

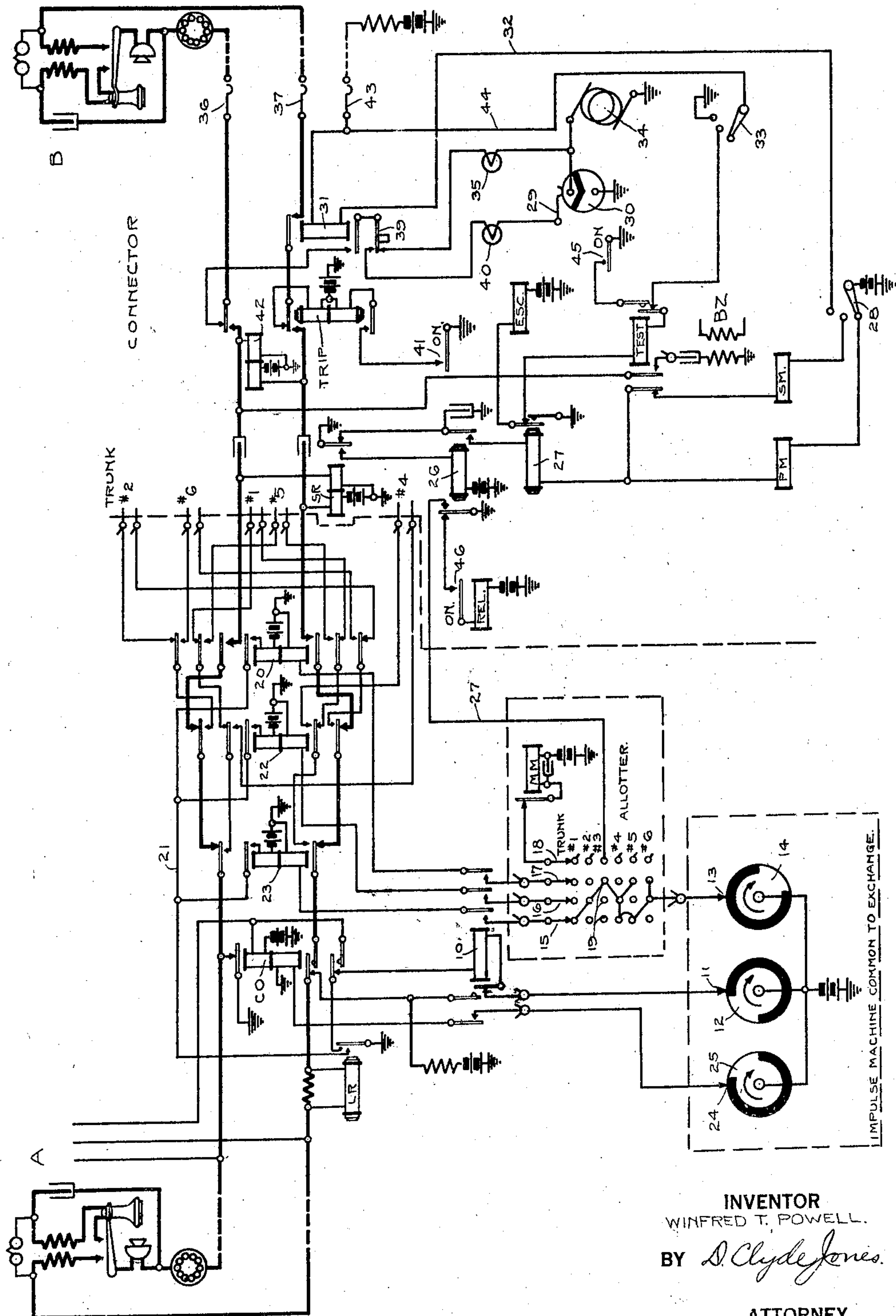
Dec. 30, 1924.

1,520,909

W. T. POWELL

AUTOMATIC TELEPHONE SYSTEM

Filed July 15, 1919



INVENTOR
WINFRED T. POWELL.

BY *D. Clyde Jones.*

ATTORNEY

UNITED STATES PATENT OFFICE.

WINFRED T. POWELL, OF ROCHESTER, NEW YORK, ASSIGNOR TO THE STROMBERG-CARLSON TELEPHONE MANUFACTURING COMPANY, OF ROCHESTER, NEW YORK, A CORPORATION OF NEW YORK.

AUTOMATIC TELEPHONE SYSTEM.

Application filed July 15, 1919. Serial No. 311,065.

To all whom it may concern:

Be it known that I, WINFRED T. POWELL, a citizen of the United States, residing at Rochester, in the county of Monroe and State of New York, have invented certain new and useful Improvements in Automatic Telephone Systems (Case 57), of which the following is a full, clear, concise, and exact description.

This invention relates to telephone systems, and more particularly to telephone systems in which connections between calling and called subscribers are established by automatic mechanisms.

The purpose of this invention is to provide for the rapid interconnection of subscribers' lines and trunks without the use of large numbers of progressively operated switches. To this end relays are employed for completing connections between calling lines and idle trunks.

In systems employing relays for the interconnection of lines, it was formerly necessary to provide as many relays for each line as there were outgoing lines, so that this method of interconnecting lines and trunks while being especially rapid, its use was greatly limited because of the expense of installing an exchange having such a large number of relays.

It is the purpose of the present invention to greatly reduce the number of switching relays employed, and to employ mechanisms common to the exchange to control the relays retained.

Other features not specifically enumerated will appear from the detailed description and claims.

The drawing diagrammatically represents a portion of a telephone system employing the present invention. At the left of the dotted line there is shown the circuits employed in extending a calling line to an idle trunk. That portion of the drawing included within the dotted rectangle near the center of the sheet shows an allotter, common to a group of lines, while the mechanism represented in the other dotted rectangle at the lower left hand corner of the sheet, represents an impulse machine, common to a group of lines, or may be employed for all of the lines of an exchange. At the right of the dotted line there is diagrammatically shown the operating circuits of a connector switch.

The connector switch may be similar in structure to that disclosed in the patent to Keith et al, No. 815,176, issued March 13th, 1906, when modified to operate in a manner similar to that shown in the British patent to Martin, No. 1419, of 1910. The allotter may be a uni-directional rotary switch which advances its four sets of brushes progressively over four corresponding sets of contacts under the control of pawl and ratchet mechanism. The impulse machine may be of any structure in which circuits are closed through the three conductors of such time relation and duration as is indicated by the arrangement of the conducting portions of the discs shown in the figure.

In accordance with the preferred form of the present invention, the lines of an exchange are divided for operating purposes into groups of twenty-five lines each. Each of these groups of lines has assigned for its use a group of trunks which are six in number. The selecting relays shown therefore perform the function of a line switch, namely, to extend a calling line to an idle one of a number of trunks.

With this brief description of the apparatus and the arrangement of lines and trunks, it is believed that the invention will best be understood by describing the method of completing a telephone connection between the calling subscriber's substation indicated at A, to the substation at B.

When the calling subscriber at A removes his receiver from its switchhook to initiate a call, the line relay LR is energized over a circuit extending from grounded battery, resistance, inner lower back contact and armature of the cut-off relay CO, winding of the line relay LR, through the substation circuits, and upper back contact and armature of the cut-off relay CO, to ground. The line relay LR is energized in this circuit and is maintained energized as long as the connection is established. At its armature and front contact it closes the circuit of an auxiliary relay 10, through the continuity spring and lower back contact of the cut-off relay, continuity spring and contact of the relay 10, brush 11 and conducting portion 12 of the impulse disc when the impulse machine has advanced to this point, to grounded battery. The relay 10 attracts its armatures and closes a locking circuit for itself,

through its continuity spring and armature and the resistance, to grounded battery. At the right hand armatures of this relay, break points in the controlling circuits of the switching relays are closed, while at the outer left hand armature and front contact of this relay 10, a break point is closed in a circuit for initially energizing the cut-off relay CO. When brush 13 engages the conducting portion 14 of the disc of the impulse machine, circuits are closed to the switching relays depending on the position of the trunk allotter.

For purposes of this description it is assumed that trunks 1 and 2 are busy, and that trunk 3 is idle and has been preselected for use by the allotter. Under this assumption brushes 15, 16, 17 and 18 of the allotter will be engagement with the set of terminals 19 corresponding to the third trunk. Under this condition when brush 13 engages the conducting portion 14 of the impulse machine, a circuit will be closed from grounded battery, through terminal 19 of the allotter, brush 17, outer right hand front contact and armature of the relay 10, lower winding of relay 20, to ground. Relay 20 attracts its armatures, and at its inner front contact and armature closes a locking circuit for itself from grounded battery, conductor 21, front contact and armature of the line relay LR, to ground.

No operating circuits were completed for the relays 22 and 23, and for this reason they remain inactive. As the discs of the impulse machine continue to rotate, brush 24 will engage conducting segment 25, closing a circuit from ground, outer left hand front contact and armature of relay 10, lower winding of the cut-off relay CO, to ground. The cut-off relay attracts its armatures and completes a locking circuit for itself through its upper winding, lowermost armature and continuity spring, front contact and armature of the line relay LR, to ground. At the back contacts of this relay, the starting circuits are disconnected from the calling line, while at the lower inner armature and continuity spring, the ring side of the calling line is extended. Since only the switching relay 20 was operated and locked up, the trunk 3 is selected. The connection between this trunk and the calling line through the contacts of the switching relays, may be readily traced by following the heavy black lines, commonly employed to indicate the conversational circuit.

By reference to the drawings it will be seen that when the relays 20, 22 and 23 are energized and deenergized in various combinations, the calling line may be extended to trunk 3 as described above, and the stepping relay SR at the connector individual to this trunk is energized in the well known manner. At the right hand front contact

and armature of the stepping relay SR, an operating circuit is closed for the slow-releasing relay 26. At the left hand front contact and armature of the relay 26, a guarding potential is applied to the test conductor 27 of the trunk seized, and a circuit is closed through brush 18, back contact and armature of the motor magnet MM of the allotter to grounded battery to advance the brushes of the allotter to preselect an idle trunk for the next call originating in the group.

The circuits are now in condition to receive the directive impulses from the calling subscriber's dial. In response to these impulses, the stepping relay SR vibrates its armature in the well known manner. At each retraction of the armature of the stepping relay SR, a circuit is closed from ground through the right hand front armature and contact of the relay 26, winding of the slow-releasing relay 27, primary motor magnet PM, side switch wiper 28 in its first position, to grounded battery. The primary motor magnet operates in the well known manner to advance the brushes of the connector switch through its various group selecting movements. The relay 27 as mentioned, does not retract its armature during momentary interruptions of its operating circuit, so that an energizing circuit is closed for the escape magnet ESC, from grounded battery, continuity spring and armature of relay 27 to ground during the tens series of impulses transmitted to the connector switch. At the close of this series of impulses, the stepping relay SR attracts its armature for a relatively long interval, and thus interrupts the energizing circuit of the relay 27. This relay retracts its armature to cause the deenergization of the escape magnet ESC, which moves the side switch wipers into their second position.

In response to the units series of impulses, the stepping relay SR again vibrates its armature, but in this instance an operating circuit is closed for the secondary motor magnet SM, from grounded battery, side switch wiper 28 in its second position, winding of this magnet, outer left hand armature and back contact of the test relay TEST, winding of the slow-releasing relay 27, right hand front contact and armature of relay 26, back contact and armature of relay SR, to ground. At the beginning of this series of impulses, the relay 27 is energized and remains energized during this series of impulses to close the energizing circuit for the escape magnet previously described. At the close of the units series of impulses, the relay 27 retracts its armature, and in the event that the wanted line is idle, the escape magnet deenergizes and moves its side switch wipers into their third position. In this position ringing current is applied to the called line.

Let it be assumed that the called line is seized when the brush 29 is resting on the silent segment 30 of the interrupter, that is, when no ringing current is supplied to the called line through the interrupter. In accordance with a feature of the present invention, a substitute circuit for applying continuous ringing current is provided previous to the connection of the well known interrupted ringing current to the line. When the called line was first seized, the relay 31 was energized in a circuit extending from grounded battery, side switch wiper 28 in its third position, conductor 32, winding of the relay 31, side switch wiper 33, to ground. The relay 31 is provided with two armatures that operate rapidly, and a third armature 39 which is so constructed that it is slow to respond. As soon as the relay 31 is energized, a ringing circuit is closed through the generator 34, lamp 35, through the back contact and sluggish armature 39 of relay 31, through the lower inner armature and front contact of this relay, upper-most armature and back contact of trip relay TRIP, brush 36 of the connector, through the called substation circuits, connector brush 37, upper front contact and armature of relay 31, upper armature and back contact of slow-releasing trip relay TRIP, upper winding of relay TRIP, to grounded battery.

Shortly after the relay 31 attracts its fast-operating armatures, it attracts its sluggish armature 39, and disconnects the continuous source of ringing current and substitutes ringing current from ground, generator 34, interrupter 30, brush 29, lamp 40, lower front contacts and armatures of relay 31, over the circuits previously described to grounded battery at the trip relay TRIP. When the called subscriber responds, the marginal trip relay is energized and closes a locking circuit for itself extending to the off normal contact 41 and its spring to ground.

Talking battery for the calling party is supplied through the windings of the stepping relay SR, while talking battery for the called subscriber is supplied through the windings of the impedance coil 42.

Let it be assumed that the called line is busy when the test brush of the connector brush engaged its test terminal at the close of the units series of impulses. Under this assumption the escape magnet instead of deenergizing as before described, is maintained energized in a circuit traceable from grounded battery, winding of the escape magnet ESC, continuity spring and contact of relay 27, winding of the test relay TEST, continuity spring and contact of this relay, side switch wiper 33 in its second position, conductor 44, test brush of the connector 43, through a multiple test terminal of the called line, and through a connector brush

similar to 43, a conductor corresponding to 44, and a side switch wiper 33 in its third position, to ground at the other connector which has seized the calling line. The test relay is energized in this circuit and closes a locking circuit for itself through its continuity spring and right hand armature, off normal contact 45 and its spring, to ground. At the inner left hand front contact and armature of the test relay TEST, a circuit is closed for applying a busy tone from the busy machine BZ to the calling line.

When the calling subscriber at A replaces his receiver on its switchhook when he wishes to abandon the connection, the energizing circuits for the line relay LR and the stepping relay SR are interrupted. The stepping relay SR retracts its armature to interrupt the operating circuit of the relay 26. This relay retracts its armature, and at its front contact removes the guarding potential from the test conductor of trunk #3, and at its back contact closes a circuit from ground through off normal contact 46 and spring, winding of the releasing magnet REL, to grounded battery. The releasing magnet operates in the well known manner to restore the connector switch to its normal position. The line relay LR when it retracts its armature, removes the holding ground from the conductor 21, permitting the actuated switching relays to deenergize.

It will thus be seen that a novel arrangement is provided for interconnecting a calling line with an idle trunk by use of relays, and also novel means for signaling a called line is provided.

In the present disclosure and description no selectors have been shown or referred to, but it will be understood that in a large telephone system selectors will be employed to extend the trunk, such as trunk #3 to an idle connector in which the called line terminates.

What I claim is:

1. In an automatic telephone system, an incoming line, a plurality of outgoing lines, a plurality of switching relays individual to said incoming line less in number than the number of outgoing lines, said relays having contacts operating in various combinations to extend said incoming line to an idle outgoing line, and a constantly operating interrupter device for automatically controlling the operation of said relays.

2. In a telephone system, an incoming line, a plurality of outgoing lines, a plurality of switching relays individual to said incoming line less in number than the number of outgoing lines, and a progressively movable allotter for assigning outgoing lines for use, said switching relays being variably operated in accordance with the setting of said allotter.

3. In an automatic telephone system, an

incoming line, a plurality of outgoing lines, a plurality of switching relays individual to said incoming line less in number than the number of outgoing lines, said switching
5 relays being operated in various combinations to extend said incoming line to an idle outgoing line, and a rotating interrupting device co-operating in the control of said relays.

10 4. In an automatic telephone system, an incoming line, a plurality of outgoing lines, a plurality of switching relays individual to said incoming line less in number than the number of outgoing lines, said switch-
15 ing relays being operated in various combinations to extend said incoming line to an idle outgoing line, an allotter for assigning an idle outgoing line for use, and a constantly operating interrupter, said allotter and interrupter co-operating in the control
20 of said switching relays.

5. In an automatic telephone system, an incoming line, a plurality of outgoing lines, a group of switching relays, and an allotter
25 for actuating a variable number of said relays in various combinations for extending said incoming line to an allotted outgoing line.

30 6. In an automatic telephone system, an incoming line, a plurality of outgoing lines, a group of switching relays, an allotter for actuating a variable number of said relays in various combinations for extending said
35 incoming line to an allotted outgoing line, and an interrupter co-operating with said allotter.

7. In an automatic telephone system, an incoming line, a plurality of outgoing lines, a group of switching relays, an allotter for
40 actuating a variable number of said relays in various combinations for extending said incoming line to an allotted outgoing line, and a timing device co-operating with said allotter.

45 8. In an automatic telephone system, groups of incoming lines, a group of outgoing lines for the exclusive use of each group of incoming lines, a group of switching relays individual to each incoming line
50 and less in number than the number of outgoing lines in a group, an allotter at each group of said switching relays and co-operating in the control thereof, and a timing device common to a plurality of allotters.

55 9. In an automatic telephone system, an incoming line, a plurality of trunk lines, a group of switching relays individual to each line and less in number than the number of said trunks, said relays operating to extend
60 said incoming line to an idle trunk, a progressively movable allotter for assigning idle trunks for use, and operating circuits for said switching relays controlled by said allotter.

10. In an automatic telephone system, an incoming line, a plurality of trunk lines, a group of switching relays individual to each line and less in number than the number of
65 said trunks, said relays operating to extend said incoming line to an assigned trunk, an allotter for assigning trunks for use, a timing device, and operating circuits for said switching relays variably completed through
70 said allotter and said timing device.

11. In an automatic telephone system, an incoming line, a plurality of trunk lines, a group of switching relays individual to each line and less in number than the number of
75 said trunks, said relays operating to extend said incoming line to an idle trunk, an allotter for assigning idle trunks for use, and a sequence controlling device for governing the operation of said switching relays to
80 extend said incoming line to an idle trunk.

12. In an automatic telephone system, an incoming line, a plurality of trunk lines, a group of switching relays individual to each line and less in number than the number of
85 said trunks, said relays operating to extend said incoming line to an idle trunk, an allotter for assigning trunks for use, and a sequence controlling device, said switching relays being variably operated under the joint control of said sequence controlling
90 device and said allotter to select an idle trunk for use.

13. In an automatic telephone system, an incoming line, a plurality of outgoing lines, a group of switching relays, and an allotter
100 for actuating a variable number of said relays in various combinations for extending said incoming line to an allotted outgoing line, said allotter having a plurality of progressively movable brushes cooperating in the actuation of said relays.
105

14. In an automatic telephone system, an incoming line, a plurality of outgoing lines, a group of switching relays, an allotter having a plurality of progressively movable
110 brushes, and multiple circuits extending through brushes of said allotter for variably actuating said switching relays in various combinations and thereby extend said incoming line to an allotted outgoing line.

15. In an automatic telephone system, an incoming line, a plurality of outgoing lines, a group of switching relays, an allotter having a plurality of progressively movable
115 brushes, multiple circuits extending through brushes of said allotter for variably actuating said switching relays in various combinations to extend said incoming line to an allotted outgoing line, and a constantly rotating interrupter cooperating with said
120 allotter in the completion of said circuits.

In witness whereof, I hereunto subscribe my name this 14th day of July, A. D. 1919
WINFRED T. POWELL.