C. S. WINSTON.

TELEPHONE TESTING SYSTEM.

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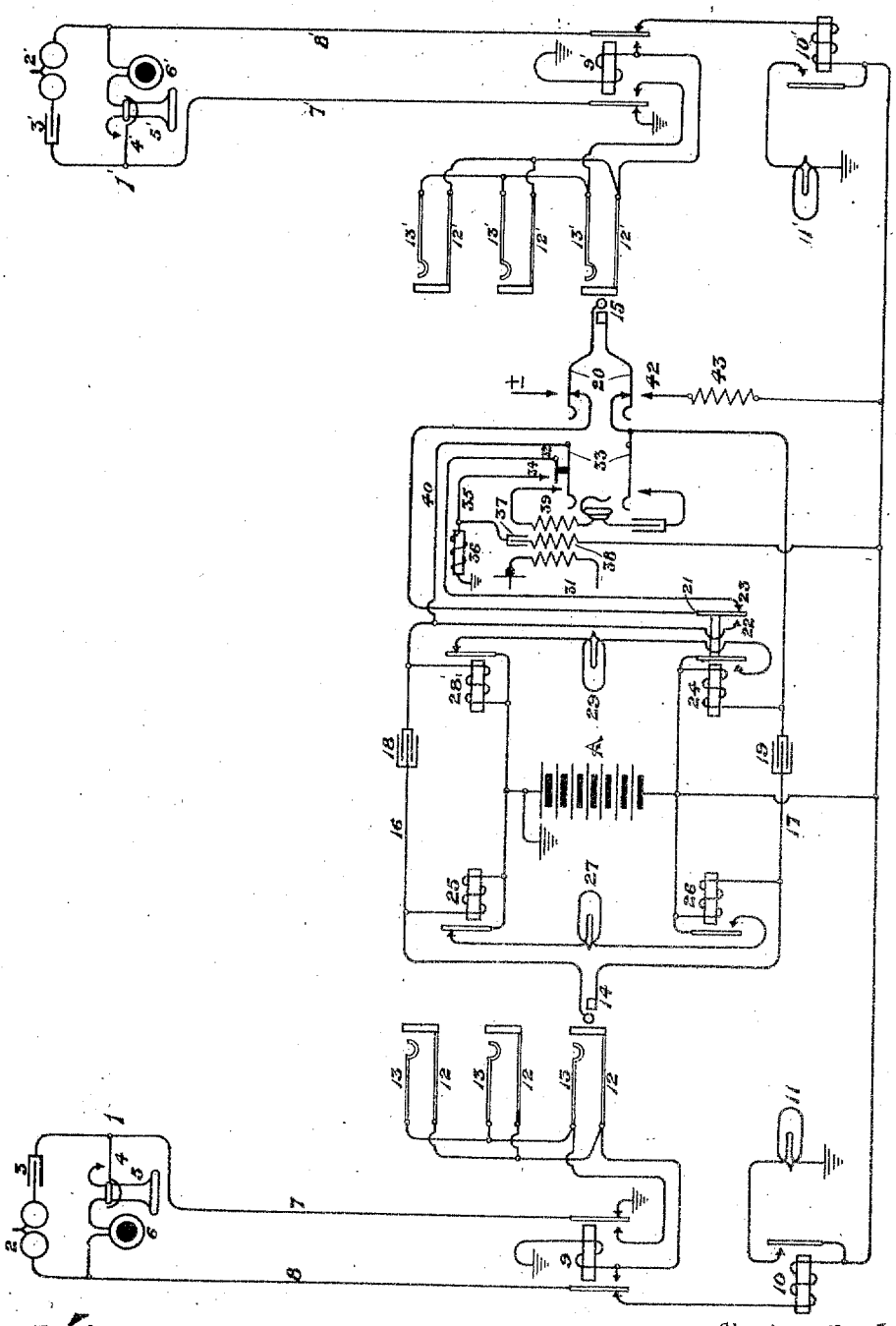
983,966.

Patented Feb. 14, 1911.



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TELEPHONE TESTING SYSTEM.

983,966. Specification of Letters Patent. Patented Feb. 14, 1911.

Application filed May 9, 1907. Serial No. 372,697.

To all whom it may concern:

Be it known that I, CHARLES S. WINSTON, a citizen of the United States, residing in Chicago, county of Cook, and State of Illinois, have invented certain new and useful Improvements in Telephone Testing Systems, of which the following is a specification.

My invention relates to telephone testing systems such as are used at the central office of an exchange for obtaining the idle or busy condition of the telephone lines before completing a conversational connection therewith.

The object of my invention is to simplify and improve systems of this character such that by the use of simple and inexpensive apparatus a positive indication of the condition of the line will be given to the operator in an efficient manner.

My invention is illustrated in the accompanying drawing in which all apparatus is shown in its normal condition.

The calling and called subscribers' stations are represented at the right and left of the drawing, these stations being equipped with similar apparatus at the central office, the apparatus of the called line being designated by figures having the suffix "′". Station 1 is provided with the ringer or annunciator 2, and condenser 3 in a permanent bridge of the line conductors, and with the transmitter 4 and receiver 5 in a bridge normally maintained open by contacts of the hook switch 6. This substation is connected with the central office by line wires 7 and 8, the conductor 7 being connected with the ground pole of battery A through the outside contacts of the cut-off relay 9, the conductor 8 being connected through the other outside contacts of relay 9 and the coil of the line relay 10 with the live pole of battery A. Line relay 10 controls contacts in the circuit of the line signal 11 and battery A. The line is provided with the usual answering and multiple jacks having test contacts 12 and tip contacts 13, the test contacts being connected with one of the inside contacts of cut-off relay 9 and with the coil of that relay, and the tip contacts being connected with the other inside contact of relay 9.

It is to be understood that the apparatus so far described comprises no part of my present invention, and that any other suitable apparatus may be substituted therefor.

The cord circuit adapted for use with this telephone line is provided with the terminal plugs 14 and 15, the tip contacts of these plugs being connected with the tip strand 16 and the sleeve contacts being connected with the sleeve strand 17. The tip and sleeve strands contain respectively condensers 18 and 19 and series contacts of the operator's ringing key 20. The tip strand also contains the normally open contacts 21 and 22 controlled by the sleeve calling supervisory relay 24. The answering end of the cord circuit is provided with the tip and sleeve relays 25 and 26 connected in a bridge of the talking circuit, including the central source of current A, and jointly controlling the circuit of supervisory signal 27. The calling end of the cord circuit is similarly provided with tip and sleeve relays 28 and 24 in a similar bridge of the calling end of the cord circuit, and similarly controlling the circuit of supervisory signal 29.

The tip of the calling plug 15 is normally connected through the tip series contacts of the operator's ringing key 20 with contact 21 of the supervisory relay 24, and thence through the normally closed contact 23 and conductor 31 with the normally disconnected auxiliary spring 32 of the operator's listening key 33. This spring 32 is adapted to make connection with the contact 34 when the key is actuated, this contact being connected through conductor 35 and the high resistance impedance coil 36 to ground. A branch conductor from conductor 35 connects with the condenser 37 and from the other terminal of this condenser through the tertiary winding 38 of the operator's induction coil 39 to the live pole of central battery A.

The upper spring of the operator's listening key is connected through conductor 40 with the tip strand of the cord circuit at a point to the left of the contacts 21 and 22 of the supervisory relay 24, while the lower spring is connected directly to the sleeve strand of the cord circuit. The lower spring of the operator's ringing key 20 is adapted when actuated to connect with contact 42 which connects with the live pole of battery A through the non-inductive resistance 43. The tip spring of this ringing key is adapted to connect with any suitable source of ringing current.

In operation, the subscriber in charge of

substation No. 1 removes his receiver from its hook, thereby completing the circuit of line relay 10 and displaying the line signal 11. The operator thereupon inserts her answering plug 14 in the jack of the called line and in so doing completes the circuit of her supervisory relay 26 from the live pole of battery through the coil of that relay, the sleeve of the plug and jack, and the coil of relay 9 to ground. Relays 26 and 9 are thereby actuated, the actuation of relay 9 completing the circuit of supervisory relay 25 over the telephone line. Relays 25 and 26 now being actuated, the supervisory signal 27 is not displayed. The operator now throws her listening key 33 and inquires the desired number. Finding 1′ to be the substation desired, the operator touches the tip contact of plug 15 to one of the test contacts 12′ associated with the desired line. If the desired line is busy, its test contacts will be in connection with the sleeve contact of another cord circuit and will thereby be at a potential higher than that of earth. Current will therefore flow from the test contact of the jack over the tip of the cord circuit, through the contacts 21 and 23 of supervisory relay 24, over conductor 31, contacts 32 and 34 of the listening key 33, through conductor 35 to the connected terminals of the impedance coil 36 and the condenser 37. The condenser 37 is normally fully charged, one terminal being connected with the earth pole of battery A through the impedance coil 36, and the other terminal being connected through the tertiary winding 38 of the operator's induction coil 39 with the live pole of battery A. Thus, the conductor 35 being connected with a potential higher than that of earth when a busy line is tested, the condenser will be suddenly partially discharged, this discharge sending a momentary impulse through the tertiary winding of the operator's induction coil, which impulse produces in the secondary of the induction coil and in the operator's receiver in series therewith, a similar momentary impulse indicating that the line is busy. By the adjustment of the resistance and impedance of the coil 36, of a capacity of condenser 37 and the resistance of the winding 38 of the operator's induction coil the most desirable volume of test current may be obtained, and it has been found possible to vary this volume between reasonable limits by simply adjusting the coil 36. If the desired line is not busy its test contact will be at the potential of earth and there will therefore be no discharge of condenser 37 when the tip of the cord is connected with the test contact of the line and the operator will receive no signal.

Assuming the desired line to be idle, the operator inserts her calling plug and thereby completes a circuit from the live pole of battery A through the coil of supervisory relay 24 through the sleeve of the plug and jack and the coil of cut-off relay 9′ to ground. This actuates relay 9′ connecting the limbs 7′ and 8′ of the telephone line respectively with contacts 13′ and 12′ of the jacks and also actuates relay 24 which completes the circuit of supervisory signal 29, displaying that signal. The actuation of relay 24 also completes the normally broken tip strand of the cord circuit by closing contacts 21 and 22 and disconnects test conductor 31 by severing contacts 21 and 23. The operator now throws her ringing key and thereby substitutes the non-inductive resistance 43 for the coil of relay 24 and maintains the cut-off relay actuated as before, simultaneously placing ringing current on the tip side of the telephone line. This ringing current passes through the condenser 3′, annunciator 2′, back through the non-inductive resistance 43 and the battery A to earth. When the called subscriber answers his call the circuit is completed through the hook switch 4′ and over the tip of the jack and plug through the coil of supervisory relay 28 to ground. This actuates relay 28 and effaces the supervisory signal 29. The subscribers are now in conversation and all signals at the central office are effaced. When either subscriber terminates the conversation the supervisory signal associated with his line is displayed by the falling back of the tip supervisory relay for his end of the cord circuit. When both supervisory signals 27 and 29 are displayed the operator removes her connecting plugs and the apparatus assumes its normal condition.

It is to be understood that the cord circuit here shown and described is only to illustrate the application of my testing system to an operative telephone system, and that many other forms of central energy cord circuits could be substituted without in any way departing from the spirit or scope of my invention.

What I claim is:

1. In a telephone system, the combination with a telephone connecting circuit, of a source of current, a winding of an induction coil, a condenser and an impedance coil connected in a bridge between the poles of said source, a testing conductor connected to the conductor connecting said condenser and said impedance coil, and a receiver inductively connected with the winding of said induction coil for receiving discharge disturbance from said condenser when a busy line is tested, substantially as described.

2. In a telephone system, the combination with a telephone line having testing contacts at the central office, a testing conductor to connect therewith, a source of current, an

impedance coil connected between a pole of said source and said testing conductor, a condenser and an induction coil winding permanently connected in series between said testing conductor and the other pole of said source, and a test receiving device affected by the change of current in the induction coil winding due to the discharge of said condenser when the test conductor is connected with the test ring of a busy line, substantially as described.

3. In a telephone system, the combination with a telephone line having testing contacts at the central office, a testing conductor to connect therewith, a source of current, an operator's induction coil, a condenser and a winding of said induction coil permanently serially connected between said testing conductor and a pole of said source, an impedance coil connected between the testing conductor and the other pole of said source, a test receiving device in the circuit of another winding of said induction coil actuated by the discharge of said condenser when the test conductor is connected with the test contact of a busy line, substantially as described.

4. A telephone testing system comprising a source of current, an impedance coil, a condenser and a winding of an induction coil in a closed circuit, whereby the condenser is charged, means to complete a circuit in shunt of the condenser and winding of the induction coil when a busy line is tested, whereby the condenser is discharged, a second winding for said induction coil, and a receiver connected therewith to detect the discharge of said condenser, substantially as described.

5. In a telephone system, the combination with a cord circuit having a talking strand, a testing strand connected therewith, a source of current, an impedance coil, a condenser and an induction coil winding in a series circuit with said source, a terminal of said impedance coil and a terminal of said condenser being connected with the test conductor during testing, a test receiving device, and means whereby said testing conductor cannot be connected with the cord circuit during a complete connection, substantially as described.

6. In a telephone system, the combination with a cord circuit having a talking strand, a testing strand normally isolated therefrom, a source of current, an impedance coil, a condenser and an induction coil winding in a series circuit with said source, a terminal of said impedance coil and a terminal of said condenser normally connected with said test conductor, a test receiving device inductively connected with said induction coil winding, means to connect said test conductor with the cord circuit during testing, and means whereby said testing conductor cannot be connected with a talking strand of the cord circuit during a complete connection, substantially as described.

7. In combination with a telephone connecting circuit, a source of current, an impedance coil, a condenser and a winding of an induction coil permanently connected in a series circuit with said source, and a test conductor having one end connected between said condenser and impedance coil, and adapted to be connected with the test contacts of a line during testing, substantially as described.

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

CHARLES S. WINSTON.

Witnesses:
EDITH F. GRIER,
CLIFFORD C. BRADBURY.