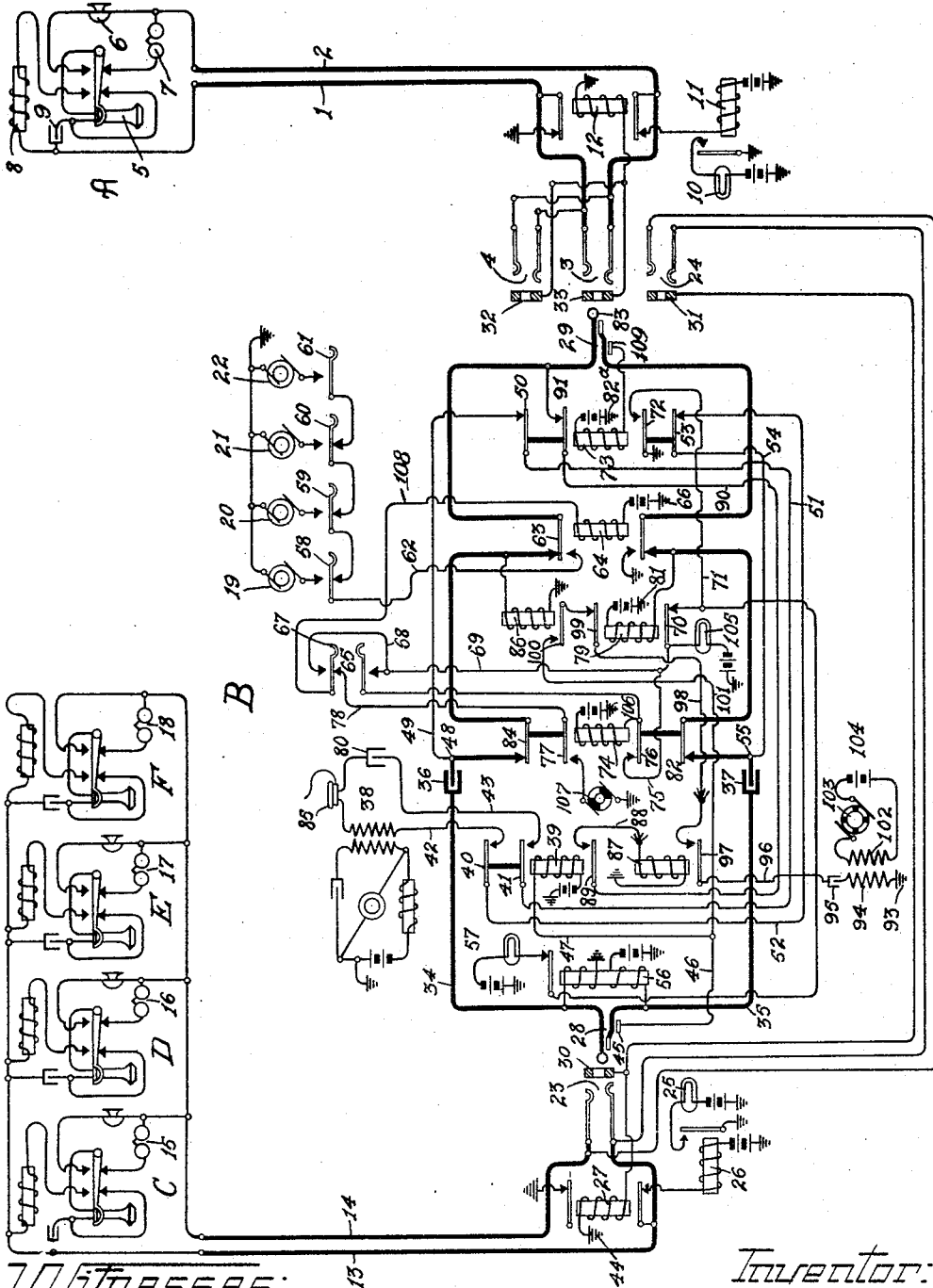


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 OPERATOR'S CORD CIRCUIT WITH REVERTING BUSY TEST.
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UNITED STATES PATENT OFFICE.

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OPERATOR'S CORD-CIRCUIT WITH REVERTING BUSY-TEST.

1,186,057.

Specification of Letters Patent.

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To all whom it may concern:

Be it known that I, CHARLES S. WINSTON, a citizen of the United States of America, residing at Chicago, in the county of Cook and State of Illinois, have invented certain new and useful Improvements in Operators' Cord-Circuits with Reverting Busy-Test, of which the following is a specification.

My invention relates to telephone systems, and more particularly to common battery multiple systems, and has for its object the provision of improved busy test arrangements.

More particularly my invention contemplates the provision of what I may call a reverting busy test by which I mean the provision of a circuit in which the operator receives a distinctive indication whenever a test is being made on a party line, one of whose telephones is initiating the call.

My invention is particularly devised to provide this reverting busy test in connection with a subscriber's operator's cord circuit arranged for automatic and secret listening arrangements. The cord circuit herein which is adapted to provide this distinctive busy test for party lines has means for automatically cutting in the operator's head set with the cord circuit whenever a connection is made by the answering plug, and has provisions for automatically disconnecting this operator's circuit when the connection is finally completed by the insertion of the calling plug.

I will describe one form of carrying out my invention more in detail by referring to the accompanying drawing, in which a telephone system arranged in accordance with my invention is diagrammatically illustrated. I here set forth in this drawing a subscriber's station A which is united by means of line conductors 1 and 2 with a central station B terminating at this central station in the answering jack 3 and multiple jack 4. Any ordinary subscriber's circuit is available for use in connection with my invention, the one shown herein including the receiver 5, transmitter 6, call signal 7, impedance coil 8 and condenser 9. The line lamp 10 at the central station is controlled by the line relay 11, and later on when the plug is inserted, by the cut-off relay 12. It is thought this part of the circuit will be clear without further explanation. I also show a subscriber's line consisting of the

line wires 13 and 14, which is provided with subscribers' party line stations C, D, E and F. These party line subscribers' stations each have talking equipment similar to that shown for the sub-station A, except that as herein shown when used in connection with the particular circuit herein shown, they are provided with harmonic signal receiving devices 15, 16, 17 and 18, respectively, which respond respectively to the currents of different frequency as supplied by generators 19, 20, 21 and 22 at the central station. This party line circuit for purposes of illustration is here shown as terminating in an answering jack 23 and multiple jack 24. The customary line lamp 25, line relay 26, and cut-off relay 27 are provided for this party line circuit similarly as provided for the single subscriber's circuit before mentioned. The cord circuit for making connections has the answering plug 28 and calling plug 29. Each jack has a thimble denoted respectively by the reference numerals 30, 31, 32 and 33. The thimbles 32 and 33 are connected together as shown and are included serially with the cut-off relay 12 and ground. Similarly the thimbles 30 and 31 are connected together and included with their corresponding cut-off relay 27 to the ground. These thimbles are used for test purposes as will be presently pointed out, and as is clear from the illustration, also form part of the circuit through their respective cut-off relays. The cord circuit consists of the tip strand 34 and the sleeve strand 35. Condensers 36 and 37 are included for purposes well understood. The operator's talking circuit 38 is connected in parallel with the strands of the cord circuit by the cut-in relay 39 which through the agency of contact levers 40 and 41 controls the circuit to the conductors 42 and 43 of this operator's circuit. Whenever an answering plug 28 is inserted in the jack there is completed a circuit from the ground 44, cut-off relay 27, thimble 30, contact 45, conductor 46, conductor 47, relay 39, through battery to ground. This energizes the cut-off relay 27 and also energizes the relay 39 whereupon the operator's circuit 38 is connected in bridge with the cord circuit which circuit may be traced from the connection point 48, conductor 49, contact lever 50, conductor 51, contact lever 41, conductor 43, operator's set 38, conductor 42, contact lever

40, conductor 52, contact lever 53, conductor 54 to the connection point 55. It will be seen that the connection points 48 and 55 are respectively on the tip and sleeve strands of the cord circuit. The answering supervisory relay 56 having two windings with battery interposed has these windings connected in bridge with the cord circuit, thus to control the answering supervisory signal 57, as will be readily apparent.

The generators 19, 20, 21 and 22 are controlled respectively by the selective key springs 58, 59, 60 and 61 to establish the desired frequency from the grounded generators on the conductor 62 which conductor then is adapted for connection to the tip strand of the cord circuit through the agency of the contact lever 63 under the control of the interrupter relay 64. This interrupter relay 64 is controlled by the ringing key 65, by means of which whenever a subscriber is to be called circuit is completed from the ground at 66 through battery, through relay 64, conductor 108, ringing key springs 67, conductor 68, conductor 69, contact spring 70, conductor 71, contact spring 72, to ground. It will of course be understood that the operator's circuit cut-out relay 73 has been energized by the insertion of the calling plug 29, thus to complete the circuit from conductor 71 to ground. At the same time a circuit is established from the ground 106 through battery, through relay 74, conductor 69, to the contact spring 70, and from there over the same path to ground, thus also energizing the relay 74 to thereby throw the interrupter 107 into the circuit. The ringing key 65 is then released, but relay 74 remains energized through the agency of the spring 76 which completes the circuit hitherto completed by the ringing key. This maintains the connection between the interrupter 107 and the contact spring 77, so that an interrupted circuit is provided for the interrupter relay 64 which may be traced from the ground through the interrupter 107, spring 77, conductor 78, ringing spring 67, conductor 108, relay 64, through battery to ground at 66. The ringing conductor 62 is thus alternately connected to the tip strand to periodically ring the called subscriber. Immediately upon the response of the called subscriber the calling sleeve relay 79 is energized thereby breaking the circuit through the relay 74 at the contact spring 70, thus preventing further operation of the relay 64 and thereby preventing further connection of ringing current to the called line.

It may be pointed out that the condenser 80 provided in the operator's talking circuit has one of its poles charged to a certain potential from battery which can be traced from ground at 81 through battery, through the relay 79, sleeve strand 35, con-

tact spring 82, conductor 54, contact spring 53, conductor 52, spring 40, conductor 42 to one pole of the condenser. This of course occurs whenever an answering plug has been inserted. Now, if at this time the calling plug 29 should be touched to the thimble 33 for instance, of a subscriber's line which is busy, then this thimble 33 will have a battery potential thereon which can be traced from the ground at 82^a through battery, relay 73, contact 109 to the thimble 33. The thimble 33 is thus charged similarly to the charged pole of the condenser 80. The opposing pole of the condenser 80 is of course by induction then oppositely charged. Now if the tip 83 of the calling plug 29 is connected to a thimble 33 thus charged, then a circuit is established by which the pole of the condenser which has the induced charge is connected through conductor 43, contact spring 41, conductor 51, contact spring 50, conductor 49, contact spring 84, tip strand of the cord circuit, tip 83, to the thimble 33. Thus the pole of the condenser which has hitherto had the induced charge will be raised to the same potential as the previously charged pole of the condenser, thus causing a discharge of current whereby the operator's receiver 85 receives a click to indicate that the line is busy. It will, of course, be seen that when the tip 83 is connected to the thimble 33 if said thimble is charged, then the calling tip relay 86 and relay 87 are energized while this test is being made. The circuit through the relay 87 can be traced from the ground, through said relay 87, conductor 88, contact spring 89, conductor 90, contact spring 91, to the tip of the cord circuit, and from there to the charged thimble 33. And similarly the circuit through the relay 86 can be traced from the ground through said relay 86 directly to the tip strand of the cord circuit. The spring 89 of course is in circuit closing position because the relay 39 remains energized if the answering plug 28 is in the jack 23. This operation of these two relays however, does not cause any disturbance as will be readily apparent. Now should the answering plug 28 be in the jack 23 and should one of the telephone stations C, for instance, desire communication with telephone station F, on the same line, then the tip 83 would be brought into contact with the thimble 31. Under these conditions a circuit would be established from the charged thimble 31 through the tip 83 and from there through the relays 86 and 87 to energize the same similarly as when testing on the jack of another line. It may be pointed out that the relay 87 is common to an operator's position. The operation of the relay 87 under all conditions serves to establish a circuit from ground 93 through a winding 94 of an induction coil, condenser 95, con-

ductor 96, contact spring 97, conductor 98, contact spring 99, contact spring 100, conductor 101, conductor 46, to the thimble contact 45 of the plug 28 which having been
 5 assumed as within the jack 23 thus is connected to the thimble 30. The thimble 30 is thus grounded through the coil 94. The coil 94 is under the influence of a primary coil 102 which through the agency of a commu-
 10 tator 103 and battery 104 imparts to the coil 94 distinctive interrupted current conditions, thus to cause distinctive potential changes of the thimble 30. The thimble 30 is of course connected to the thimble 31 and
 15 thus these distinctive potential changes are communicated to the tip 83 thus to alternately charge and discharge the condenser 80 as will be readily apparent whereby the operator receives a distinctive test when
 20 testing back on a calling party line. During the conversation the relay 79 is of course energized, this energization being effected when the calling party answers to thereby eliminate the calling supervisory signal 105,
 25 and this energization of this relay 79 will prevent the special tone from the coil 94 from being placed upon the sleeve of the answering cord when the relay 87 for instance, is energized, due to tests being made
 30 by other calling cords in the same position. As before stated, the operator's circuit is connected by the cut in relay 39 directly in bridge of the cord circuit. Now the moment the plug 29 is inserted in the jack of
 35 the called for line, relay 73 is energized, thus through the agency of springs 50 and 53 to break this operator's circuit, thus to automatically cause disconnection of said operator's circuit from this particular cord.
 40 From what has been described it is thought it will be entirely clear that I have provided a reverting busy test arrangement for a cord circuit of the automatic and secret listening type. It will, of course, also
 45 be readily apparent that many changes and modifications may be made and other circuits used without departing from the spirit of my invention.

Having, however, thus described one form
 50 which my invention may take, what I claim as new and desire to secure by Letter Patent is:

1. A telephone exchange system having entering party lines, each provided with a
 55 plurality of terminating jacks, a test thimble for each jack, and a link circuit for completing the electrical connection between jacks having an operator's set and means for automatically connecting and disconnecting said set with conductors of said circuit, said link circuit having means operable
 60 only during the testing operation for changing during said testing operation the test conditions of a thimble connected therewith.

65 2. A telephone exchange system having

entering party lines, each provided with a plurality of terminating jacks, a test thimble for each jack, and a link circuit for completing the electrical connection between jacks having an operator's set and means
 70 for automatically connecting and disconnecting said set with conductors of said circuit, said link circuit having means operable only during the testing operation for changing during said testing operation the test
 75 conditions of a thimble connected therewith, said last aforesaid means including a source of distinctive current.

3. A telephone exchange system having entering party lines, each provided with a
 80 plurality of terminating jacks, a test thimble for each jack, a plurality of link circuits for completing electrical interconnections between jacks, an operator's set and means for automatically connecting and
 85 disconnecting said set with conductors of said circuits, said link circuits each having means for changing the test conditions of a thimble connected therewith, said means including
 90 electromagnetic apparatus common to said link circuits, and each link circuit also having means to prevent such test condition changes in its associated thimbles when said common apparatus is actuated by the test-
 95 ing operations of another link circuit.

4. A telephone exchange system having entering party lines, each provided with a plurality of terminating jacks, a test thimble for each jack, a plurality of link circuits
 100 for completing electrical interconnections between jacks, an operator's set and means for automatically connecting and disconnecting said set with conductors of said circuits, said link circuits each having operable dur-
 105 ing the testing operation means for changing during said testing operation the test conditions of a thimble connected therewith, said means including electromagnetic apparatus common to said link circuits, and
 110 each link circuit also having means to prevent such test condition changes in its associated thimbles when said common apparatus is actuated by the testing operations of another link circuit.

5. A telephone exchange system having
 115 entering party lines, each provided with a plurality of terminating jacks, a test thimble for each jack, a plurality of link circuits for completing electrical interconnections between jacks, an operator's set and means
 120 for automatically connecting and disconnecting said set with conductors of said circuits, said link circuits each having operable during the testing operation means for changing during said testing operation the
 125 test conditions of a thimble connected therewith, said means including electromagnetic apparatus common to said link circuits, and each link circuit also having means operable when said link circuit is connected with two
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jacks to prevent such test condition changes in its associated thimbles when said common apparatus is actuated by the testing operations of another link circuit.

- 5 6. A telephone exchange system having entering party lines, each provided with a plurality of terminating jacks, a test thimble for each jack, and a link circuit for completing the electrical connection between jacks having
10 an operator's set and means for automatically connecting and disconnecting said set with conductors of said circuit, said link circuit having means operable during the testing operation for changing during said testing
15 operation the test conditions of a thimble connected therewith, said last aforesaid means including a source of distinctive current and a relay adapted to associate said source with said connected thimble.
- 20 7. A telephone exchange system having entering party lines, each provided with a plurality of terminating jacks, a test thimble for each jack, and a link circuit for completing the electrical connection between
25 jacks having an operator's set and means for automatically connecting and disconnecting said set with conductors of said circuit, said link circuit having means operable during the testing operation for changing during
30 said testing operation the test conditions of a thimble connected therewith, said last aforesaid means including a source of distinctive current and a relay adapted to associate said source with said connected thimble, the circuit through said relay being controlled by said first aforesaid means.
- 35 8. A telephone exchange system having entering party lines, each provided with a plurality of terminating jacks, a test thimble for each jack, and a link circuit for completing the electrical connection between
40 jacks having an operator's set, a supervisory relay, and means for automatically connecting and disconnecting said set with conductors of said circuit, said link circuit having
45 means operable during the testing operation for changing during said testing operation the test conditions of a thimble connected therewith, said last aforesaid means including
50 a source of distinctive current and a relay adapted to associate said source with said connected thimble, the circuit through said relay being controlled by said first aforesaid means, and the circuit through
55 said source being also controlled by said supervisory relay.
9. A telephone exchange system having entering party lines, each provided with a plurality of terminating jacks, a test thimble for each jack, and a link circuit for completing the electrical connection between
60 jacks having an operator's set, a supervisory relay, and means for automatically connecting and disconnecting said set with conductors of said circuit, said link circuit having

means operable during the testing operation for changing during said testing operation the test conditions of a thimble connected therewith, said last aforesaid means including a source of distinctive current and a relay adapted to associate said source with
70 said connected thimble, the circuit through said relay being controlled by said first aforesaid means, and the circuit through said source being also controlled by said supervisory relay.

10. A telephone exchange system having entering party lines, each provided with a plurality of terminating jacks, a test thimble for each jack, a plurality of link circuits for completing electrical interconnections
80 between jacks, an operator's set and means for automatically connecting and disconnecting said set with conductors of said circuits, said link circuits each having operable means during the testing operation means for changing during said testing operation the test conditions of a thimble connected therewith, said means including electromagnetic
85 apparatus common to said link circuits, and each link circuit also having means operable when said link circuit is connected with two jacks to prevent such test condition changes in its associated thimbles when said common
90 apparatus is actuated by the testing operations of another link circuit, said last aforesaid means including a supervisory relay.

11. In a testing system the combination with a telephone line having a busy testing terminal, of an operator's link circuit provided with a testing contact for testing the busy condition of the line, means for automatically connecting and disconnecting an operator's set with the conductors of said link circuit, a testing circuit including a
100 conductor of the answering end of the cord adapted to be closed when a busy line is tested, and means associated with said circuit for interrupting the current flow therein whereby when said circuit is closed a
105 special tone is produced in the operator's set.

12. In a testing system the combination with a telephone line of a plurality of substations upon said line, a plurality of testing contacts for said line at the central office, a link circuit provided with means for automatically connecting and disconnecting an operator's set with the conductors of said link circuit, a testing terminal associated
110 with said link circuit, a busy test circuit adapted to be closed when the link circuit terminal is connected to the test terminal of a busy line, and a tone signal circuit adapted to be closed over a conductor of the answering end of said link circuit when said line
115 is busy whereby the tone is transmitted to the operator's set.

13. In a testing system the combination with a telephone line having a busy testing
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terminal, of an operator's testing contact for testing the busy condition of the line, a link circuit provided with means for automatically connecting and disconnecting an operator's set with the conductors of said link circuit, said link circuit having its answering end connected with the line, a test circuit including a conductor of the answering end of the link circuit closed when a busy line is tested, and a suitable device for interrupting the current flow in said circuit whereby when said line is tested a special tone is produced in the operator's set.

14. A telephone system comprising party lines each provided with a plurality of terminal jacks, a link circuit provided with terminals for interconnecting the said lines, means for automatically connecting and disconnecting the operator's set with the conductors of said link circuit, and means for connecting a distinctive tone through the answering terminal of said link circuit to the operator's set when the said answering terminal is connected to a calling line and

the calling terminal of said link circuit is brought into engagement with a jack of said calling line.

15. A telephone system having party lines each provided with a plurality of terminal jacks, a link circuit provided with terminals for completing electrical connection between jacks having an operator's set and means for automatically connecting and disconnecting the said set with conductors of said link circuit, and means for connecting a distinctive tone current with the test contact of said jacks when one subscriber on a line requests connection with a second subscriber on the same line and the operator tests a jack of said calling line.

Signed by me at Chicago, county of Cook and State of Illinois, in the presence of two witnesses.

CHARLES S. WINSTON.

Witnesses:

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