

W. G. BLAUVELT.
SEMIMECHANICAL TELEPHONE SYSTEM.
APPLICATION FILED OCT. 12, 1917.

1,310,730.

Patented July 22, 1919.

3 SHEETS—SHEET 1.

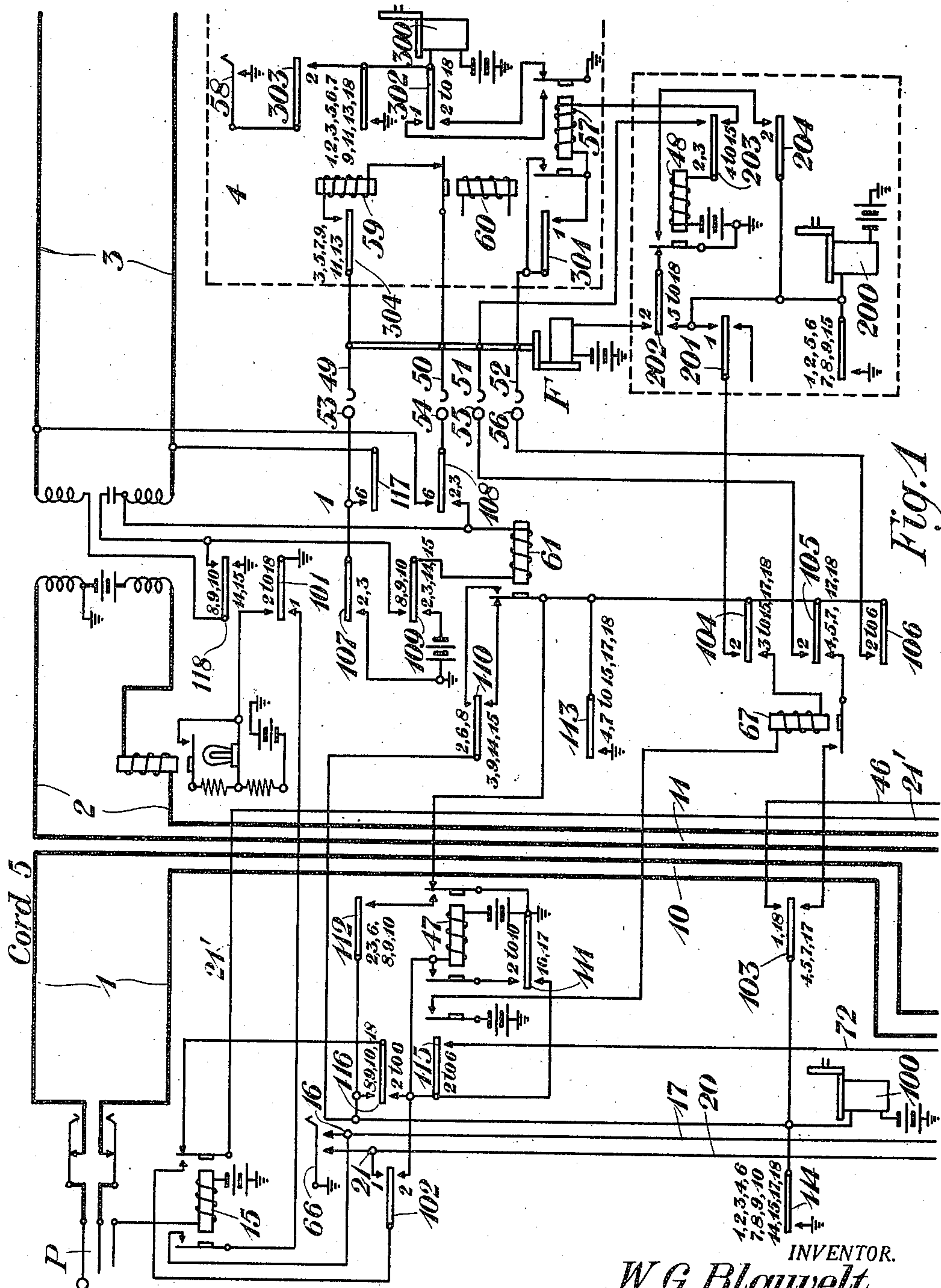


Fig. 1

INVENTOR.
W. G. Blauvelt
BY *J. V. Folger*
ATTORNEYS.

W. G. BLAUVELT.
SEMIMECHANICAL TELEPHONE SYSTEM.
APPLICATION FILED OCT. 12, 1917.

1,310,730.

Patented July 22, 1919.

3 SHEETS—SHEET 2.

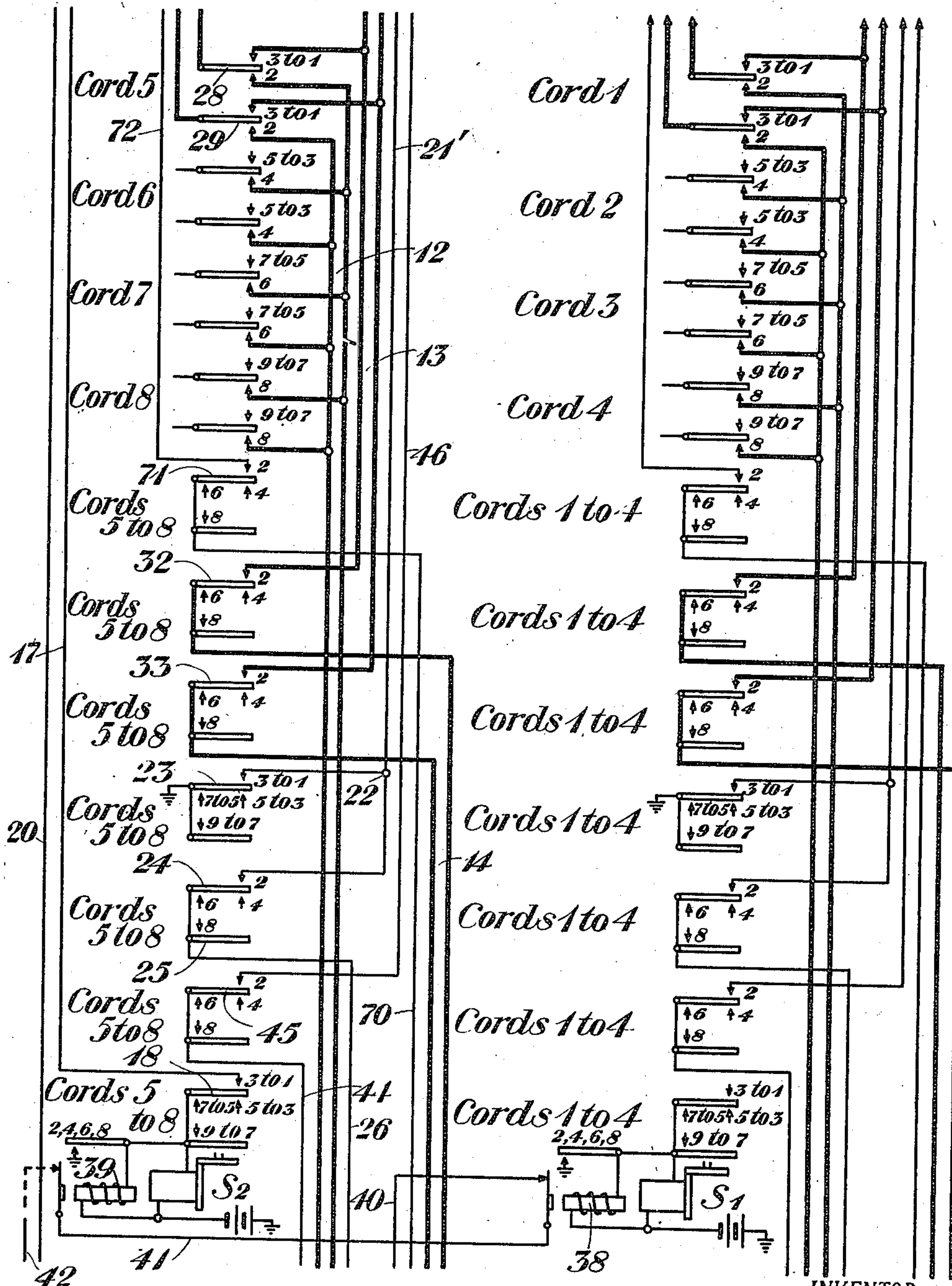


Fig. 2

INVENTOR.
W. G. Blauvelt
BY *J. E. Felt*
ATTORNEYS.

W. G. BLAUVELT.
SEMIMECHANICAL TELEPHONE SYSTEM.
APPLICATION FILED OCT. 12, 1917.

1,310,730.

Patented July 22, 1919.

3 SHEETS—SHEET 3.

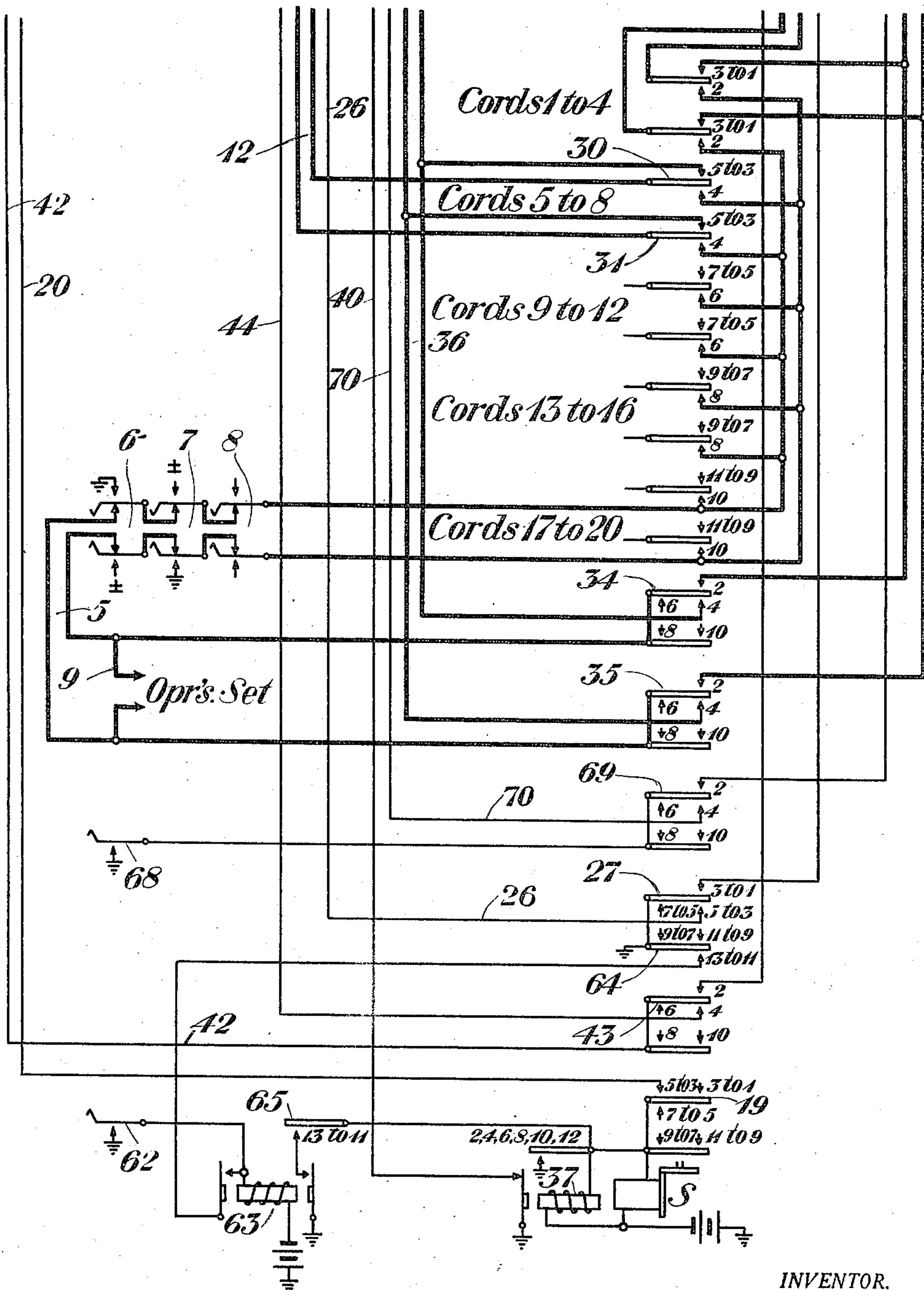


Fig. 3

INVENTOR.
W. G. Blauvelt
BY *g. r. folk.*
ATTORNEYS.

UNITED STATES PATENT OFFICE.

WILLIAM G. BLAUVELT, OF NEW YORK, N. Y., ASSIGNOR TO AMERICAN TELEPHONE AND TELEGRAPH COMPANY, A CORPORATION OF NEW YORK.

SEMIMECHANICAL TELEPHONE SYSTEM.

1,310,730.

Specification of Letters Patent.

Patented July 22, 1919.

Application filed October 12, 1917. Serial No. 196,281.

To all whom it may concern:

Be it known that I, WILLIAM G. BLAUVELT, residing at 308 W. 82nd street, New York city, in the county of New York and State of New York, have invented certain Improvements in Semimechanical Telephone Systems, of which the following is a specification.

This invention relates to semi-mechanical telephone systems, and more particularly concerns the provision of means whereby when an operator answers a call by inserting the plug of an idle cord circuit into the jack of a calling subscriber, the operator's talking set and associated apparatus will be automatically connected with that particular cord circuit.

It is one of the objects of this invention to provide means whereby the time necessary to effect this operation may be reduced to a minimum, the apparatus necessary to produce this result being greatly simplified.

In constructions heretofore used, where an operator has at her disposal a large number of cord circuits to each of which she must be able to connect her listening and controlling apparatus, in order to effect said connections in a minimum space of time, it has been proposed to arrange the cord circuits in groups of some small number, with a selecting switch for each group to select a particular cord circuit in the group, and an additional selecting switch common to the groups for selecting a group and connecting the operator's set to the terminals of the group. Suppose, for instance, there are twenty-five cord circuits, divided into groups of five each. Five switches, preferably of the sequence switch type, shown for instance in U. S. patent to McBerty 1,105,811, August 4, 1914, or U. S. patent to Reynolds, *et al.*, 1,127,808, February 9, 1915, would be provided, each having a position for each cord circuit of the group to which the switch is assigned. An additional switch of the same type would be provided, common to the other five, and having a position corresponding to each of the groups, and if desired, an additional position in which the operator's set would be connected to no group. If a cord in any group is used in answering a call, as soon as the operator plugs into the answering jack, the switch of that group begins to seek that particular

cord, and simultaneously the common switch seeks the group switch.

In systems such as above described, upon the completion of the selection, which at most involves but five steps of the switches occurring in a time period of one third of a second or less, a bridge is connected across the cord circuit and through the switches, said bridge including the operator's talking set, as well as ringing and coin return keys.

Inasmuch as the ringing and coin return keys are included in a bridge of the talking circuit, it is necessary with this arrangement to provide means to open the cord circuit to prevent the application of ringing or coin return current to the calling end of the cord. This was accomplished by providing each cord circuit with a relay whose circuit was extended through the selecting switches to the ringing and coin control keys, said relay functioning to open the cord circuit upon the operation of any key.

In accordance with the present invention the selecting switches are arranged so that the cord selecting switch, upon selecting a cord circuit, introduces into that cord circuit a loop extending to the group switch, which switch in turn, upon selecting the group, introduces in the first loop another loop in which the coin control and ringing keys are serially included and across which the operator's set is bridged. By this arrangement, when a cord circuit is selected the coin control and ringing keys are serially included therein so that the key itself when operated opens the cord circuit. This obviates the necessity for the relays individual to each cord and provides a more accurate operation of the ringing and coin control apparatus, which bear the same relation to the cord circuit as in manual practice.

The invention may be more fully understood by reference to the drawing in which Figures 1, 2 and 3, when arranged so that Figs. 2 and 3 are end to end with Fig. 1 horizontally at the top of Fig. 2, constitute a circuit diagram of the arrangements of the invention.

Referring to Fig. 1, a cord circuit is shown terminating in plug P, and consisting of two sections, 1 and 2, the latter of which is associated by means of the usual induction coil with a circuit 3 leading to automatic switching machinery of a well-

known type. As the switching machinery forms no part of the present invention it is not illustrated.

In order to control the sequence of operations whereby when the cord circuit is taken for use a sender is selected and the sending operations performed, a sequence switch 100 is provided, said sequence switch being of the type illustrated in the patents to McBerty or Reynolds above referred to. A sending apparatus 4 is also illustrated, said sending apparatus being adapted to be associated with the cord circuit illustrated in Fig. 1, or any other cord circuit to which it has access, by means of a finder switch F. The sending apparatus has associated therewith a sequence switch 300 of the type already described for controlling its operations. Similarly, the finder switch F has associated therewith a sequence switch 200 for a similar purpose. The contacts of the sequence switches 100, 200 and 300 are not shown in their actual relative positions, but are arranged in such a manner as to simplify the circuits. The contacts within the lower rectangle inclosed in dotted lines on Fig. 1 are individual to the sequence switch 200, those in the upper rectangle being individual to the sequence switch 300, while the remaining sequence switch contacts of Fig. 1 are individual to the sequence switch 100.

Referring to Fig. 3, an operator's loop 5 is shown, having serially included therein ringing keys 6 and 7 and a coin return key 8. The operator's set (not shown) is bridged across said loop by means of conductors 9.

In order to associate the operator's loop 5 with any one of a plurality of cord circuits, a number of selecting switches, S , S_1 and S_2 , are provided. Each of these switches is of the general type disclosed in the patents to McBerty or Reynolds, above referred to. Switches S_1 and S_2 are group switches, each having access to a group of cord circuits and being adapted to select a particular cord circuit in a group. In accordance with the arrangement illustrated, the cord circuits, eight in number, would be arranged in groups of four each, the switch S_1 having access to cords 1, 2, 3 and 4 and the switch S_2 having access to cords 5, 6, 7 and 8, the cord circuit illustrated in Fig. 1 being cord No. 5. It will be understood, however, that as many cord circuits may be included in a group as may be found desirable, and that in practice a larger number of groups may be provided, each of which will have a switch such as S_1 or S_2 associated therewith, two switches only having been illustrated in order to simplify the diagram.

The switch S is similar in construction to switches S_1 and S_2 , but is common to all of

the groups and is adapted to associate the operator's loop with the terminals of any one of the group switches, such as S_1 or S_2 . When a cord circuit is taken for use, the common switch S , and the group switch associated with the group of that particular cord, rotate simultaneously until the group switch finds the cord, and the common switch finds the group switch. Normally, the two sections 1 and 2, of cord No. 5 are connected by means of a loop 10, 11, through the contacts of switch S_2 . When said cord has been selected by the switch S_2 , however, said loop is opened at the upper contacts of the switch, and a new loop, consisting of conductors 12, 13 and 14 interpolated therein, said loop being connected through the second set of contacts of the common switch S . As soon as the switch S has selected the group switch S_2 , said loop in turn is opened at the second set of contacts of the switch S , and the operator's loop is introduced therein. In a similar manner, upon the selection of any other cord circuit, the operator's loop will be introduced in the two sections of the cord circuit by means of the common switch and the proper group switch.

The contacts of the switches S , S_1 and S_2 are so arranged that before any loop is opened the loop to be introduced therein is connected thereto so as to avoid clicks in the subscriber's instrument, in other words, the contacts of the sequence switches which control the loops are of the make before break type. The invention may now be understood from a description of the operation in connection with cord No. 5, it being understood that the operation with respect to other cords not shown is similar.

Listening in upon answering a call.

Assuming that cord No. 5 is to be used in answering a call, plug P is inserted in the answering jack, thereby energizing the sleeve relay 15. A circuit is then closed over the left-hand front contact of relay 15 from ground, lower sequence switch contact 101, left-hand front contact of relay 15, point 16, conductor 17, upper right-hand contact 18 of switch S_2 , through the winding of the motor magnet of the switch S_2 to battery. The motor magnet of the switch S_2 is energized over the above circuit, and the switch rotates from whatever position it may have been in at that time to its second position, whereupon the circuit above described is opened at contact 18, and the switch comes to rest. At the same time that the circuit above described was closed, a circuit was completed through the winding of the motor magnet of the switch S from battery over the upper contact 19 of said switch, conductor 20, point 21, upper sequence switch contact 102, right-hand front

contact of relay 15, conductor 21' to point 22, from which point the circuit continues to ground over the upper contact 23 of switch S_2 if said switch is not in position 2. If said switch is already in position 2, the circuit will continue from point 22 over upper contact 24 of switch S_2 , over conductor 26 and over lower contact 27 of switch S to ground. The winding of the motor magnet of switch S is energized over the circuit above traced, and said switch is rotated from the position in which it happened to be at that time to its fourth position, in which position the circuit above described is opened at contacts 19 and 27 and the switch comes to rest.

Upon switch S_2 coming to rest in its second position, the loop 10, 11, which is closed over upper contacts 28 and 29 of switch S_2 in all positions except position 2, is opened at said contacts, and conductors 10 are extended over lower contacts 28 and 29 in the same position, over conductors 12, over upper contacts 30 and 31 of switch S , over conductors 14, upper contacts 32 and 33 of switch S_2 and conductors 13 to conductors 11. So long as the switch S is in any other position than position 4, the loop just described remains closed over contacts 30 and 31. Upon switch S coming into its fourth position, however, the said loop is opened and conductors 12 are extended over lower contacts 30 and 31, over the loop 5, lower contacts 34 and 35 of switch S and over conductors 36 to conductors 14. With switch S_2 in position 2 and switch S in position 4, it will be seen that the operator's loop 5 is introduced in cord No. 5, over a circuit extending from section 1, over conductors 10, lower contacts 28 and 29 of switch S_2 , conductors 12, lower contacts 30 and 31 of switch S , coin control key 8, ringing keys 7 and 6, loop 5, lower contacts 34 and 35 of switch S , conductors 36, conductors 14, upper contacts 32 and 33 of switch S_2 , conductors 13, and over conductors 11 to section 2. The operator's set is now bridged across the cord circuit over conductors 9, and if the operator actuates any of the keys 6, 7 or 8, the ringing or coin-collect current, as the case may be, is applied to the answering end of the circuit only, the calling end being disconnected from the answering end by the contacts of the actuated keys.

It will be noted that the windings of relays 37, 38 and 39 are arranged in parallel with the windings of the motor magnets of the switches S , S_1 and S_2 , consequently during the time that the windings of the motor magnets of switches S and S_2 were energized to complete the operations above described, relays 37 and 39 were also energized. Upon the switches S and S_2 coming to rest, however, relays 37 and 39 are deenergized, thereby completing a circuit from ground

over the back contact of relay 37, conductor 40, back contact of relay 38, conductor 41, back contact of relay 39, conductor 42, over lower contact 43 of switch S , conductor 44, contact 45 of switch S_2 , conductor 46, upper sequence switch contact 103, through the winding of the motor magnet of sequence switch 100 to battery. Sequence switch 100 is driven from position 1 into position 2 over said circuit, whereupon a circuit is completed from ground over the back right-hand contact of restoring relay 47, over upper sequence switch contact 104, sequence switch contact 201 and through the winding of the driving magnet of finder sequence switch 200 to battery. Sequence switch 200 is driven into position 2, thereby completing a circuit from ground over the back contact of relay 48, upper sequence switch contact 202, and through the winding of the driving magnet of the finder switch F to battery. The motor magnet of the finder switch F is now energized to drive finder wipers 49, 50, 51 and 52 over their waiting contacts until the wiper 51 rests upon the test contact 55 corresponding to cord No. 5, whereupon a circuit is completed from ground over the back right-hand contact of relay 47, upper sequence switch contact 105, contact 55, wiper 51, upper sequence switch contact 203, and through the winding of test relay 48 to battery. Test relay 48 is energized over this circuit, thereby opening the driving circuit of the finder switch F , so that the same comes to rest with its wipers associated with the contacts corresponding to cord No. 5.

Relay 48 at its front contact completes a circuit from ground over sequence switch contact 204 and through the winding of the driving magnet of sequence switch 200 to battery, thereby driving the sequence switch 200 to position 5. As said sequence switch passed from position 3 to position 4, a new circuit is completed for test relay 48 from ground over the back right-hand contact of relay 47, sequence switch contact 106, contact 56 and wiper 52 of the finder F , sequence switch contact 301, winding of relay 57, lower sequence switch contact 203, winding of test relay 48 to battery. Relay 57 is energized over the circuit above traced, and at its left-hand front contact completes a locking circuit for relays 57 and 48 independent of sequence switch contact 301. Relay 57 at its front right-hand contact completes a circuit from ground over upper sequence switch contact 302, and through the winding of the driving magnet of sender sequence switch 300 to battery. Sequence switch 300 is thereby driven into position 2.

The operator having now ascertained by means of her listening set the number of the desired subscriber, proceeds to set up the call upon her sending apparatus (not

shown), thereby operating a key 58. The sending apparatus above referred to forms no part of the present invention and is, therefore, not illustrated. This sending apparatus may be of any well known type such as, for instance, a sending apparatus of the general character illustrated in United States patents to Lundell, 1,252,911 of January 8, 1918, and 1,254,711, of January 29, 1918. Upon operating the key 58 a circuit is completed from ground over the contact of key 58, sequence switch contact 303, through the winding of the driving magnet of sequence switch 300 to battery, thereby driving the sender sequence switch 300 into its third position. In this position a sending apparatus, conventionally represented by relays 59 and 60, is associated with the cord circuit, the circuit of the sending apparatus being as follows:—from ground, sequence switch contact 107, contact 53 and wiper 49 of finder F, sequence switch contact 304, winding of relay 59, back contact of relay 60, wiper 50 and contact 54 of the finder F, lower sequence switch contact 108, winding of relay 61, lower sequence switch contact 109 to battery. Relay 61 is energized over the circuit above traced, completing at its front contact a circuit from ground, back contact of relay 47, front contact of relay 61, upper sequence switch contact 110 and through the winding of sequence switch 100 to battery. Sequence switch 100 is driven to its third position over the circuit above traced, and in said position the selecting switch (not shown) associated with circuit 3 is driven through its group selecting travel under the control of the sender. After the last impulse has been transmitted by the sender the relay 60 is energized to open the circuit traced through the relay 61, which is thereby deenergized and at its back contact completes a circuit from ground over the back contact of relay 47, back contact of relay 61, lower sequence switch contact 110, and through the winding of the motor magnet of sequence switch 100 to battery. Sequence switch 100 is now driven into position 4, in which the trunk hunting operation of the selector switch takes place. At the completion of the trunk hunting operation the sequence switch 100 is driven to the sixth position, over a circuit not shown, since the details of the sending operations form no part of the present invention. In position 6 of sequence switch 100, the sending apparatus, comprising relays 59 and 60, is disconnected from the relay 61 and connected over upper sequence switch contact 108 and 117 in position 6 to the circuit 3. The remainder of the sending and selecting operations now takes place in the sixth position of sequence switch 100, and need not be further described.

Listening out after the call is set up on the sender.

As soon as the operator has set up the call upon the sender, which it will be remembered resulted in the sequence switch 100 moving out of position 2, she may disconnect her set from the cord circuit while the sending and selecting operations above described are taking place. For this purpose she may depress the listening out key 62 (see Fig. 3) thereby completing a circuit for relay 63, which at its left-hand front contact completes a locking circuit from ground over lower contact 64 of switch S, front left-hand contact of relay 63 and through the winding of said relay to battery. Relay 63 at its front right-hand contact completes a circuit from ground over contact 65 of switch S and through the winding of the driving magnet of said switch to battery, thereby driving said switch to its twelfth position, whereupon the locking circuit of relay 63 is opened at contact 64 and the switch comes to rest. In its twelfth position switch S is disconnected from all of the group switches, and consequently the operator's loop 5 is disconnected from the loops of all the group switches. It will be noted that the switch S as illustrated is arranged to select any one of five group switches, although but two group switches are herein shown. If it were desired to have a greater number of groups the same may be done by arranging the switch S with extra positions, always, of course, reserving one extra position in which the switch will not be associated with any group switch.

The operator may also listen out from the particular cord, such as cord No. 5, with which her set is associated, by plugging in with another cord, thereby shifting either the switch S or switch S₂, or both, to the proper positions to associate the loop 5 with the cord just plugged in. This operation necessarily results in the disconnection of the operator's loop 5 from cord No. 5, as it will be noted that said loop can only be connected to the cord with switch S in position 4 and switch S₂ in position 2.

Listening in to supervise a connection.

Should the operator desire to listen in upon a connection either established or partially established for supervisory purposes, she may do so by depressing a listening key individual to the cord circuit used in establishing that particular connection. Assuming that the operator desires to listen in upon cord No. 5, she may depress the listening key 66, thereby applying ground to conductors 17 and 20, so that the energizing circuits of the motor magnets of switches S and S₂ are completed to drive said switches into positions 4 and 2, respectively, as de-

scribed under the heading "Listening in upon answering a call". In these positions the operator's loop 9 is introduced in the cord circuit.

5 *Listening out before setting up a connection.*

If, after answering a call, the operator desires to leave the plug of the cord in the jack without completing a connection, as
10 where a subscriber has forgotten the number desired and the operator wishes in the meantime to answer other calls, it is desirable that the sender should be released from that cord in order not to keep it idle uselessly as
15 would be the case if the sequence switch 100 of the cord were permitted to remain in position 2. Therefore, with switch 100 of cord No. 5 in this position, should the operator listen out either by operating the listening
20 out key 62, or by plugging in with another cord, a ground will be applied to conductor 21' as soon as switch S_2 moves out of position 2 or switch S moves out of position 4. A circuit will then be completed either from
25 ground over upper contact 23 of switch S_2 to point 22, or from ground over lower contact 27 of switch S and over conductor 26 and contact 24 of switch S_2 to point 22, from which point the circuit continues over con-
30 ductor 21', front right-hand contact of relay 15, lower sequence switch contact 102 now in position 2, and through the winding of relay 47 to battery. Relay 47 is energized over the circuit above traced, and at
35 its middle front contact completes a locking circuit over upper sequence switch contact 111 to ground, so that it will remain locked up between positions 2 and 10, inclusive, of sequence switch 100. Relay 47 at its front
40 right-hand contact completes a circuit over sequence switch contact 112 and through the winding of the motor magnet of sequence switch 100, driving said switch to position 4. In position 4 a circuit is completed from
45 ground over sequence switch contact 113, lower sequence switch contact 104, winding of relay 67 and over the left-hand front contact of relay 47 to battery. Relay 67 is thereby energized and at its front contact
50 completes a circuit from ground over sequence switch contact 113, lower sequence switch contact 105 front contact of relay 67, lower sequence switch contact 103 and through the winding of the motor magnet
55 of sequence switch 100 to battery. Sequence switch 100 is driven through position 5 into position 6 under the control of its master contact 114. In position 6 the circuit of the driving magnet of sequence switch 100 is
60 completed over the front right-hand contact of relay 47 and sequence switch contact 112, driving sequence switch 100 into position 7. In position 7 the circuit controlled by relay 67 drives sequence switch 100 into position

8, from which position it passes to position 65 14 under the joint control of master contact 114, and the circuit completed over the front right-hand contact of relay 47 and sequence switch contact 112. As the sequence switch 100 passed out of position 10, relay 47 was 70 deenergized, and in position 14 a circuit is completed from ground over the back right-hand contact of relay 47, back contact of relay 61, lower sequence switch contact 110 and through the winding of the motor mag- 75 net of sequence switch 100 to battery. The sequence switch is driven to position 17 over said circuit, and in position 17 relay 47 is energized over a circuit from ground, lower sequence switch contact 111 and through 80 the winding of relay 47 to battery. Relay 47 now completes the circuit previously traced through the winding of relay 67, which in turn at its front contact completes a circuit from ground over sequence switch 85 contact 113, lower sequence switch contact 105, front contact of relay 67, lower sequence switch contact 103 and through the winding of the motor magnet of sequence switch 100 to battery. Sequence switch 100 is thereby 90 driven from position 17 to position 18, in which position it remains. As soon as sequence switch 100 passed out of position 6, the leads from the sending apparatus extending over wipers 49 and 50 of the finder are discon- 95 nected from the circuit 3 at sequence switch contacts 108 and 117, thereby disconnecting the sender from the cord circuit. At the same time, the holding circuit of relays 48 and 57 is opened at sequence switch contact 100 106, whereby relays 48 and 57 are deenergized. Relay 48 at its back contact completes a circuit over lower sequence switch contact 202, through the winding of the motor magnet of the finder sequence switch 200, 105 thereby driving said sequence switch through position 18 to position 1. Relay 57, upon being deenergized, at its back right-hand contact completes a circuit over lower se- 110 quence switch contact 302, through the winding of the driving magnet of the sender sequence switch 300 thereby driving said switch through position 18 to position 1. The sender is thereby restored to normal, and although the finder F is permitted to re- 115 main with its wipers resting upon the contacts individual to cord No. 5, it is disconnected from said cord by reason of the opening of sequence switch contacts 108 and 117.

Listening in upon an uncompleted connection. 120

Where a connection has been left in the condition just described, if the sender has been associated with some other cord cir- 125 cuit over which a connection is being established, by rotating the finder switch F into a position in which its wipers rest upon the

contacts individual from such other cord circuit, it is desirable when the operator returns to said connection that a sender be picked up again in order that the operator may set up a call. Assuming then that the sender illustrated in Fig. 1, with its finder F and finder sequence switch 200, is a second group of apparatus which is now idle, upon the operator's actuating the listening key 66 individual to cord No. 5, a ground is applied to conductors 17 and 20, thereby causing the switches S and S₂ to connect the operator's set to the cord circuit. At the completion of this operation, upon the deenergization of the relays 37 and 39, a circuit is completed from ground over the back contact of relay 37, conductor 40, back contact of relay 38, conductor 41, back contact of relay 39, conductor 42, lower contact 43 of switch S, conductor 44, upper contact 45 of switch S₂, conductor 46, upper sequence switch contact 103, and through the winding of the motor magnet of sequence switch 100 to battery. Sequence switch 100 is thereby driven from position 18 and through position 1 into position 2, so that the listening set is again connected to the cord circuit, and a sender associated therewith in the manner already set forth.

30 *Restoring a partially completed connection.*

If at any time between the connection of a sender to the cord circuit and the completion of the operation of setting up a connection by the sender, the operator desires to restore the apparatus to normal in order to set up the connection anew, she may depress the master restoring key 68, whereby a circuit is completed from ground over the contact of said key, contact 69 of the switch S, conductor 70, contact 71 of switch S₂, conductor 72, sequence switch contact 115, (which may be in any position between positions 2 and 6, inclusive), and through the winding of relay 47 to battery. The relay 47 is energized over this circuit and locked up over sequence switch contact 111. The relay 47 upon being energized, drives the sequence switch 100 into position 18, as described under the heading "Listening out before setting up a connection". In position 18, since the operator's set is at this time connected to the cord, a circuit is completed from ground over the back contact of relay 37, conductor 40, back contact of relay 38, conductor 41, back contact of relay 39, conductor 42, contact 43 of switch S in position 4, conductor 44, contact 45 of switch S₂ in position 2, conductor 46, upper sequence switch contact 103 in position 18 and through the winding of the motor magnet of sequence switch 100 to battery. The sequence switch 100 is driven from position 18 through position 1 into position 2. As said sequence switch passed out of position 6 on its way to position 18, the

sender was released in the manner already described. In position 2 a sender is again associated with the cord, as described under the heading "Listening in upon answering a call", and the apparatus is again ready for setting up the call anew. The restoring key 68 is only effective from positions 2 to 6 of the sequence switch 100, as sequence switch contact 115 is open in all other positions. After the sequence switch 100 has passed out of position 6, the connection to a called subscriber has been completed, and if the connection is wrong it may be restored as described under the following heading.

Withdrawing the plug to take down a connection.

If the operator desires to take down an established connection, she will first listen out by depressing the listening out key 62, if her operator's set happens to be connected to the cord, and will then withdraw the plug of the cord from the answering jack. Upon withdrawing the plug the relay 15 is deenergized and a circuit is closed from conductor 21', which is always grounded when the operator's set is unconnected to the cord circuit, over the back right-hand contact of relay 15 and over the upper sequence switch contact 116, if the connection taken down has been completely established, and thence through the winding of the motor magnet of sequence switch 100. The sequence switch 100 is driven under the joint control of its contacts 116 and 114 through position 10 to position 14. In position 14 a circuit is closed from ground over sequence switch contact 113, back contact of relay 61, lower sequence switch contact 110, and through the winding of the motor magnet of sequence switch 100 to battery, thereby driving the sequence switch through position 15 to position 17. In position 17 relay 47 is energized in a manner already described, thereby completing the circuit of relay 67, which in turn completes a circuit for the motor magnet of sequence switch 100 in a manner already described to drive the sequence switch into position 18. In position 18 the circuit of the motor magnet of sequence switch 100 is again completed from the grounded conductor 21', over the back right-hand contact of relay 15 and upper sequence switch contact 116, as already described, thereby driving the sequence switch 100 into position 1. The apparatus associated with the cord circuit is now restored to normal. Had the sequence switch 100 been in any position between positions 2 to 6, inclusive, as would be the case with a partially established connection, upon withdrawing the plug from the jack a circuit would have been completed from grounded conductor 21' over the back right-hand contact of relay 15, lower sequence switch contact 116 through

the winding of relay 47 to battery. Relay 47 would be locked up from positions 2 to 10, thereby operating to close circuits for the motor magnet of sequence switch 100 to drive said sequence switch to position 14 in the manner described under the heading "Listening out before setting up connection". From position 14 the sequence switch 100 is driven through position 18 to position 1 in the manner just described.

Withdrawing a plug without releasing the connection.

If while listening in on a cord circuit the operator removes the plug from the jack, relay 15 is, of course, deenergized, but no circuit changes result because the conductor 21' is ungrounded while the operator is listening in. This permits the operator to withdraw the plug to either insert it in another jack, or for any other purpose without disturbing the existing connections.

In accordance with this invention a very simple and yet efficient means has been devised whereby automatic listening in is effected without appreciable loss of time, and while the invention is disclosed as embodied in a particular form, it will be understood that it is capable of variation in its embodiment without departing from the spirit of the invention as defined in the appended claims.

What is claimed is:

1. In combination, a cord circuit, an operator's loop including controlling keys serially connected therein and an operator's set associated therewith, and means for introducing said loop in said cord circuit.

2. In combination, a group of cord circuits, an operator's loop including controlling keys serially connected therein and an operator's set associated therewith, and means for introducing said loop in any cord circuit of the group.

3. In combination, a cord circuit, an operator's loop having ringing and coin control keys serially included therein, an operator's set bridged across said loop, and means for introducing said loop in the cord circuit.

4. In combination, a group of cord circuits, an operator's loop having ringing and coin control keys serially included therein, an operator's set bridged across said loop, and means for introducing said loop in any cord circuit of the group whereby the ringing and coin control keys will be serially included in the cord circuit.

5. In combination, a plurality of transmission circuits, each transmission circuit being divided into sections, an automatic switch having a plurality of contacts, said switch being so arranged, that the sections of a plurality of transmission circuits may be simultaneously connected over its contacts.

6. In combination, a plurality of cord circuits each divided into sections, an automatic switch having separate sets of contacts corresponding to each cord circuit, the sections of a cord circuit being connected to the corresponding set of contacts, and means for individually controlling each set of contacts.

7. In combination, a plurality of cord circuits each divided into sections, a switching apparatus having contacts for individually connecting the sections of plurality of cord circuits, a loop, and means controlled by said switching apparatus for including said loop between the sections of any cord circuit.

8. In combination, a plurality of cord circuits divided into groups, a loop, group switches for selecting any cord circuit of a group and for connecting said loop in said cord circuit.

9. In combination, a plurality of cord circuits divided into groups, a loop corresponding to each group, group switches for selecting a cord circuit in a group and connecting a loop therein, an operator's loop, and a common switch for selecting a group and including the operator's loop in the loop corresponding to that group.

10. In combination, a plurality of cord circuits divided into groups and each cord circuit consisting of at least two sections, a loop corresponding to each group, group switches for connecting a loop between the sections of one cord circuit of each group and for directly connecting the sections of the remaining cord circuits of each group, an operator's loop, and a common switch for introducing the operator's loop in the loop corresponding to any group.

11. In combination, a plurality of cord circuits divided into groups and each cord circuit consisting of at least two sections, a loop consisting of at least two sections corresponding to each group, group switches for connecting the loop of each group between the sections of one cord circuit of each group, and for directly connecting the sections of the other cords of each group, an operator's loop, and a common switch for connecting said operator's loop between the sections of a loop corresponding to one group, and for directly connecting the sections of the loops corresponding to the other groups.

12. In combination, a plurality of cord circuits divided into groups and each cord circuit consisting of at least two sections, a loop consisting of at least two sections corresponding to each group, group switches comprising sets of make-break contacts for directly connecting the sections of the cord circuits of each group and for disconnecting the sections of any cord circuit in a group and connecting the loop of that group to said sections before the sections are disconnected, an operator's loop, and a common switch comprising sets of make-break contacts for

directly connecting the sections of the loops corresponding to the various groups, and for disconnecting the sections of any loop and connecting the operator's loop to said sections before the sections are disconnected.

13. In combination, a plurality of cord circuits each consisting of at least two sections, a loop, and a switch comprising sets of make-break contacts for directly connecting the sections of the cord circuits, and for disconnecting the sections of one cord circuit

and connecting said loop to said sections before they are disconnected.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses, this eleventh day of October, 1917.

WILLIAM G. BLAUVELT.

Witnesses:

J. W. WALTERS,
E. D. TALBOT.

Copies of this patent may be obtained for five cents each, by addressing the "Commissioner of Patents, Washington, D. C."