

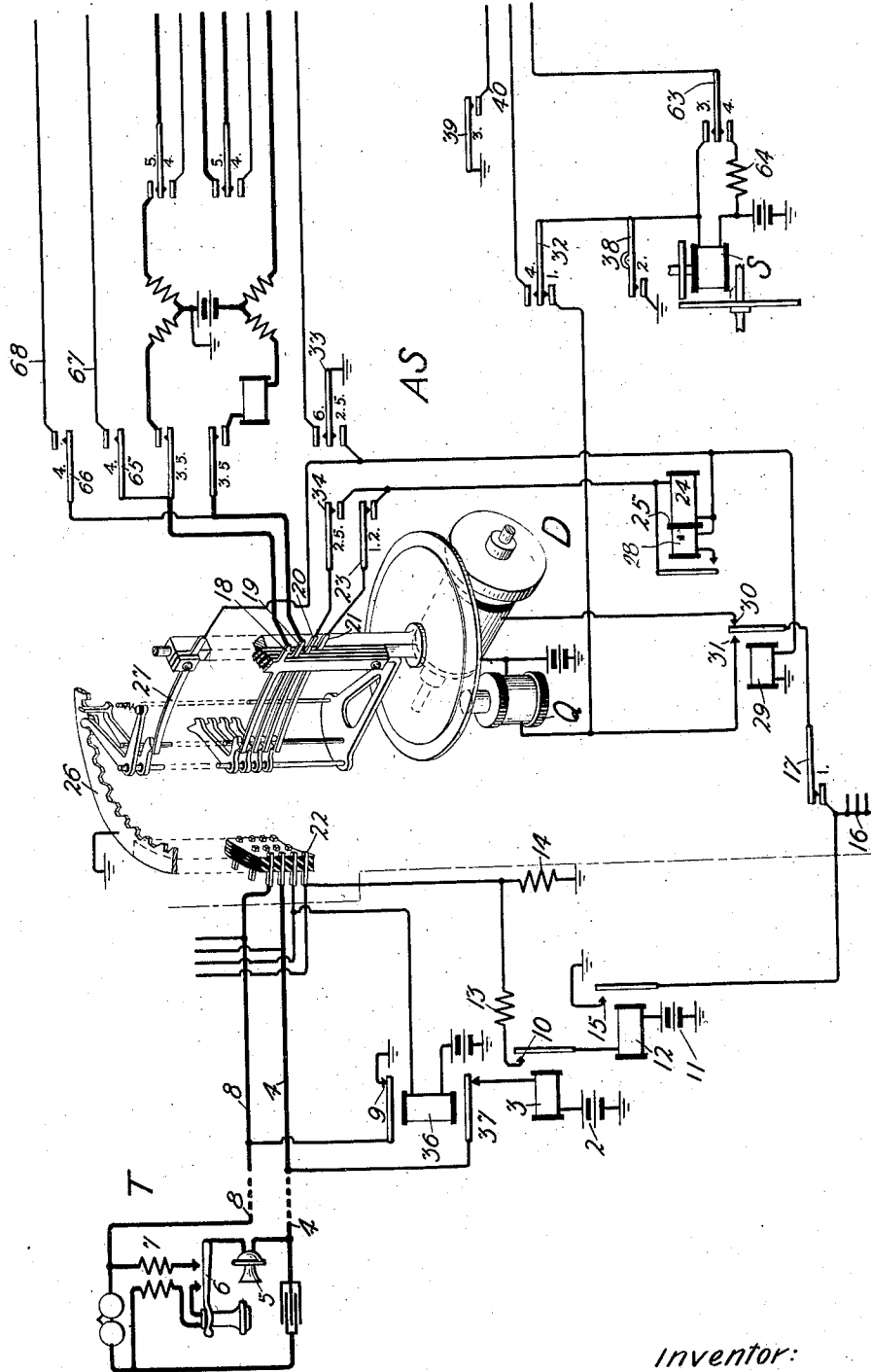
F. R. McBERTY.
 AUTOMATIC CALL DISTRIBUTER SYSTEM
 APPLICATION FILED JAN. 6, 1913.

Patented Sept. 15, 1914

2 SHEETS—SHEET 1.

1,110,809.

Fig. 1.



Witnesses:
 O. D. M. Luth &
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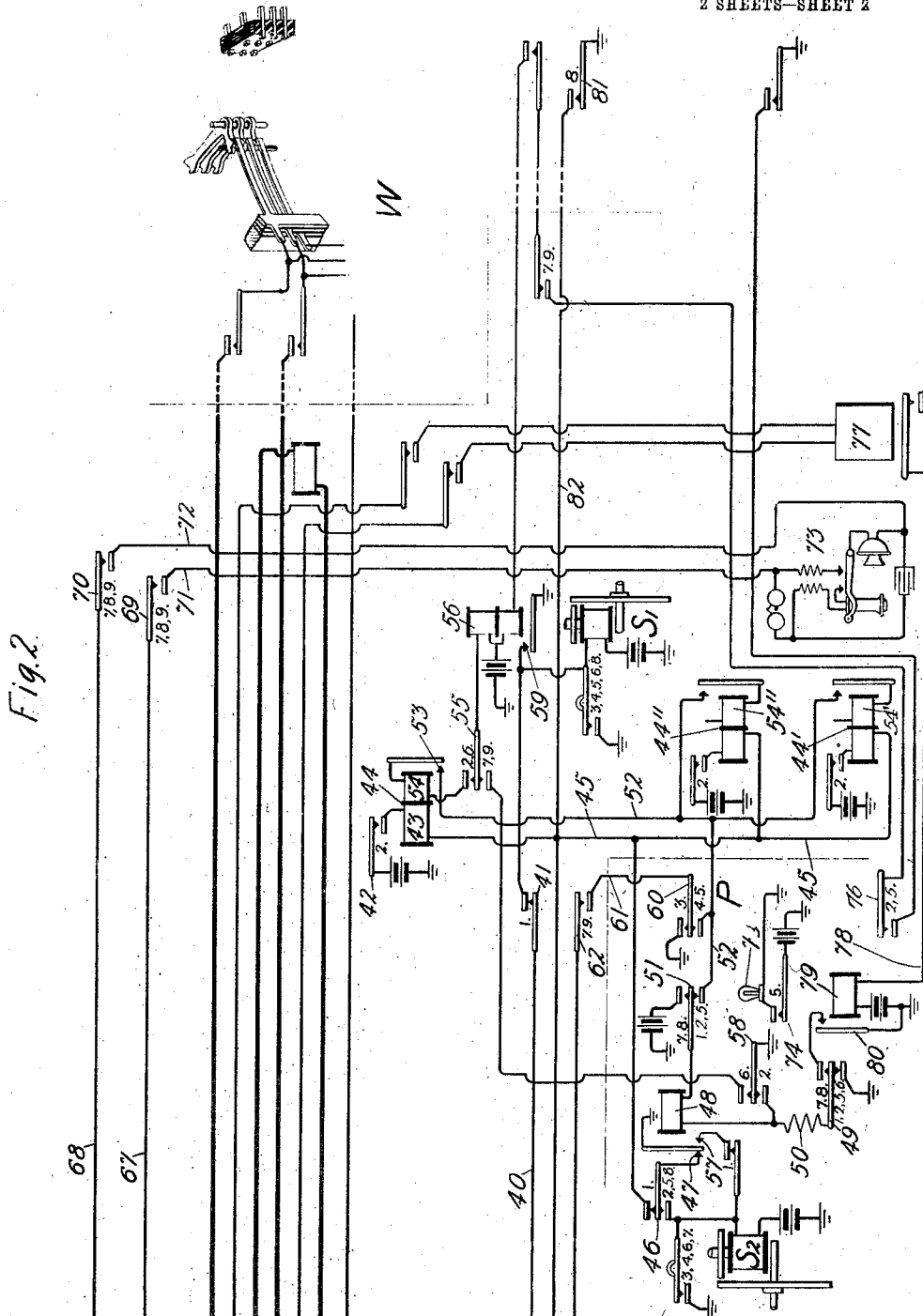
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 Frank R. McBerty.
 by John G. Roberts,
 Atty.

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2 SHEETS—SHEET 2



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UNITED STATES PATENT OFFICE.

FRANK R. McBERTY, OF ANTWERP, BELGIUM, ASSIGNOR TO WESTERN ELECTRIC COMPANY, OF NEW YORK, N. Y., A CORPORATION OF ILLINOIS.

AUTOMATIC CALL-DISTRIBUTER SYSTEM.

1,110,809.

Specification of Letters Patent.

Patented Sept. 15, 1914.

Application filed January 6, 1913. Serial No. 740,497.

To all whom it may concern:

Be it known that I, FRANK R. McBERTY, a citizen of the United States, residing at Antwerp, in the Province of Antwerp and Kingdom of Belgium, have invented a certain new and useful Improvement in Automatic Call-Distributor Systems, of which the following is a full, clear, concise, and exact description.

This invention relates to circuit arrangements and mechanism for establishing a suitable connection from one of a group of lines to another line, and its object is to provide an improved system of this kind capable with great facility of establishing the desired connections and of avoiding simultaneous connections being maintained with the same line.

In accordance with the invention, the apparatus is so arranged and connected that, although several group lines may by chance be connected simultaneously to the other line, only one of the group lines can remain so connected. The selecting process, by means of which only one group line can get effectively connected with another line and remain connected therewith, may be controlled by various means but preferably relays, one for each line, are used. Any number of these relays may be simultaneously energized. Whenever this happens they are brought into a common circuit in which but one can remain energized.

The invention is of especial advantage in telephone systems where there are many points at which a plurality of lines are to be connected each with a single line. In well-known systems there is required not only the apparatus for connecting a certain line of the group (hereinafter designated as an "incoming" line) to the other line (hereinafter designated as the "outgoing" line), but also special arrangements to prevent more than one incoming line from making connection to the outgoing line. Conditions, however, may and do arise in such systems where the calls are distributed automatically or indiscriminately as to time among the operators or switches so that simultaneous or practically simultaneous connections are occasionally made to a single outgoing line, and the invention is especially useful in taking care of this undesirable condition.

Figure 1 of the drawing illustrates a subscriber's line, a line finder and the associated

apparatus, whereas Fig. 2 illustrates apparatus and circuits associated with a connecting circuit, and an operator's telephone. The two drawings when taken together represent so much of an automatic telephone exchange system as seems necessary for a full disclosure of the invention, it being understood of course that the system described is only one of many types in which the invention may find useful embodiment.

In the drawing is shown a system of circuits and apparatus wherein only one of the incoming calls from subscribers may be transferred to an operator at a time and that only in case the operator is free. When a subscriber T desires a connection he removes his receiving telephone from the hook and thereby closes a circuit from battery 2 in the central office through line relay 3, contact 37 of cutoff relay 36, to wire 4 of the calling line, thence through the substation transmitter, hook switch 6, induction coil 7, to the other wire 8 of the line, and through contact 9 of the cutoff relay 36 to ground or other side of battery 2. Line relay 3 operates closing a circuit at its contact 10 from battery 11, through the starting relay 12, said contact 10 and resistances 13 and 14 to ground.

The operation of starting relay 12 closes at its contact 15 a ground connection to a common starting wire 16. This common wire 16 is connected, as will be presently explained, to starting devices which serve to connect the calling line with an operator's position. These devices include switches A S called line finders which may be of any well-known type, but that type is shown the wipers or moving brushes of which are operated by an electromagnetic coupling with a power shaft. It is similar to the switch for automatic telephone exchanges described in my application, Serial No. 573,516 filed July 23, 1910. The electromagnetic coupling of these line finders A S operates to connect the brushes or wipers with a continuously revolving power shaft. The sequence of the switching operations is in this system controlled in its various phases by so-called sequence switches which may be like or similar to that disclosed in Patent No. 1,009,080 issued November 21, 1911.

All line finders A S adapted to serve a certain group of subscribers' lines are connected to the common wire 16. This is ac-

complied for each line finder through spring contact 17 which is closed in position 1 (the normal position) of the sequence switch of that line finder. The branch wires to common wire 16 indicate connections to like sequence switch contacts 17 of other line finders. When contact 15 of the starting relay 12 is closed in the above described manner, the clutch magnets D of all line finders A S, whose sequence switches are at that time in their No. 1 or home positions, receive current through common wire 16 and contacts 17, the circuit for each such magnet D being from battery, magnet D, contact 30 of relay 29, sequence switch contact 17, common wire 16, contact 15 and ground. The several magnets D thus operated effect the coupling between the drive and the shafts of the idle line finders whereby the wipers 18, 19, 20 and 21 of each line finder are moved over a bank of contacts associated with the group of lines, of which the line calling is one.

Upon the closing of contact 10 of the line relay, a certain battery potential, different from the normal or ground potential, was put on contact 22. Through wiper 21 of that line finder A S, which first arrives at such contact or a multiple thereof, the following circuit is established:—Battery 11, relay 12, contact 10, resistance 13, contact 22, wiper 21, contact 23 of the sequence switch (position 1), a high resistance winding 24 of test relay 25, and contact brush 27 which travels over a toothed metal piece 26 connected to ground, this circuit being intermittently completed by engagement of brush 27 with the teeth of the piece 26. The brush 27 is carried with the movable wipers 40 of the line finder, and the toothed metal piece 26 is fixed on the frame thereof. The brush makes contact with the teeth during the intervals of time that the wipers 18 to 21 are passing between successive sets of line contacts, and rests between the teeth and out of contact with the metal piece only when the brushes are in contact with and centrally positioned on a set of line contacts. Relay 25 operates when the line calling is thus found and connects its low resistance winding 28 in shunt of the high resistance winding 24. At the same time the brush 27 comes to rest in a notch in the piece 26, thereby opening a short circuit of the relay 29. The cutting in of winding 28 effects a drop of the voltage at the test contact 22 which prevents any other one of the line finders set in motion from stopping on the same line. The relays 25 are made marginal, thus if by chance the brushes of two or more line finders should arrive simultaneously on the contacts of a calling line and the corresponding relays 25 should become energized, the cutting in of the low resistance winding will cause a decrease in the holding

power of these relays so that only one will be maintained energized. This dropping off of all but one of the relays 25 will occur before the short circuits of the relays 29 are interrupted, thus only the relay 29 associated with that relay 25 which has been maintained actuated will be energized. When relay 29 becomes energized it interrupts at its back contact 30, the circuit of the clutch magnet D of the line finder now in connection with the calling line, thereby stopping further motion of its wipers.

Simultaneously with the interruption of the circuit through D a circuit is closed for magnet S of a line finder sequence switch, this circuit being from battery through S, sequence switch contact 32 (position 1), front contact 31 of relay 29, sequence switch contact 17 (position 1), contact 15 to ground. At the same time a circuit is established for stop magnet Q of the line finder A S, the path for this magnet being in parallel circuit with magnet S. The sequence switch is thereupon advanced to position 3, the circuit of magnet S being maintained in position 2 by contact 38. During the advancement of the sequence switch, the initial circuit for S is interrupted at contact 32. In passing position 2 relay 29 is short-circuited by sequence switch contact 33 and cutoff relay 36 is also operated over a circuit from battery, relay 36, a contact closed by wiper 20, sequence switch contact 34 (position 2), the windings 24 and 28 of relay 25 in multiple, sequence switch contact 33 to ground. A branch of this circuit may be traced from sequence switch contact 34, through contact 23, brush 21, contact 22, and resistance 14 to ground. Cutoff relay operates disconnecting at contact 37 the line relay 3 from one side of the line and removing ground at contact 9 from the other side. Line relay 3 in releasing interrupts the circuit of relay 12 which in turn opens its contact 15 which had maintained a ground connection to the driving magnets D of all idle line finders in the group. These line finders now stop in whatever positions they happen to be in at that time.

In position 3 of the line finder sequence switch a circuit is closed from ground through sequence switch contact 39 (position 3), line 40, spring 41 of another sequence switch (position 1) to the driving magnet S¹ of that second sequence switch to battery. This second sequence switch, which is individual to the selected link circuit, serves to connect the line finder AS, now set for the calling line, temporarily with an operative telephone. As soon as the above mentioned circuit through magnet S¹ is closed, the second sequence switch advances to its second position thereby closing the following circuit: From battery, through sequence switch contact 42 (posi-

tion 2), winding 43 of starting relay 44, which is individual to the selected link circuit, wire 45 leading to the operator's position P, thence through spring 46 of a third sequence switch (in position 1) associated with that operator's position, and back contact 47 of relay 48 to ground.

Associated with each line finder of an operator's position is a starting relay such as relays 44' and 44'' corresponding to relay 44. All these relays are connected to wire 45. It may be assumed that a plurality of these starting relays, for example, three of them are connected simultaneously to the above-mentioned wire 45 due to the closure by their respective sequence switches at practically the same moment of the several contacts corresponding to contact 42; there being one such contact associated with each line finder sequence switch. All of such relays which happen to be simultaneously energized will have current flowing in their windings corresponding to windings 43, and each will close a circuit for its other winding.

This circuit may be traced as follows: From ground, through the operator's sequence switch contact 49 (position 1), a high resistance 50, winding of relay 48, operator's sequence switch spring 51, wire 52, and thence through the front contact 53 and the winding 54 of starting relay 44, sequence switch spring 55 and a relay 66 to battery. Other starting relays simultaneously energized close multiple branches in the same circuit, so that all of the windings of such relays are in parallel and fed through the common resistance 50. Thereupon relay 48 is operated which, by opening contact 47, removes ground from the wire 45 thereby interrupting the current in the windings 43 and corresponding windings of the several starting relays. At this time windings 54, 54', and 54'', etc., of these relays receive current through sequence switch spring 49 (position 1), the high resistance 50 and relay 48. The current through the high resistance is insufficient to hold operated all the starting relays in multiple. It is a fact observed in actual operation that the armatures of several relays in the same circuit do not release absolutely simultaneously. As soon as one of the armatures releases, the current in the windings of the remaining relays is strengthened a little. The resistances are so balanced that only one relay may be held operated through the resistance 50, and that one relay will in each case be the one whose armature releases most tardily. Extremely little difference in the inertia of the relay armatures has sufficed to produce this effect. In case the existing difference should prove insufficient, it is easy to adjust the armatures by stiffening the springs, etc. It may be assumed that relay

44 is that one of these relays which holds up its armature. It will be understood that the elimination of the remaining starting relays from the circuit takes place in an extremely short period of time.

By the operation of relay 48 a circuit for the magnet S^2 of the operator's sequence switch was closed at its front contact 57, the sequence switch thereupon advancing to its second position. This switch reaches position 2 only after all the above described operations of the starting relays have taken place. In position 2 a contact 58 short-circuits the high-resistance 50 and thereby causes such an increase of the current in the circuit through the relays 48, 44 and 56 that the latter relay, which had not previously been sufficiently energized, also operates closing its contact 59 which completes a circuit for the sequence switch magnet S^1 . This sequence switch thereupon moves to position 7.

In moving to position 7 contact 55 interrupts this circuit for relays 56, 44 and 48. Relay 48 closes at its back contact 47 a circuit for sequence switch magnet S^2 , from battery, through S^2 , sequence switch contact 46 (position 2), and contact 47 to ground. This sequence switch thereupon advances to position 5. While passing through position 3 a circuit is closed at contact 60 from ground, through 60, wire 61, sequence switch contact 62 (position 7), contact 63 of the sequence switch associated with the line finder (now in position 3), and through sequence switch magnet S , thus causing the line finder sequence switch to advance to position 4. As soon as the sequence switch at the operator's position reaches position 5, relay 48 is again operated through the circuit from ground, contact 49, resistance 50, relay 48, contact 51, wire 52, contact 60, wire 61, contact 62, contact 63, (position 4), and resistance 64 to battery.

The sequence switch of the line finder in position 4 connects both sides of the subscriber's line through the contacts 65, 66 to the wires 67, 68, which had been connected previously to the wires 71, 72 by contacts 69, 70 of the sequence switch operated by magnet S^1 in position 7. The wires 71, 72 lead to the operator's telephone set 73. Thus a talking connection is established and the operator can ask the subscriber for the number wanted. The call is made visible to the operator by the closure of a local circuit for the call lamp 75 at contact 74 of the operator's sequence switch in position 5. In this position of this sequence switch there is also closed a circuit for relay 56 at contact 76, which circuit is also led through contacts of a sequence switch of a selector W associated with the line finder AS. The relay closes contact 59 and thus causes the sequence switch controlled by magnet S^1 to

advance to position 9 in which the talking set of the operator remains connected to the subscriber's line.

The operator now inquires of the calling subscriber the number of the line wanted. After obtaining it she sets up this number in the well-known manner on a keyboard 77 at her position, thereby operating the selector W and eventually other selectors which may be supplied but are not shown. Inasmuch as these events are not immediately concerned with the present invention, a detailed description of them will not be entered into. After the setting up of the number on the keyboard sender a ground connection to wire 78 is established by a contact associated with the sender, thereby operating relay 79 which closes its contact 80 which prepares for the subsequent operation of relay 48.

As soon as the impulses produced by the sender have caused the advance of the sequence switch associated with selector W to position 8, a contact 81 is operated thereby by closing a circuit from ground through contact 81, wire 82, contact 32 (position 4), sequence switch magnet S and battery. This sequence switch thereupon advances to position 5 in which the operator's talking equipment is disconnected at contacts 65, 66. At the same time relay 48, which had been held operated, is released by the opening of contact 63, and thereby closes contact 47, completing a circuit through magnet S², causing the sequence switch associated with the operator's position to advance to position 8. At this time a new circuit for relay 48 is closed through contact 80, contact 49 (positions 7 and 8), resistance 50, relay 48, contact 51 (positions 7 and 8) to battery, thus again opening the circuit for S². The sequence switch is therefore retained in position 8 until ground is disconnected from wire 78 to release relay 79 which may happen at any time after the setting of all the selectors is completed. In such instance the circuit for S² would again be established by the releasing of relay 48, and the sequence switch associated with the operator's position would be advanced from position 8 to normal, whereupon the operator's position would be free for a new call. The connection established may be supervised and taken down at the operator's position in the well-known manner.

I claim:

1. In a switching system the combination

with a plurality of incoming lines, an outgoing line and switching apparatus for connecting said incoming lines with said outgoing line, of means operating in case a plurality of simultaneous connections are established by the said lines for permitting only one connection to remain.

2. In a switching system the combination with a plurality of incoming lines, an outgoing line and switching apparatus for connecting said incoming lines with said outgoing line, of means operating in case a plurality of simultaneous connections are established by the said lines for permitting only one connection to remain, said means comprising a relay for each incoming line, and a common circuit for said relays adapted to permit only one relay to remain energized therein.

3. In a telephone system the combination with a plurality of incoming lines, an outgoing line and switching apparatus for connecting said incoming lines with said outgoing line, of means operating in case a plurality of simultaneous connections are established by the said lines for permitting only one connection to remain, said means comprising a relay for each incoming line, a common circuit for said relays adapted to permit only one relay to remain energized therein, each of said relays having two windings, one of which is an energizing winding and the other a holding winding, and means for switching said holding winding into parallel with the corresponding windings of other simultaneously energized relays.

4. A multiple switching system comprising means for establishing simultaneously a plurality of connections to a single line and means for thereupon adjusting the switching apparatus so that one connection only may remain.

5. A switching system, comprising means for establishing simultaneously a plurality of connections to a single line and for holding said connections momentarily, and means for thereupon adjusting the switching apparatus so that all but one of the connections will be interrupted.

In witness whereof, I hereunto subscribe my name this 24th day of December A. D., 1912.

FRANK R. McBERTY.

Witnesses:

ELLA EDLER,

WALTER F. HOFFMAN.