrupter in connection with such a pole changer, which is arranged to operate only when it is desired to supply ringing current to a called line. Heretofore this interrupter, however, interrupted the ringing current for the whole exchange at one time.

The object of my present invention is to provide a simple and efficient interrupter which will embody both the features of the above types. I provide an interrupter which is normally at rest and which supplies ringing current to only one section of the exchange at a time and operates only when some connector is in ringing position.

These and other objects of my invention will be more readily understood by reference to the accompanying drawings, in which, for the purpose of illustration, I have shown my invention in connection with an automatic system of a particular type. It will, of course, be understood that any other suitable form of automatic system could be employed. I have also illustrated my invention in connection with a manual system in which it is but necessary to substitute an ordinary cord circuit for the automatic connector.

Throughout the drawings similar reference characters illustrate similar parts.

Figure 1 is an elevation of my improved interrupter device. Figs. 2 and 3 show a portion of an automatic telephone system in connection with which I have chosen to illustrate my invention. Fig. 4 shows a portion of a manual system with which I have chosen to illustrate my invention.

The interrupter proper, as illustrated in Fig. 1, comprises, among other details, a solenoid 2 the plunger of which is connected through the medium of a link 3 with the piston rod 4 of a dash-pot. The dash-pot comprises a cylinder 5 in which the piston 6 works. The cylinder 5 is inclosed in a cup 7 which is partly filled with oil or some other suitable liquid. The bottom of the cylinder is closed, except for a ball valve 8 and a small opening 9. When the solenoid 2 is energized, its plunger and the piston 6 are raised, and the liquid in the cup 7 enters the cylinder 5 through the valve 8 and offers little or no resistance to the movement of the piston and plunger. When, however, the solenoid is deenergized, and the plunger and piston begin to fall back to their lower positions, the valve 8 closes and the only exit for the liquid from the cylinder is through the small opening 9, so

that the movement of the piston is retarded and it falls only slowly. Carried by the link 3, but insulated therefrom, there is a brush or wiper 10 one end of which bears upon a long contact strip 11, while the other end brushes over and makes contact with a number of short contact pieces 12 which are insulated from each other. Back of the link 3 there is a group of interrupter springs comprising a long spring 13 and two shorter springs 14 and 15. The spring 13 is supported at both ends and is slightly longer than the distance between its supports, so that it is forced to bow slightly up or down. On the rear of the link 3 there are two insulating pins 16 and 17 which strike the springs 14 and 15, respectively, when the plunger of the solenoid is in its lower and upper positions, respectively. As shown in Fig. 1, the plunger is in its lowest position and the spring 13 is bowed downward in contact with the spring 15. As the plunger nears the limit of its upward movement when the solenoid is energized, the pin 17 strikes the spring 15 and forces both it and the spring 13 upward until the latter spring slightly passes its mid position, when, of its own accord, it springs to its extreme upper position and into contact with the spring 14 and out of contact with the spring 15. As the plunger nears its lowest position when the solenoid is deënergized, the pin 16 in like manner forces the spring 13 back to its original position in contact with the spring 15 and out of contact with the spring 14.

In Figs. 2 and 3 are represented a connector switch A, a called subscriber's substation C and an individual switch D. This individual switch is described in British patent to S. G. S. Dicker, No. 1298 of 1910.

The connector switch comprises among other details a set of wipers 20, 21 and 22 carried upon a shaft (not shown) having a vertical motion controlled by the vertical magnet 23 and a rotary motion controlled by the rotary magnet 24. The usual side switch, comprising the wipers 25, 26, 27 and 28, is controlled by the private magnet 30 in a well-known manner. The relays 31 and 32 are slow acting relays—that is, they deënergize slowly after their energizing circuits have been broken. The relay 37 is the ringing relay—that is, the relay which operates after connection between the calling and called lines has been completed to momentarily sever the connection and apply ringing current to the called line to signal the called subscriber. All of the connectors in an exchange may be supplied with ringing current by a single ringing current generator 33, and a single interrupter device of the character shown in Fig. 1 and represented diagrammatically at L in Fig. 2 may be employed to properly control the supply of ringing current to the connectors. With respect to the ringing current generator, the connectors are divided into a plurality of groups, each group being supplied with ringing current over a separate pair of leads 38 and 39, and to each group of connectors a group of relays 34, 35 and 36 is allotted. The upper and lower contacts of the group 12 of the interrupter L are preferably dead contacts and serve only as supports for the wiper 10 when it is in its upper and lower positions. Between the upper and lower contacts there are as many contacts as there are groups of connectors, each contact being connected to the relays 34 and 35 of some particular group. The other terminals of the relays 34 and 35 are connected to the battery B. The relay 36 is included in a permanent ground connection of the ringing relay 37 of all the connectors of its group. The springs of the relay 36 control a battery connection to one terminal of the solenoid 2. The other terminal of the solenoid is connected to the spring 15. The spring 13 is connected to the grounded terminal of the battery B and the contact 14 is connected to the strip 11.

Having given a general description of the apparatus, it will now be explained how connection is completed with a called line through the medium of the connector switch shown, and how the supply of ringing current to the called line is controlled through the medium of the interrupting apparatus described herein. When the connection reaches the connector over the conductors 40 and 41 from the calling substation, the connector line relay 42 becomes energized by reason of the closed bridge across the line at the calling substation. The relay 42, upon energizing, closes the circuit of the relay 32. When the calling subscriber operates his calling device for the next digit of the called number, the circuit of the line relay 42 is momentarily broken a number of times corresponding to the digit called. The relay 32 being a slow acting relay does not have time to deënergize during the momentary interruptions of its circuit by the relay 42, and, therefore, each time the line relay deënergizes, a circuit is closed extending from ground G′ through the spring 43 and its back contact, spring 44 and its front contact, vertical magnet 23, side switch wiper 28 and the relay 31 to the battery lead 45, and thence through battery B to ground G. The vertical magnet 23 operates in response to the impulses transmitted over this circuit to raise the shaft wipers 20, 21 and 22 a number of steps to a position opposite the row or level of bank contacts corresponding to the digit called. The relay 31, which is included in the energizing circuit of the vertical magnet, is energized by the first impulse, but being a slow acting relay does not deënergize

until after the last impulse is delivered. The relay 31, in its energized position, closes a circuit extending from ground G^2 through the springs 46 and 47 and the private magnet 30 to the battery lead 45. This circuit is broken when the relay 31 deënergizes after the last impulse is delivered to the vertical magnet, and the private magnet, upon deënergizing, permits the side switch to pass from first to second position. The side switch wiper 28, is passing from first to second position, transfers the battery connection from the vertical magnet 23 to the rotary magnet 24, so that when the calling subscriber operates his calling device for the last digit of the called number, the line relay 42 operates to transmit a series of impulses through the rotary magnet 24 and the relay 31. The rotary magnet operates in response to these impulses to rotate the switch wipers onto the contacts of the called line. The relay 31 operates in response to the impulses for this digit in the same manner as for the previous digit to cause the private magnet to advance the side switch one more step—that is, from second to third position—after the last impulse is delivered. The side switch wipers 25 and 26, upon reaching third position, complete the connection from the calling line through the wipers 20 and 21 to the conductors 48 and 49 which lead to the called substation. The contact 70 in the talking circuit at the switch D (Fig. 3) is closed by the energization of the winding 71, the circuit of which extends from ground G^5 at the connector through the side switch wiper 27, private wiper 22 and the winding 71 to the battery lead 45. The winding 71 is not strong enough to operate the plunger arm 72. The side switch wiper 28, upon reaching third position, completes a circuit extending from ground G^3 through the group relay 36, ringing relay 37 of the connector, springs 51, side switch wiper 28 and the relay 31 to the battery lead 45. The relay 36 is energized in this circuit, but it has a comparatively high resistance and prevents the relays 37 and 31 from being operatively energized. The relay 36, upon energizing, completes a circuit extending from ground G^4 at the interrupter L through the springs 13 and 15 (assuming that the solenoid is deënergized and the plunger at rest in its lowest position), solenoid 2 and the springs 53 to the battery lead 45. The solenoid, upon energizing, immediately draws its plunger to its extreme upward position, whereupon the pin 17 moves the spring 13 out of engagement with the spring 15 and into contact with the spring 14. The separation of the springs 13 and 15 breaks the circuit of the solenoid 2, whereupon its plunger begins to fall slowly under the control of the dash-pot.

When the wiper 10 reaches the second contact in its downward movement, a circuit is closed from ground G^4 through the springs 13 and 14, strip 11, wiper 10 and the relays 34 and 35 in multiple to the battery lead 45. The relay 34, upon energizing, operates to connect the ringing current generator 33 with the springs 54 and 55 of the connector ringing relay 37. The relay 35, upon energizing, operates to short-circuit the relay 36, thereby increasing the current through the connector ringing relay 37 sufficiently to cause it to be operatively energized. The relay 37, upon energizing, operates to disconnect the calling line from the called line and to connect the ringing current generator with the latter. The relay 37 will remain energized and continue to supply the ringing current to the called line until the wiper 10 passes off the second contact, whereupon the circuit of the relays 34 and 35 will be broken. The relay 35 is slightly slow acting, so that it does not deënergize until after the relay 34 has had time to restore to normal position. The relay 34, upon deënergizing, disconnects the ringing current generator 33 from the called line and short-circuits the line through the springs 56 and 57 for a purpose which will hereinafter be described. The relay 35, upon deënergizing, permits the ringing relay 37 to deënergize, which disconnects the generator leads 38 and 39 from the called line and restores the connection with the called line. The wiper 10 of the interrupter device L continues its downward movement and, in passing over each of the remaining contacts 12, causes any connectors in the remaining groups which are in ringing position to operate to supply ringing current to the lines which they have called in the manner above explained. When the plunger of the interrupter device reaches its lowest position, the spring 13 is forced back into contact with the spring 15, and if the called subscriber has not answered nor the calling subscriber hung up his receiver, the solenoid 2 will again be energized and the above operations repeated. In this manner ringing current will be periodically supplied to the called line until the called subscriber removes his receiver. When this occurs a bridge is closed across the line through the talking circuit in the usual manner, and as soon as the ringing relay 37 deënergizes, if it happens to be energized at the time, the connector back-bridge relay 57 is energized over a circuit extending from ground G^6 through the springs 68, lower winding of the relay 57, ringing relay springs 58 and 59, side switch wiper 26, shaft wiper 21, conductor 49, thence to and through the called substation and back over the other side of the line over the conductor 48, wipers 20 and 25, springs 61 and 60 and the upper winding of the relay 57 to the battery lead 45. The

relay 57, upon energizing, closes a circuit extending from ground G^5 through the side switch wiper 27, springs 63 and the relay 64 to the battery lead. The relay 64, upon energizing, separates the springs 51, thereby breaking the circuit of the ringing relay 37 and preventing its further operation after the called subscriber has answered. The relay 64, upon energizing, also forms a locking circuit for itself through the springs 65, so that it does not deënergize and permit the ringing relay to again become operative when the called subscriber hangs up his receiver and permits the back-bridge relay 57 to deënergize.

In the above description it will be seen that when the back-bridge relay energizes and causes the relay 64 to energize to finally cut out the ringing relay 37, the relay 64 becomes locked up and cannot deënergize to close the ringing relay circuit again when the called subscriber hangs up his receiver and allows the back-bridge relay 57 to deenergize. At the substation there is a condenser 73 included in the circuit of the ringer 74 to furnish a path for ringing current which is impassable to battery current. When ringing current is disconnected from the line, this condenser may be left in a charged condition. If the ringing relay 37 were to deënergize and connect the back-bridge relay 57 with the line while the condenser was thus charged, it would discharge through the back-bridge relay and might cause it to be momentarily energized to cause the relay 64 to break the circuit of the ringing relay before the called subscriber had answered. As described, however, the relay 34, after cutting off the ringing current, short-circuits the line and thereby causes the substation condenser to be discharged before the relay 35 permits the relay 37 to deënergize, and thus the possibility of the ringing relay being prematurely cut out is entirely avoided.

It will be seen from the above description that the connector shown, as well as all other connectors belonging to the same group and to which the relays 34, 35 and 36 are allotted, can operate to supply ringing current to the lines which are called through them only while the wiper 10 is passing over the second contact. While the wiper 10 is passing over the third, fourth, fifth and sixth contacts, the connectors of the remaining groups are rendered operative for supplying ringing current to the called line with which they happen to be connected. It will thus be seen that if two connectors in different groups are in ringing position at the same time, they will not be able to actually draw ringing current from the generator 33 simultaneously. It will also be seen that the interrupter device L is normally at rest and that it begins to operate only when some connector reaches ringing position and causes the relay 36 allotted to its group to be energized.

After a conversation is completed the connector shown is released by the hanging up of the receiver at the calling substation. The hanging up of the receiver permits the relay 42 to deënergize, which breaks the circuit of the relay 32. The relay 32, upon deenergizing, closes the circuit of the release magnet 66, said circuit extending from ground G′ through the spring 43 and its back contact, spring 44 and its back contact, magnet 66 and the springs 67 to the battery lead 45. The magnet 66, upon energizing, restores the switch shaft and side switch, and the switch shaft, upon reaching its lowest position, separates the springs 67 to permit the release magnet to deënergize.

In case the called line is already in use when the connector attempts to make connection therewith, the connection is not completed, but the side switch remains locked in second position and the calling subscriber is given the busy signal from the busy signaling device M in a well-known manner, which it is not thought necessary to describe herein.

In Fig 4 there is shown a mannual telephone line and the calling end of a cord circuit which is adapted for automatic ringing, the supply of ringing current being controlled by an interrupter similar to that hereinbefore described. The various parts of the interrupter and the controlling relays are designated by the same reference numerals as in Fig. 2. The cord circuit represented is a simple form of circuit which, in addition to the usual supervisory relay 73 and the lamp 77. is provided with a ringing relay 75 and a lock-out relay 74′. The functions of these two latter relays are similar to those of the relays 37 and 64, respectively, in the automatic connector switch.

The operation of the manual apparatus is as follows: Upon the insertion of the plug P into the jack J of the called line, a circuit is closed from ground through the cut-off relay 76, sleeve of the jack J and the plug P and the relay 78 to the battery B′. The relay 78, upon energizing, closes the circuit of the supervisory lamp 77, connects the battery with the relay 74 and closes a circuit extending from battery through contacts 79 and 80 and the relays 75 and 36 to ground. The relay 36 being of a high resistance is itself operatively energized, but does not permit sufficient current to flow to operate the relay 75. The relay 36, upon energizing, starts the operation of the interrupter L, which operates in the same manner as explained in connection with Fig. 2 to intermittently operate the ringing relay 75. Upon the response of the called subscriber talking current flows to the called

substation through the relay 73 and impedance coil 73ª. The relay 73, upon energizing, breaks the circuit of the lamp 77 at the contact 81 and closes the circuit of the relay 74 at the contact 82. The relay 74, upon energizing, breaks the circuit of the ringing relay at the contact 80 and closes a locking circuit for itself at the contact 84. When the called subscriber hangs up his receiver, the relay 73 deënergizes and again closes the circuit of the lamp 81 to give the usual disconnect signal, but the relay 74 remains locked up through its contact 84 and prevents the ringing relay 75 from again becoming operative. The relay 74 resumes its normal position when the plug P is removed from the jack J, whereby the relay 78 is permitted to deënergize.

When the interrupter device is used in connection with manual cord circuits, the same arrangement is employed as in an automatic system—that is, the cords are divided into a number of groups, the ringing relays of the diffeent groups being controlled through different contacts of the interrupter.

It will thus be seen that I have devised a very efficient interrupting device, one which is normally at rest and operates only when it is desired to supply ringing current to a called line. Likewise, ringing current is supplied to but a few lines at any one time, whereby the momentary consumption of current is greatly reduced, thus making it possible to employ a ringing generator of smaller capacity.

While I have illustrated and described certain particular embodiments of my invention, it is to be understood that I do not wish to be limited to the exact constructions shown and described.

What I claim as my invention is:—

1. In a telephone system, a plurality of groups of subscribers' lines, means for automatically supplying ringing current to said lines, a distributing interrupter common to said groups, said interrupter being normally at rest, and means for bringing said interrupter into use when it is desired to apply ringing current to a line to successively interrupt the ringing current in the different groups of subscribers' lines.

2. In a telephone system, a plurality of subscribers' lines divided into groups, means for establishing a connection with one of said lines, means for applying ringing current to said line when connection has been established therewith, an interrupter common to said groups of lines normally at rest, means for bringing said interrupter into operation when connection is made with the line, and means controlled by said interrupter for successively interrupting the ringing current supplied to the different groups of subscribers' lines.

3. In a telephone system, a plurality of groups of subscribers' lines, means for automatically supplying ringing current to said lines, a distributing interrupter common to a plurality of said groups, said interrupter comprising a magnet, a wiper carried by the plunger of said magnet, and a bank of contacts successively engaged by said wiper, said contacts belonging to different groups of said subscribers' lines, whereby the ringing current supplied to said groups is successively interrupted.

4. In a telephone system, a plurality of subscribers' lines divided into groups, means for automatically supplying ringing current to said lines, an interrupter common to a plurality of said groups for interrupting said ringing current, said interrupter comprising a magnet, a plunger controlled thereby for controlling a series of contacts, whereby the ringing current supplied to the different groups of subscribers' lines is successively interrupted, and a dash-pot for controlling the operation of said plunger.

5. In a telephone system, a plurality of subscribers' lines divided into groups, means for automatically supplying ringing current to said lines, an interrupting device common to a plurality of said groups for interrupting said ringing current, said interrupter comprising a magnet, means for energizing said magnet when connection is made with a subscriber's line, means for automatically breaking said energizing circuit, and means controlled by the return of the plunger of said magnet to normal position to successively interrupt the supply of ringing current to the different groups of said subscribers' lines.

6. In a telephone system, a plurality of subscribers' lines divided into groups, means for automatically supplying ringing current to said lines, an interrupting device common to a plurality of said groups for interrupting said ringing current, said interrupter comprising a magnet, means for energizing said magnet when connection is made with a subscriber's line, means for automatically breaking said energizing circuit, means controlled by the return of the plunger of said magnet to normal position to successively interrupt the supply of ringing current to the different groups of said subscribers' lines, and a dash-pot for controlling the return movement of said plunger.

7. In a telephone system, a plurality of subscribers' lines, means divided into groups for automatically supplying ringing current to said lines, a distributing interrupter common to a plurality of said groups, said interrupter being normally at rest, and means for bringing said interrupter into use when it is desired to apply ringing current to a line to successively interrupt the ringing current in the different groups.

8. In a telephone system, a plurality of subscribers' lines, means for establishing connection with said lines, means divided into groups for applying ringing current to said lines when connection has been established therewith, an interrupter common to a plurality of said groups normally at rest, means for bringing said interrupter into operation when connection is made with a line, and means controlled by the interrupter for successively interrupting the ringing current supplied to the subscribers' lines.

9. In a telephone system, a plurality of subscribers' lines, means divided into groups for automatically supplying ringing current to said lines, a distributing interrupter common to a plurality of said groups, said interrupter comprising a solenoid magnet, a wiper carried by the plunger of said solenoid, and a bank of contacts successively engaged by said wiper, said contacts belonging to different groups of said automatic ringing means, whereby the ringing current supplied to said groups is successively interrupted.

10. In a telephone system, a plurality of subscribers' lines, means divided into groups for automatically supplying ringing current to said lines, an interrupting device common to a plurality of said groups for interrupting said ringing current, said interrupter comprising a solenoid magnet, means for energizing said magnet when connection is made with a subscriber's line, means for automatically breaking said energizing circuit, and means controlled by the return of the plunger of said solenoid to normal position to successively interrupt the supply of ringing current from the different groups of ringing means to said subscribers' lines.

11. In a telephone system, a plurality of subscribers' lines, means for automatically supplying ringing current to said lines, an interrupting device common to a plurality of said groups for interrupting said ringing current, said interrupting device comprising a solenoid magnet, means for energizing said magnet when connection is made with a subscriber's line, means for automatically breaking said energizing circuit, means controlled by the return of the plunger of said solenoid to normal position to successively interrupt the supply of ringing current from the different groups of ringing mechanism to said subscribers' lines, and a dash-pot for controlling the return movement of said solenoid.

12. In a telephone system, a series of lines divided into groups, means for each group for connecting two lines, ringing means comprising a generator for signaling when the connection is made, said ringing means also comprising equipment normally at rest and common to said groups, and equipment individual to said groups, the common equipment controlling the individual equipment.

13. In a telephone system, a series of lines divided into groups, means for each group for connecting lines, ringing means comprising a generator for signaling when the connection is made, said ringing means also comprising equipment common to said groups and electromagnetic equipment individual to said groups, said common equipment controlling said individual equipment.

14. In a telephone system, a series of lines divided into groups, means for each group for connecting lines, ringing means comprising a generator for signaling when the connection is made, said ringing means also comprising equipment common to said groups and electromagnetic equipment individual to said groups, said common equipment controlling said individual equipment to render the individual equipments operative consecutively.

15. In a telephone system, a series of lines divided into groups, automatic switches for each group for connecting lines, ringing means for signaling when the connection is made, said means comprising equipment common to said groups, equipment individual to said groups and equipment individual to each switch in each group, said common equipment controlling the individual group equipment and the individual switch equipment.

16. In a telephone system, a series of lines divided into groups, automatic switches for each group for connecting lines, ringing means for signaling when the connection is made, said means comprising electromagnetic equipment common to said groups, equipment individual to said groups and equipment individual to each switch in each group, said common equipment controlling the individual group equipment and the individual switch equipment.

17. In a telephone system, a series of lines divided into groups, automatic switches for each group for connecting lines, ringing means for signaling when the connection is made, said means comprising equipment common to said groups, electromagnetic equipment individual to said groups and equipment individual to each switch in each group, said common equipment controlling the individual group equipment and the individual switch equipment.

18. In a telephone system, a series of lines divided into groups, automatic switches for each group for connecting lines, ringing means for signaling when the connection is made, said means comprising equipment common to said groups, equipment individual to said groups and electromagnetic equipment individual to each switch in each

group, said common equipment controlling the individual group equipment and the individual switch equipment.

19. In a telephone system, a series of lines divided into groups, automatic switches for each group for connecting lines, ringing means for signaling when the connection is made, said means comprising electromagnetic equipment common to said groups, electromagnetic equipment individual to said groups and electromagnetic equipment individual to each switch in each group, said common equipment controlling the individual group equipment and the individual switch equipment.

20. In a telephone system, a series of lines divided into groups, automatic progressively movable switches for each group for connecting lines, a circuit controller, ringing means for signaling when the connection is made, said means comprising equipment common to said groups, equipment individual to said groups and equipment individual to each switch in each group, said common equipment controlling the individual group equipment and the individual switch equipment through the medium of said circuit controller.

21. In a telephone system, a series of lines divided into groups, automatic progressively movable switches for each group for connecting lines, a circuit controller, ringing means for signaling when the connection is made, said means comprising equipment common to said groups, equipment individual to said groups and equipment individual to each switch in each group, said common equipment controlling the individual group equipment and the individual switch equipment through the medium of said circuit controller, said circuit controller having a bank with a series of contacts, one for each group, and a wiper for moving over said contacts.

22. In a telephone system, a series of lines divided into groups, automatic switches for each group for connecting lines, ringing means for signaling when the connection is made, said means comprising equipment common to said groups, equipment individual to said groups and equipment individual to each switch in each group, said common equipment provided with means for rendering one individual group equipment and its associated switch equipments operative while another individual group equipment is maintained inoperative.

23. In a telephone system, a series of lines divided into groups, automatic switches for each group for connecting lines, ringing means for signaling when the connection is made, said means comprising electromagnetic equipment common to said groups, equipment individual to said groups and equipment individual to each switch in each group, said common equipment provided with means for rendering one individual group equipment and its associated switch equipments operative while another individual group equipment is maintained inoperative.

24. In a telephone system, a series of lines divided into groups, automatic switches for each group for connecting lines, ringing means for signaling when the connection is made, said means comprising equipment common to said groups, electromagnetic equipment individual to said groups and equipment individual to each switch in each group, said common equipment provided with means for rendering one individual group equipment and its associated switch equipments operative while another individual group equipment is maintained inoperative.

25. In a telephone system, a series of lines divided into groups, automatic switches for each group for connecting lines, ringing means for signaling when the connection is made, said means comprising equipment common to said groups, equipment individual to said groups and electromagnetic equipment individual to each switch in each group, said common equipment provided with means for rendering one individual group equipment and its associated switch equipments operative while another individual group equipment is maintained inoperative.

26. In a telephone system, a series of lines divided into groups, automatic switches for each group for connecting lines, ringing means for signaling when the connection is made, said means comprising electromagnetic equipment common to said groups, electromagnetic equipment individual to said groups and electromagnetic equipment individual to each switch in each group, said common equipment provided with means for rendering one individual group equipment and its associated switch equipments operative while another individual group equipment is maintained inoperative.

27. In a telephone system, a series of lines divided into groups, automatic progressively movable switches for each group for connecting lines, a circuit controller, ringing means for signaling when the connection is made, said means comprising equipment common to said groups, equipment individual to said groups and electromagnetic equipment individual to each switch in each group, said common equipment through the medium of said circuit controller for rendering one individual group equipment and its associated switch equipments operative while another individual group equipment is maintained inoperative.

28. In a telephone system, a series of lines divided into groups, automatic progressively movable switches for each group for connecting lines, a circuit controller, ringing means for signaling when the connection is made, said means comprising equipment common to said groups, equipment individual to said groups and equipment individual to each switch in each group, said common equipment controlling the individual group equipment and the individual switch equipment through the medium of said circuit controller, said circuit controller having a bank with a series of contacts, one for each group, and a wiper for moving over said contacts to render one individual group equipment operative at a time.

29. In a telephone system, a series of lines divided into groups, means for each group for connecting lines, a circuit controller, ringing means for signaling when the connection is made, said means comprising equipment common to said groups and individual to said groups, said common equipment controlling said individual equipment through the medium of said circuit controller, said circuit controller having a bank with a series of contacts, one for each group, and a wiper for moving over said contacts, said equipments being all automatic.

30. In a telephone system, a series of lines divided into groups, automatic switches for each group for connecting lines, ringing means for signaling when the connection is made, said means comprising equipment common to said groups, equipment individual to said groups and equipment individual to each switch in each group, said common equipment controlling the individual group equipment and the individual switch equipment, said equipments being all automatic.

31. In a telephone system, a series of lines divided into groups, automatic switches for each group for connecting lines, ringing means for signaling when the connection is made, said means comprising electromagnetic equipment common to said groups, equipment individual to said groups and equipment individual to each switch in each group, said common equipment controlling the individual group equipment and the individual switch equipment, said equipments being all automatic.

32. In a telephone system, a series of lines divided into groups, automatic switches for each group for connecting lines, ringing means for signaling when the connection is made, said means comprising equipment common to said groups, electromagnetic equipment individual to said groups and equipment individual to each switch in each group, said common equipment controlling the individual group equipment and the individual switch equipment, said equipments being all automatic.

33. In a telephone system, a series of lines divided into groups, automatic switches for each group for connecting lines, ringing means for signaling when the connection is made, said means comprising equipment common to said groups, equipment individual to said groups and electromagnetic equipment individual to each switch in each group, said common equipment controlling the individual group equipment and the individual switch equipment, said equipments being all automatic.

34. In a telephone system, a series of lines divided into groups, automatic switches for each group for connecting lines, ringing means for signaling when the connection is made, said means comprising electromagnetic equipment common to said groups, electromagnetic equipment individual to said groups and electromagnetic equipment individual to each switch in each group, said common equipment controlling the individual group equipment and the individual switch equipment, said equipments being all automatic.

35. In a telephone system, a series of lines divided into groups, automatic progressively movable switches for each group for connecting lines, a circuit controller, ringing means for signaling when the connection is made, said means comprising equipment common to said groups, equipment individual to said groups and equipments individual to each switch in each group, said common equipment controlling the individual group equipment and the individual switch equipment through the medium of said circuit controller, said equipments being all automatic.

36. In a telephone system, a series of lines divided into groups, automatic progressively movable switches for each group for connecting lines, a circuit controller, ringing means for signaling when the connection is made, said means comprising equipment common to said groups, equipment individual to said groups and equipment individual to each switch in each group, said common equipment controlling the individual group equipment and the individual switch equipment through the medium of said circuit controller, said circuit controller having a bank with a series of contacts, one for each group, and a wiper for moving over said contacts, said equipments being all automatic.

37. In a telephone system, a series of lines divided into groups, automatic switches for each group for connecting lines, ringing means for signaling when the connection is made, said means comprising equipment common to said groups, equipment individual to said groups and equipment individual to each switch in each group, said common equipment provided with means for

rendering one individual group equipment and its associated switch equipments operative while another individual group equipment is maintained inoperative.

38. In a telephone system, a series of lines divided into groups, automatic switches for each group for connecting lines, ringing means for signaling when the connection is made, said means comprising electromagnetic equipment common to said groups, equipment individual to said groups and equipment individual to each switch in each group, said common equipment provided with means for rendering one individual group equipment and its associated switch equipments operative while another individual group equipment is maintained inoperative, said equipments being all automatic.

39. In a telephone system, a series of lines divided into groups, automatic switches for each group for connecting lines, ringing means for signaling when the connection is made, said means comprising equipment common to said groups, electromagnetic equipment individual to said groups and equipment individual to each switch in each group, said common equipment provided with means for rendering one individual group equipment and its associated switch equipments operative while another individual group equipment is maintained inoperative, said equipments being all automatic.

40. In a telephone system, a series of lines divided into groups, automatic switches for each group for connecting lines, ringing means for signaling when the connection is made, said means comprising equipment common to said groups, equipment individual to said groups and electromagnetic equipment individual to each switch in each group, said common equipment provided with means for rendering one individual group equipment and its associated switch equipments operative while another individual group equipment is maintained inoperative, said equipments being all automatic.

41. In a telephone system, a series of lines divided into groups, automatic switches for each group for connecting lines, ringing means for signaling when the connection is made, said means comprising electromagnetic equipment common to said groups, electromagnetic equipment individual to said groups and electromagnetic equipment individual to each switch in each group, said common equipment provided with means for rendering one individual group equipment and its associated switch equipments operative while another individual group equipment is maintained inoperative, said equipments being all automatic.

42. In a telephone system, a series of lines divided into groups, automatic progressively movable switches for each group for connecting lines, a circuit controller, ringing means for signaling when the connection is made, said means comprising equipment common to said groups, equipment individual to said groups and equipment individual to each switch in each group, said common equipment through the medium of said circuit controller for rendering one individual group equipment and its associated switch equipments operative while another individual group equipment is maintained inoperative, said equipments being all automatic.

43. In a telephone system, a series of lines divided into groups, automatic progressively movable switches for each group for connecting lines, a circuit controller, ringing means for signaling when the connection is made, said means comprising equipment common to said groups, equipment individual to said groups and equipment individual to each switch in each group, said common equipment controlling the individual group equipment and the individual switch equipment through the medium of said circuit controller, said circuit controller having a bank with a series of contacts, one for each group, and a wiper for moving over said contacts to render one individual group equipment operative at a time, said equipments being all automatic.

44. In a telephone system, a plurality of subscribers' lines divided into groups, connectors for each group for connecting a calling and a called line, automatic ringing means comprising equipment common to said groups and equipment individual to each group for ringing the called line, and means in the common equipment for rendering the individual equipments inoperative.

45. In a telephone system, a plurality of subscribers' lines, groups of switches for connecting a calling and a called line, automatic ringing means comprising equipment common and individual to said groups of switches for ringing a called line, and means in the common equipment for rendering the individual equipment inoperative.

Signed by me at Chicago, Cook county, Illinois, this 18th day of May, 1912.

HERBERT F. OBERGFELL.

Witnesses:
ARTHUR J. RAY,
ALBERT ANDERSEN.