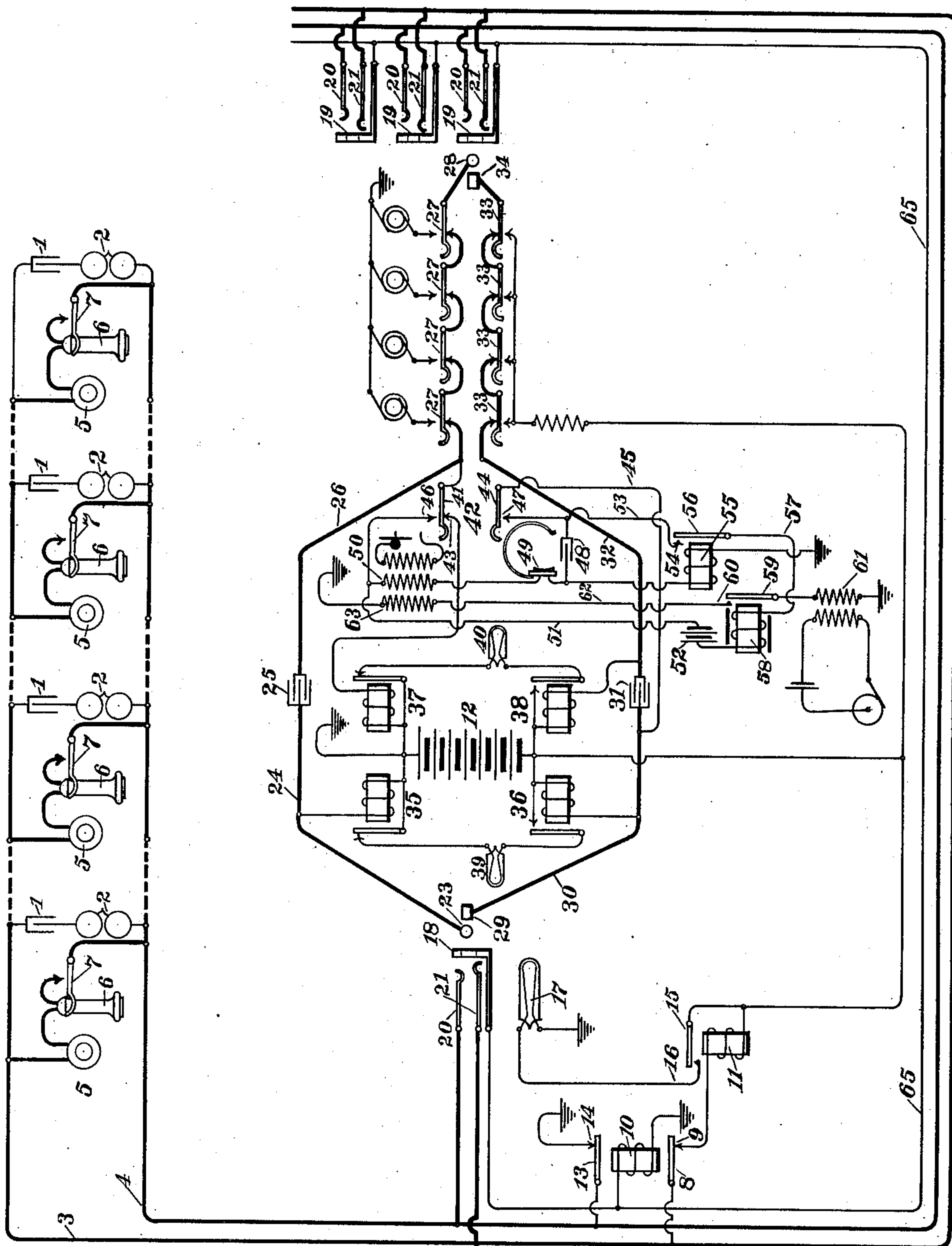


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 TESTING SYSTEM FOR TELEPHONE PARTY LINES.
 APPLICATION FILED MAR. 25, 1912.

1,100,116.

Patented June 16, 1914.



Witnesses

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TESTING SYSTEM FOR TELEPHONE PARTY-LINES.

1,100,116.

Specification of Letters Patent.

Patented June 16, 1914.

Application filed March 25, 1912. Serial No. 685,933.

To all whom it may concern:

Be it known that I, CLIFFORD C. BRADBURY, a citizen of the United States, residing in Rochester, county of Monroe, and State of New York, have invented certain new and useful Improvements in Testing Systems for Telephone Party-Lines, of which the following is a specification.

My invention relates to testing systems for telephone party-lines.

The object of my invention is to provide means for giving the operator a positive indication of the condition of a line which is being tested.

When there are several telephones connected with the same line and one subscriber on this line desires a connection with another subscriber on the same line, the operator will test the jack of the desired line, and, with my present invention, will receive a distinctive tone to indicate that the line tested is the same as the line upon which the call originated. The subscriber is then instructed to hang up his receiver while the other party on the line is called.

My present invention is an improvement upon the invention of D. A. Lawver and C. C. Bradbury, shown in Patent No. 978,603, December 13, 1910.

With the system of my present invention, no tone is produced upon the calling telephone line except when another party on the same line is desired. The calling party, therefore, will soon become acquainted with the fact that when he hears the busy test tone it is necessary for him to hang up his receiver while the operator rings the other party on the same line. Furthermore, inasmuch as the tone is only placed upon the sleeve contact of a line upon which a reverting call is desired, the possibility of an operator's testing the multiple contact of a jack at the same time that some other operator is testing some other jack in response to a call upon said line, and thereby giving a false tone test to the first operator, is greatly reduced, since, on an average, the number of reverting calls is only about one in one hundred calls.

In accordance with my present invention, a low resistance relay and a source of current are placed in a circuit between the sleeve

conductor of the answering cord and the test contact of the calling cord so that, when the test contact of the calling cord is connected with the sleeve of a multiple jack which is directly connected with the sleeve of the jack to which the answering cord is connected, a low resistance circuit is completed, causing the actuation of the low resistance relay. The actuation of this low resistance relay connects a tone-producing device with a winding of the operator's induction coil and thus gives the operator a distinct tone, this tone also being inductively received by the calling subscriber.

My invention is illustrated in the accompanying drawing, wherein all apparatus is shown in its normal or unactuated condition.

Upon the subscriber's line here illustrated, four subscribers' sets are shown, each provided with a condenser 1 and annunciator 2 in a permanent bridge between line conductors 3 and 4, and with a transmitter 5 and receiver 6 in a bridge maintained normally open by contacts of the switch-hook 7. At the central office, line conductor 3 is connected through contacts 8 and 9 of cut-off relay 10, and through the coil of line relay 11, with the live pole of battery 12. The line conductor 4 is connected through contacts 13 and 14 of cut-off relay 10, with earth. Line relay 11 has normally open contacts 15 and 16, adapted, when closed, to include the line lamp 17 in circuit with the battery 12. The coil of cut-off relay 10 has one terminal connected with earth and the other terminal connected with the sleeve contact 18 of the answering jack, and with the sleeve or test contacts 19 of the various multiple jacks for said line. Each of the jacks is also provided with tip and ring talking circuit contacts 20 and 21, the tip contacts 20 being connected with line conductor 4, and the ring contacts 21 being connected with line conductor 3. The cord circuit for connecting with this line has a tip answering contact 23, connected through conductor 24, condenser 25, conductor 26, and the series contacts 27 of the operator's ringing key, with the tip or test contact 28 of the calling plug. This cord circuit also has the sleeve answering contact 29, connected through conductor 30, condenser 31, conductor 32,

and the sleeve series contacts 33 of the operator's ringing key, to the sleeve contact 34 of the calling plug.

The tip and sleeve supervisory relays 35 and 36 are connected in a bridge of the answering end of the cord circuit, this bridge also containing the battery 12; and the tip and sleeve supervisory relays 37 and 38 are connected in a bridge of the calling end of the cord circuit, this bridge also containing the battery 12. Relays 35 and 36 coöperate to control the answering supervisory signal 39 and relays 37 and 38 coöperate to control the calling supervisory signal 40.

The upper spring 41 of the operator's listening key 42 is connected with the tip contact of the calling plug and through contact 43 connects the coil of relay 37 with the tip conductor 26. The lower spring 44 of the operator's listening key 42 is connected through conductor 45 with the sleeve conductor 30 of the answering end of the cord circuit. The normally disconnected contacts 46 and 47 of the operator's listening key 42 are adapted, upon the actuation of the key, to connect the condenser 48, operator's receiver 49 and secondary 50 of the operator's induction coil in a bridge of the talking strands of the cord circuit. Contact 46 is also connected by means of conductor 51 with one terminal of the low potential battery 52, this battery being individual to an operator's position and not common to the entire exchange. The contact 47 of the operator's listening key 42 is connected through conductor 53, with normally open contact 54 of the operator's test relay 55. The other normally open contact 56 of test relay 55 is connected through conductor 57 and the coil of low resistance reverting test relay 58 with the other terminal of low potential battery 52. One terminal of the coil of test relay 55 is connected with earth, while the other terminal is connected with the operator's bridge at a point between the receiver and the condenser. The low resistance relay 58 has normally open contacts 59 and 60, adapted, when closed, to complete the circuit from the tone-producing coil 61, through conductor 62 and the tertiary winding 63 of the operator's induction coil, to ground.

In the operation of my system, the removal of the receiver 6 at one of the substations upon the telephone line completes the circuit of the relay 11 and displays the line lamp 17. The display of this lamp indicates to the operator that a connection is desired upon the line designated thereby and she, therefore, inserts her answering plug into the jack of that line. A circuit is thereby completed from the battery 12, through the coil of supervisory relay 36, conductor 30, contacts 29 and 18 of the plug

and jack, and the coil of cut-off relay 10, to ground, thus actuating relay 10 and interrupting the circuit of the line relay 11 and effacing the line lamp 17. The operator now actuates her listening key 42 and connects her receiver 49 in a bridge between the tip and sleeve strands of the cord circuit. She then obtains the desired number and, with her listening key 42 still depressed, touches the tip 28 of her calling plug to the sleeve contact of the jack of the desired line. If the desired line is busy, by reason of a connection being established therewith through some other cord circuit, the sleeve contact of the jack will be at a potential above that of earth and current will, therefore, flow from the sleeve of the tested jack through the series contacts 27 of the operator's ringing key, through contacts 41 and 46 of the operator's listening key 42, the secondary 50 of the operator's induction coil, operator's receiver 49, and the coil of high resistance test relay 55, to ground. The current in this path causes a click in the operator's receiver 49 and also actuates high resistance test relay 55. The actuation of this test relay 55 closes its contacts 54 and 56, which completes the circuit from contact 46 of the operator's listening key 42, through conductor 51, battery 52, the coil of relay 58, conductor 57, contacts 56 and 54 of relay 55, conductor 53, contacts 47 and 44 of the operator's listening key 42, conductor 45, to the sleeve conductor 30 and sleeve contact 29 of the answering end of the cord circuit. When an ordinary line is tested, that is, a line other than the calling line, no current will flow in the path just described, and relay 58 will not be actuated. If, however, the line tested is the one with which the answering end of the cord circuit is connected, a low resistance circuit is completed from one terminal of the battery 52, through the coil of relay 58, conductor 57, contacts 56 and 54 of relay 55, conductor 53, contacts 47 and 44 of the operator's listening key 42, conductor 45, conductor 30, contacts 29 and 18 of the answering plug and jack, conductor 65, sleeve contact 19 of the multiple jack, tip contact 28 of the calling plug, series contacts 27 of the ringing key, contacts 41 and 46 of operator's listening key 42, and conductor 51, to the other pole of battery 52. The current in this path will actuate the low resistance relay 58, closing its contacts 59 and 60, and thus connecting the tone-producing coil 61 in circuit with the tertiary 63 of the operator's induction coil. In this manner the operator receives a tone only when testing the line of the subscriber with which the answering end of her cord is connected, and the calling subscriber receives the tone only when the operator receives it. After receiving such a test, it is

customary for the operator to instruct the subscriber to replace the receiver upon the switch-hook while the bell of the desired subscriber is rung. The operator may then remove either her answering or her calling cord from the jack of the line which is in use, the current for talking purposes being thereafter supplied through the supervisory relays by means of which one of the supervisory signals 39 or 40 is controlled so that the operator is informed when both subscribers on the line replace their receivers at the termination of the conversation.

While my invention is shown and described with respect to a specific form of cord and line circuit, it is to be understood that I do not wish to be unduly limited thereto, it being possible to apply the principles of my invention to other structures without departing from the spirit or scope thereof.

I claim—

1. In a telephone system, the combination with a telephone line, of answering and multiple jacks therefor, multiplied testing contacts for said jacks, a cord circuit, a common talking battery in permanent bridge of said cord circuit, an answering sleeve strand and a calling test strand for said cord circuit, a relay and a source of current each rendered temporarily individual to said cord circuit and adapted to be connected in series between said sleeve and said test strands during testing, and a special tone circuit closed by the actuation of said relay.

2. In a testing system, the combination with jacks having multiple testing contacts, of a cord circuit having a pair of contacts adapted to be connected with two of said multiple testing contacts, a source of current for supplying busy potential to said multiple contacts of the lines when the lines are busy, an electro-magnet and a second source of current for actuating it connected in a circuit including the two cord circuit contacts and two multiple jack testing contacts, the energization of said electro-magnet effecting a signal for the operator.

3. In a testing system, the combination with a cord circuit, a common battery in bridge of the talking strands of said cord circuit, of a pair of multiplied jack contacts with which the answering and calling ends of said cord circuit may be connected, and a low resistance circuit including a source of current temporarily rendered individual to the cord circuit, an electro-magnet, a contact of the answering end of the cord, two multiplied jack contacts, and a contact of the calling end of the cord, the current from said source in said path actuating said electro-magnet, and a signaling circuit completed by the actuation of said electro-magnet.

4. In a telephone system, the combination with a telephone line, of an answering and a multiple jack for said line at the same operator's position, a cord circuit having contacts to register with the contacts of the answering jack for said line, a test contact for said cord circuit adapted to be connected with the multiple contact for said line, or with the multiple contacts of other lines, a high resistance relay connected with the test contact of the cord circuit during testing and actuated whenever a busy line is tested, an electro-magnet and a source of current connected between the test contact of the answering jack and the test contact of the calling plug by the actuation of said high resistance relay, said electro-magnet being actuated when the test contact of the calling plug is connected with the test contact of said line, but remaining unactuated when the test contact of said plug is connected with the test contact of another line and a special busy signal controlled by said electro-magnet.

5. In a telephone system, the combination with a telephone line, having answering and multiplied jacks at the same operator's position, of a two conductor cord circuit having answering and calling ends for connecting with said jacks, the test contact of the answering jack registering with a talking strand of said cord circuit when the answering plug is inserted into the answering-jack, a test relay, and a tone circuit including the calling subscriber's line completed by contacts of said relay only when the multiple contact of the calling line is tested.

6. In a telephone system, the combination with a telephone line, having multiplied testing contacts connected with one of the voice current conductors of the line when a cord is connected with the line at the central office, of a busy testing circuit at the central office, and means for said circuit to signal the calling subscriber and the operator only when a reverting call is desired.

7. In a telephone cord or connecting circuit, a sleeve contact for the answering end and a test contact for the calling end of said cord circuit, an operator's listening key, a common source of current and a common low resistance relay temporarily associated with the cord circuit and serially connected between the sleeve contact of the answering end and the test contact of the calling end of the cord through contacts of the operator's listening key when the key is actuated, and a signal circuit completed by the actuation of said relay.

8. In a telephone cord or connecting circuit, an answering sleeve contact, a common source of current and an impedance coil connected thereto, a low resistance relay, a low voltage source of current, and a calling

test contact serially connected together during testing to actuate said relay, current from said common source through said impedance coil being insufficient to actuate said relay.

9. In a reverting busy test system, a pair of connecting circuits having their answering ends connected with different lines, a relay for one of said circuits actuated when
10 the calling end of its connecting circuit is connected with a contact of the same line with which the answering end is connected,

but not actuated when connected with a similar contact of the line with which the answering end of the other connecting circuit is connected, and a test circuit completed by said relay. 15

Signed by me at Rochester, county of Monroe, and State of New York, in the presence of two witnesses.

CLIFFORD C. BRADBURY.

Witnesses:

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