A. E. LUNDELL.

AUTOMATIC TELEPHONE SYSTEM.

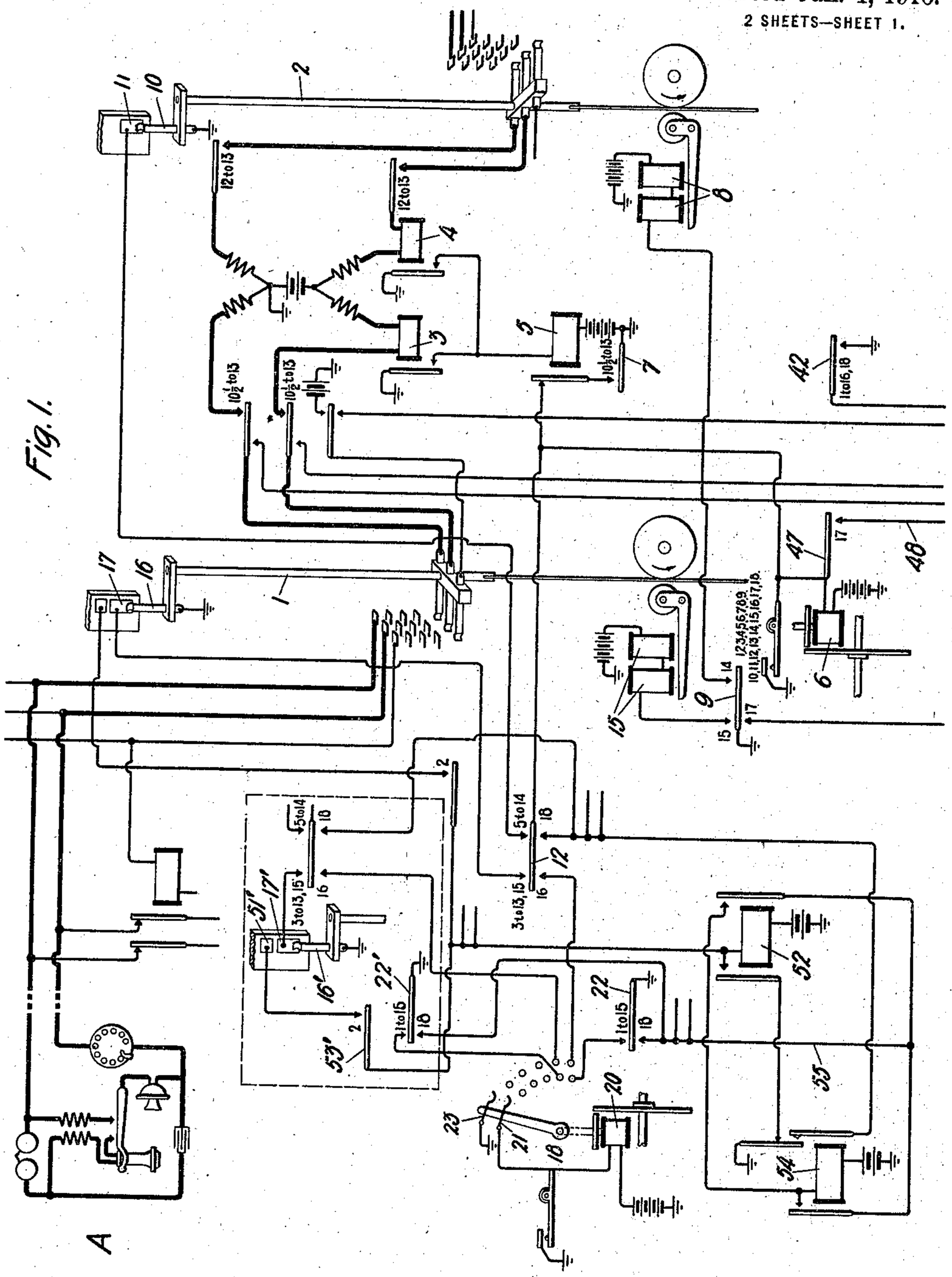
APPLICATION FILED MAR. 19, 1915.

1,166,466.

Patented Jan. 4, 1916.

2 SHEETS—SHEET 1.

Fig. 1.



Witnesses:

O. D. M. Guthe.

John Waldheim.

Inventor:

Alben E. Lundell.

by S. C. Tanner. Atty

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2 SHEETS—SHEET 2.

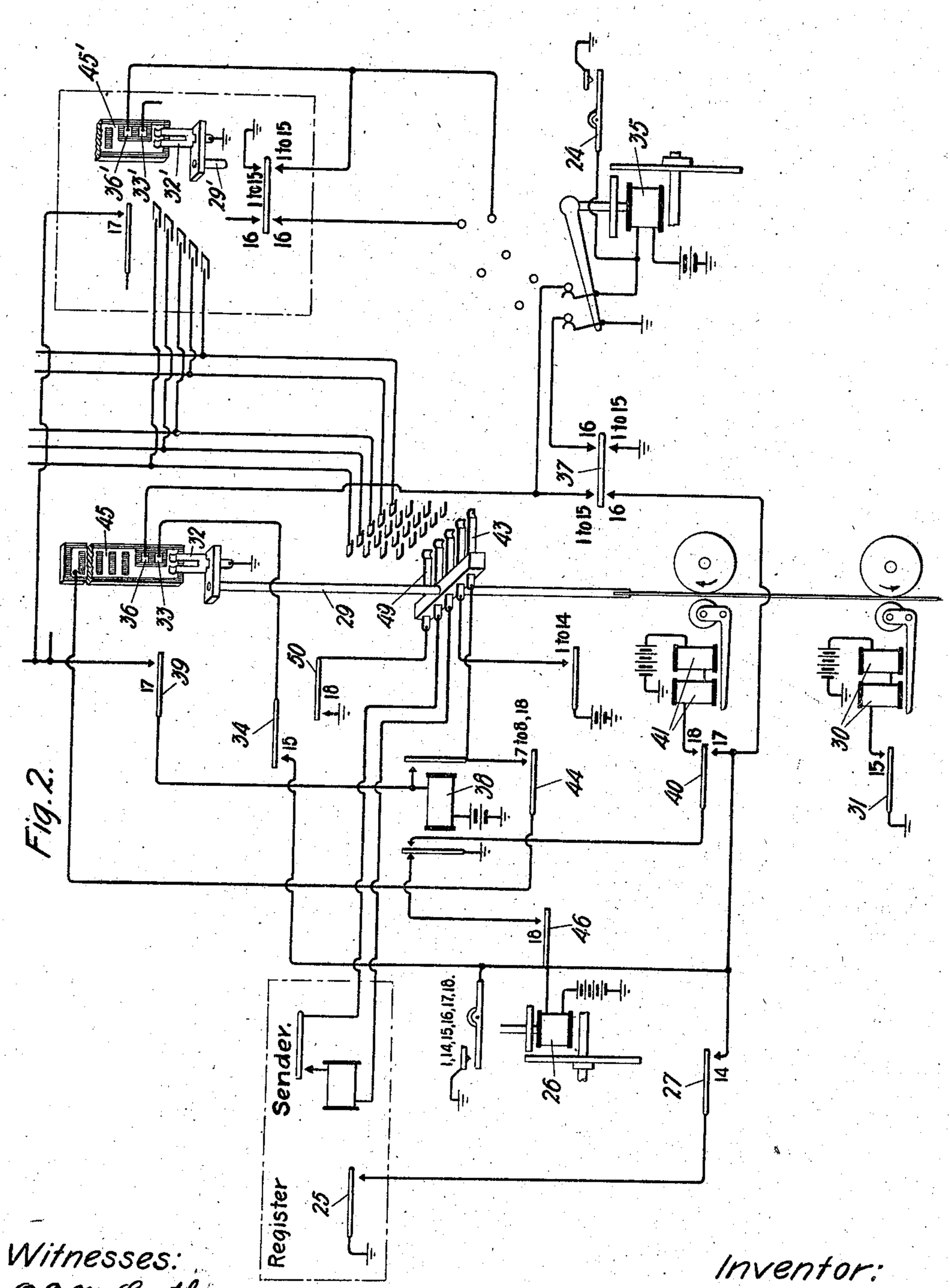

Fig. 2.

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UNITED STATES PATENT OFFICE.

ALBEN E. LUNDELL, OF NEW YORK, N. Y., ASSIGNOR, BY MESNE ASSIGNMENTS, TO WESTERN ELECTRIC COMPANY, INCORPORATED, A CORPORATION OF NEW YORK.

AUTOMATIC TELEPHONE SYSTEM.

1,166,466. Specification of Letters Patent. Patented Jan. 4, 1916.

Application filed March 19, 1915. Serial No. 15,437.

To all whom it may concern:

Be it known that I, ALBEN E. LUNDELL, a citizen of the United States, residing at New York, in the county of Bronx and State of New York, have invented certain new and useful Improvements in Automatic Telephone Systems, of which the following is a full, clear, concise, and exact description.

This invention relates to telephone systems employing mechanical switches which are controlled by means of a sending device located at the central station. This sending device may be operated by an operator if the system is of the type commonly known as semi-automatic, or it may be a register sender which is set by the controlling device at the calling substation, as in a full automatic system.

The principal feature of this invention resides in having at all times a plurality of connecting circuits preselected or allotted. and a sending device definitely associated with or connected to each of said preselected circuits. By means of this invention, when two calls are answered practically simultaneously, no delay is necessitated in waiting for the sending device to be associated with the selected cord circuit.

In the drawings, Figures 1 and 2, taken together with Fig. 1 above Fig. 2, represents so much of the circuits of a full automatic system embodying my invention as is necessary for a clear understanding thereof.

The automatic switches shown in the drawings may be of a structure similar to that shown in Patent No. 1,123,696. The sender cord finder switch shown in Fig. 2, however, will ordinarily be provided with but a single set of brushes.

The sequence switches shown in the drawings may be similar to that disclosed in Patent No. 1,127,808. The numerals which appear adjacent to the sequence switch contacts diagrammatically represented in various portions of the drawing indicate the positions of the sequence switch at which these contacts are closed with the exception that the controlling contacts, one of which appears immediately above the motor magnet of each of the sequence switches, are open only at the positions indicated by the numerals adjacent thereto and therefore the sequence switches can stop in only these positions. In the specification the numbers in brackets following the reference characters of the sequence switch contacts designate the position of the sequence switch at the time the circuit exists.

The rotary switching devices shown at the left in Fig. 1 and at the lower right corner in Fig. 2 are allotters. The motor means for these allotter switches may be similar to that for the sequence switches. The switch shaft, however, is provided with an arm carrying a pair of brushes instead of the series of disks as in the sequence switch. It is thought that the operation of these devices will be readily understood from the following description of the circuits.

In the present embodiment of my invention each cord circuit is provided at one end with a line finding switch 1 and at the other end with a selector switch 2, both being of the panel type as previously stated. Upon the initiation of a call by any of the subscribers whose lines terminate in the panel bank traversed by the brushes of the switches 1, a preselected switch 1 is caused to immediately move to and select the terminals of the calling line. The calling subscriber will thereupon actuate the sending device at the substation to register the designation of the line wanted in a register sender which was preselected and definitely associated with the line finder prior to its actuation.

As the manner of operation of the switches forms no part of the present invention, we will now assume that the subscriber at A has initiated a call and such call has been extended through line finder 1 and selector 2 and the succeeding switches to the wanted subscriber. We will further assume that the subscribers have finished their conversation and disconnection is about to take place. During conversation the sequence switch of the connecting circuit will be in position 12. Upon the subscribers' hanging up, the supervisory relays 3 and 4 will be deenergized and open the circuit for relay 5 which in retracting its armature will complete a circuit from battery through the connecting circuit sequence switch motor magnet 6, back-contact and armature of relay 5, sequence switch contact 7, (12 and 13) to ground. The connecting circuit sequence switch thereupon moves to position 14 under the control of sequence switch contact 7. In position 14 a circuit is completed through sequence switch contact 9 for the down-drive clutch magnet 8 of the selector switch 2 and

the switch returns to its normal position. As the selector switch approaches normal the interrupter brush 10 engages the conducting segment 11 and completes a circuit from battery through sequence switch motor magnet 6, sequence switch contact 12 (14) contact 11 and brush 10 to ground. The sequence switch thereupon moves to position 15.

In position 15 a circuit is completed through the sequence switch contact 9, for the down-drive clutch magnet 15 of the finder switch 1. As the finder switch approaches its normal position, brush 16 thereof engages the conducting segment 17 and completes a circuit from battery through sequence switch motor magnet 6, contact 12 (15), segment 17 and brush 16 to ground. This moves the sequence switch to position 16 in which position it remains until it is preselected by the allotter 18.

At all times when the system is at rest there are two preselected line finder switches, the sequence switch of one being in position 1, the sequence switch of the other being in position 18. Upon the initiation of a call, the finder switch, the sequence switch of which is in position 1, will be first actuated and the sequence switch of the second preselected finder will immediately go into position 1 upon the actuation of the first. The reason for this and the manner in which it is accomplished will presently appear.

The allotter 18 is caused, upon starting it into operation, to select a finder switch having its sequence switch in position 16 and cause the connection of a sender cord finder 29 to the connecting circuit of said cord finder. The allotter remains on the terminals of this cord finder until its sequence switch moves into position 1, or the first preselected position. Assuming now that the brushes of the allotter 18 are on the contacts individual to the line finder switch diagrammatically indicated by the dotted rectangle which appears at the left in Fig. 1, upon the sequence switch of this finder going into position 1, a circuit will be completed from battery through motor magnet 20 of allotter 18, brush 21 and the contact engaged thereby, sequence switch contact 22′ to ground. The allotter switch will begin to rotate and will continue to rotate until its brush 21 engages a terminal connected to a contact 22, the sequence switch of which is not in positions 1 to 15. As the contacts individual to the finder switch of the connecting circuit shown in the drawings will be next engaged by the allotter brush and as the sequence switch of this connecting circuit is in position 16, contact 22 will be open and the circuit through motor magnet 20 will be interrupted. The allotter brushes will therefore stop on the contacts of this connecting circuit. The brush 23 of the allotter will complete a circuit from ground through the contact engaged thereby, sequence switch contact 12 (16) sequence switch motor magnet 6 to grounded battery, causing the line finder sequence switch to go to position 17.

Before continuing the description we will consider the senders and the sender cord finders. As many register senders are provided as are necessary to handle the maximum number of simultaneous or substantially simultaneous calls. A register sender is diagrammatically indicated in the dotted rectangle at the left in Fig. 2 of the drawing. Each register sender is definitely associated with a sender cord finder such as switch 29 in Fig. 2. A second sender cord finder switch is indicated at the dotted rectangle at the right in Fig. 2. Associated with the sender cord finder switches is an allotter 24, which is similar in function and operation to that in Fig. 1. This allotter determines the order in which the register senders or rather the register sender cord finders shall be actuated. At the time a sender finishes its operation in setting up a connection its cord finder sequence switch will be in position 14. When the sender has finished its operation, contact 25 may be closed in any desired manner as by the sequence switch associated with the sender. This will complete a circuit from battery through the sender cord finder sequence switch motor magnet 26, contact 27, (14), contact 25 to ground. The cord finder sequence switch thereupon moves to position 15. In position 15 a circuit is completed from battery, through the down-drive clutch magnet 30, sequence switch contact 31 (15) to ground. The finder switch thereupon returns to normal. As it approaches the normal position, a circuit is completed from battery, through sequence switch motor magnet 26, sequence switch contact 34 (15), contact 33 and right spring of brush 32 to ground. The cord finder sequence switch thereupon moves into position 16, in which position it remains until it is seized by the allotter 24. It may be here noted that the allotter, after seizing the cord finder, remains on the contact individual thereto until the switch starts into operation.

We will now assume that the brushes of the allotter 24 are on the contacts individual to the switch 29′ indicated at the right in Fig. 2 and the switch starts into operation. A circuit will be completed from ground, through the right spring of brush 32′, contact 36′, contact and inner brush of the allotter 24, motor magnet 35, to grounded battery. The allotter will thereupon start into operation and will continue moving as long as its inner brush engages contacts indi-

vidual to finder switches having their sequence switches in positions 1 to 15, a circuit for the motor magnet being maintained through the innermost brush, the contacts engaged thereby, and sequence switch contacts 37 (1 to 15) of the various switches, to ground. If the allotter brushes engage the contacts individual to switch 29, the circuit through motor magnet 35 will be interrupted at contact 37 (the sequence switch of this cord finder being in position 16) and the allotter will stop. A circuit will now be completed from battery, through motor magnet 26, to sequence switch contact 37 (16) outermost brush of allotter 24, to ground, causing the cord finder sequence switch to move to position 17. With a cord finder sequence switch in position 17 when the connecting circuit sequence switch goes into position 17 which occurred upon the seizing of its contacts by the allotter 18, a circuit is completed from battery through the relay 38, sequence switch contact 39 (17), sequence switch contact 9 (17) to ground. Relay 38 is energized and in attracting its armature completes a circuit from battery through sequence switch magnet 26, sequence switch contact 40 (17), contact and left armature of relay 38 to ground. The cord finder sequence switch thereupon moves to position 18 thus completing a circuit from battery through the updrive clutch magnet 41, sequence switch contact 40 (18), front contact and left armature of relay 38 to ground. The cord finder starts and as it leaves its normal position its interrupter brush 29 makes passing contact with the segment 36 and thus starts the allotter hunting for another cord finder the sequence switch of which is in position 16 or awaiting allotter position. As the sequence switch of only one line finder switch can be in position 17 at a time, the contact 42 of only one of said sequence switches can be open at this time; therefore, as the cord finder brushes traverse the connecting circuit terminals in the bank, relay 38 will be maintained energized by a circuit through the winding of said relay, its front contact and right armature, brush 43 and contacts engaged thereby to ground through the sequence switch contacts 42 of all the line finder switches except the one which is awaiting the sender. While the cord finder switch brushes are passing between terminals, relay 38 is maintained energized by a circuit from battery through the winding of said relay, front contact and right armature thereof, sequence switch contact 44, interrupter 45 and interrupter brush 32. This holding circuit is interrupted only while the cord finder brushes are centrally positioned on the sets of contacts of the switch bank. When the brush 43 engages the contact associated with the waiting connecting circuit, relay 38 will be deënergized, thus interrupting the circuit for the clutch magnet 41 and stopping the switch. At its back left contact it will close a circuit from battery through magnet 26, sequence switch contact 46 (18) thus driving the cord finder sequence switch into position 1. When the brushes of the cord finder arrived on the contacts of the selected connecting circuit and before the cord finder sequence switch moved to position 1, a circuit was completed from battery through motor magnet 6, sequence switch contact 47 (17) conductor 48, contact and brush 49, sequence switch contact 50 (18) to ground. The connecting circuit sequence switch moves to position 18 which is the sub-preselected position and where it remains until the first preselected line finder switch starts into operation.

Assuming now that the switch diagrammatically indicated in the rectangle at the left in Fig. 1 is started into operation and that the sequence switch thereof is in position 2, when it leaves its normal position the interrupter brush 16′ makes passing contact with contacting segment 51′, thus completing a circuit from battery through relay 52, sequence switch contact 53′ (2) to ground. Relay 52 is energized and locks up through its left armature and normal contact of relay 54. If no line finder sequence switch is in position 18 at this time, relay 52 will remain locked up until a sequence switch moves into position 18, when a circuit will be completed through sequence switch contact 22 (18) conductor 55, right armature and contact of relay 52, winding of relay 54 to grounded battery. Relay 54 is thereupon energized and locks up through its left armature and contact 22; it also closes a circuit from battery through sequence switch motor magnet 6, sequence switch contact 12 (18) and right front contact of relay 54 to ground and the sequence switch of the sub-preselected line finder thereupon goes into position 1 or first preselected position. When the sequence switch goes into position 1 a circuit is completed from battery through allotter motor magnet 20, sequence switch contact 22 (1 to 15) to ground. The allotter switch is thereupon caused to select another finder switch or connecting circuit, the sequence switch of which is in position 16, when the foregoing operation will be repeated in connection with the newly allotted line finder.

What is claimed is:

1. In a telephone exchange system, a group of lines, a plurality of connecting circuits for use with said lines, automatic switches for extending said connecting circuits, a plurality of central office sending devices for controlling said switches, automatic means for preselecting a plurality of said connecting circuits, and automatic means for definitely associating a sending

device with each of said circuits when it is preselected.

2. In a telephone exchange system, a group of lines, a plurality of connecting circuits for use with said lines, automatic switches for connecting said circuits with said lines, switches for extending said connecting circuits to a wanted subscriber, central station sending devices for controlling the operation of said last mentioned switches, means for preselecting a plurality of said first mentioned switches, and automatic means for definitely associating a sending device with each preselected switch.

3. In a telephone exchange system, a group of lines, a plurality of connecting circuits, line finder switches in which said connecting circuits terminate, selector switches for extending said connecting circuits to a wanted subscriber's line, a plurality of central station sending devices for controlling the operation of said selector switches, means for preselecting a plurality of said finder switches, and connecting circuit finder switches for automatically associating a sending device with the connecting circuit of a finder switch when it is preselected.

4. In a telephone exchange system, a group of lines, a plurality of connecting circuits, line finder switches in which said circuits terminate, selector switches for extending said connecting circuits to a wanted subscriber's line, a plurality of central station sending devices for controlling the operation of said selector switches, means for preselecting a plurality of said finder switches, and connecting circuit finder switches for automatically associating a sending device with the connecting circuit of each preselected finder switch.

5. In a telephone exchange system, a group of lines, a plurality of connecting circuits, line finder switches in which said circuits terminate, selector switches for extending said connecting circuits to a wanted subscriber's line, a plurality of central station sending devices for controlling the operation of said selector switches, means for causing a plurality of said line finder switches to be preselected, an allotter associated with said finder switches for determining the order in which they shall be operated, and connecting circuit finder switches for automatically associating the sending device with the connecting circuit of each preselected finder switch.

6. In a telephone exchange system, a group of lines, a plurality of connecting circuits, line finder switches in which said circuits terminate, selector switches for extending said connecting circuits to a wanted subscriber's line, a plurality of central station sending devices for controlling the operation of said selector switches, means for causing the preselection of a plurality of said finder switches, an allotter for determining the order of such preselection, connecting circuit finder switches for automatically associating a sending device with the connecting circuit of each preselected finder switch, and an allotter associated with said connecting circuit finder switches for determining the order in which they shall be operated.

In witness whereof, I hereunto subscribe my name this 17th day of March A. D., 1915.

ALBEN E. LUNDELL.

Witnesses:
E. EDLER,
H. L. STAHL.