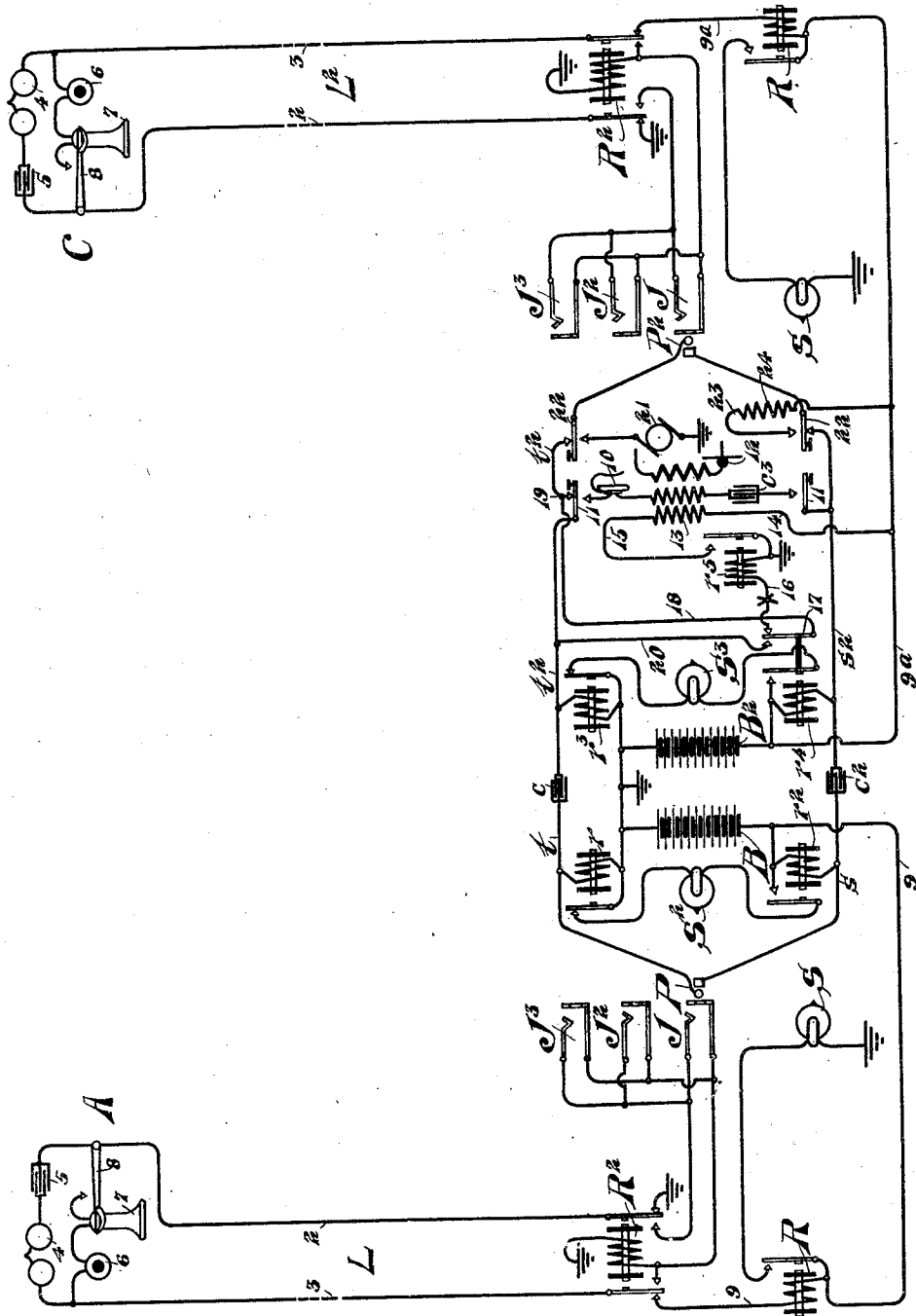


No. 836,489.

PATENTED NOV. 20, 1906.

W. W. DEAN.
TESTING SYSTEM FOR TELEPHONE LINES.
APPLICATION FILED JUNE 29, 1903.



Witnesses.
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TESTING SYSTEM FOR TELEPHONE-LINES.

No. 836,489.

Specification of Letters Patent.

Patented Nov. 20, 1906.

Application filed June 29, 1903. Serial No. 163,617.

To all whom it may concern:

Be it known that I, WILLIAM W. DEAN, a citizen of the United States of America, and a resident of Chicago, county of Cook, and State of Illinois, have invented a new and useful Improvement in Testing Systems for Telephone-Lines, of which the following is a specification.

My invention relates to new and useful improvements in telephone operator's connective means, my object being to provide a simple and convenient system for testing the idle or busy condition of the telephone-lines when it is desired to establish connections therewith.

My invention is illustrated in the accompanying drawing, in which the figure is a diagram of a telephone system embodying my improvements.

In the figure, L and L² indicate two subscribers' lines extending in two limbs 2 and 3 from their respective substations A and C to the central office, where they are fitted with the usual appurtenances, including a line-signal S and a plurality of spring-jacks or connection-terminals, such as J, J², and J³. At the substation a bell 4 and a condenser 5 are included in a permanent bridge of the line conductors, while a transmitter 6 and a receiver 7 are placed in a second bridge that is normally open at the switch-hook 8. This apparatus is intended merely to typify any usual or desired substation outfit. The line conductor 2 is normally grounded, while the line conductor 3 is normally connected with the conductor 9, leading to the live pole of the central common battery B, including the winding of the line-relay R, which controls the local circuit of the line-signal S. The cut-off relay R² is legged to ground from the sleeve-conductor of the jack-section of the line, said relay serving when a connection is established with the line to render the line-signal inoperative.

The operator's cord-circuits, of which only one is fully shown, includes an answering-plug P and a calling-plug P², having tip and sleeve contacts adapted to register with the corresponding contacts of the line. The tip-contacts of said plugs are joined by flexible strands *t* and *t*² and the interposed condenser *c*, while their sleeve-contacts are united by strands *s* and *s*² and the interposed con-

denser *c*². Supervisory relays *r* and *r*² are connected upon opposite sides of the battery B between the strands *t* and *s* of the cord-circuit, while similar relays *r*³ and *r*⁴ are connected upon the opposite sides of the battery B² across the calling end of the cord-circuit. Supervisory signal S² is associated with the answering-plug P and is controlled by the associated supervisory relays, while a similar signal S³ is associated with the calling-plug P² and is controlled by the corresponding relays. The operator's head telephone 10, together with the secondary of her induction-coil and the condenser *c*³, are adapted to be connected across the cord-circuit by means of the springs 11 11, while her transmitter 12 is charged from any suitable source of current. A tertiary winding 13 of said induction-coil is connected upon one side by a conductor 14, leading to the battery-lead 9^a, while upon the other side a wire 15 leads to the forward contact of the high-impedance and high-resistance test-relay *r*⁵. This relay is connected upon one side with ground and upon the other by the conductor 16, leading to a normal contact of spring 17 of supervisory relay *r*⁴, said spring being connected by conductor 18 with the point 19 upon the tip-strand *t*² in advance of the contacts of the listening-key 11. The forward contact of said spring 17 is joined by conductor 20 with the rear portion of strand *t*² of the cord-circuit.

A suitable ringing-generator 21 is adapted to be connected by the tip-spring 22 of a ringing-key with the cord-circuit, while the sleeve-spring of said key when simultaneously depressed connects with the conductor 23, leading to the conductor 9^a and including a suitable resistance 24.

In the operation of the system the subscriber A takes up his receiver, thereby completing a path for current from the battery B over his line and operating his line-signal S. Upon observing the signal the operator connects her cord-circuit with the line and her telephone with the cord-circuit to receive the order. If when testing the condition of the wanted line it is busy, a flow of current takes place over the forward portion of the strand *t*² to point 19, the listening-key being now open, thence by conductor 18, spring 17 of relay *r*⁴, conductor 16, and through the high-

resistance and high-impedance test-relay r^5 to ground. This relay responds to such current and closes the path through tertiary winding of the operator's induction-coil, thereby causing a click in her receiver. If the line is found idle, the calling-plug P^2 is inserted and the subscriber called in the usual manner. The insertion of the plug P^2 operates the supervisory relay r^4 , which closes the path for current through the signal S^3 and also completes a connection between the conductors 18 and 20 around the contacts of the listening-key in the tip-strand t^2 and severs the connection between conductor 18 and the testing device. The operator may thus thereafter connect her head telephone with the cord-circuit without interrupting the path over the tip-strand, since the conductors 20 and 18 are connected together as long as the plug P^2 is connected with the called line. Upon the subscriber's response the tip-relay r^3 is operated and the supervisory signal deenergized. During operation the batteries B and B^2 are sending current out over the corresponding telephone-lines for the operation of the substation-transmitters. At the termination of the conversation the relays r and r^3 are deenergized by the opening of the line-circuits and the supervisory signals are actuated. Upon observing these signals the operator takes down the connection and all parts are restored to normal condition.

What I claim is—

1. In a telephone system, the combination with an operator's connecting cord and plug, of a testing device normally connected with the tip-strand of said cord, and a switch operated during testing to open said strand in the rear of the connection of said device and to place the operator's telephone set in condition to receive impulses from said device, substantially as described.

2. In a telephone system, the combination with a cord-circuit, of a listening-key having normally closed contacts in the testing-strand thereof, and a testing device normally connected with said strand in advance of said contacts, and means whereby the receiving of the busy-test signal depends upon the actuation of said key, substantially as described.

3. In a telephone system, the combination with a cord-circuit, of a listening-key having contacts in the testing-strand thereof, a testing device normally connected with said strand in advance of said contacts, and means whereby the actuation of said key places the testing device in condition to operate and the operator's telephone set in condition to receive signals from said device, substantially as described.

4. In a telephone system, the combination

with a cord-circuit, of a listening-key associated therewith and having contacts in the testing-strand thereof, a supervisory relay normally associated with said strand, a test-relay connected with said strand in advance of said listening-key contacts, the winding of said test-relay being normally in parallel with the winding of said tip supervisory relay, and means whereby the actuation of said listening-key breaks the circuit of said supervisory relay and places the operator's telephone in condition to receive signals from said testing-relay, substantially as described.

5. In a telephone system, the combination with a subscriber's line connective circuit having tip and sleeve talking-strands, of a testing-relay and a supervisory relay normally connected in parallel between the tip-strand of said connective circuit and one pole of a common source of current, of two switches associated with said tip-strand, and means whereby the actuation of one of said switches removes said supervisory relay from the circuit and the actuation of the other of said switches removes said testing-relay from the circuit and replaces said supervisory relay therein, substantially as described.

6. In a telephone system, the combination with a cord-circuit, of a supervisory relay for said cord-circuit, a test-circuit normally completed through the contacts of said relay, and a listening-key having normally closed contacts which complete a shunt-circuit and render said testing-circuit inoperative, substantially as described.

7. In a telephone system, the combination with a cord-circuit, of a supervisory relay associated with said cord-circuit, a test-receiving relay normally in parallel with said supervisory relay, a listening-key actuated to place the operator's telephone in a bridge across the cord-circuit and at the same time to open the circuit of said supervisory relay, and means whereby said supervisory relay may be actuated even though said listening-key is maintained actuated, substantially as described.

8. In a telephone system, the combination with a cord-circuit, of a supervisory relay associated with said cord-circuit, a testing-relay associated with said cord-circuit, a listening-key actuated to place said testing-relay in condition to operate, and means whereby said testing-relay cannot again be operated after a connection has been established with a called line, substantially as described.

Signed by me at Chicago, county of Cook, State of Illinois, this 12th day of June, 1903.

WILLIAM W. DEAN.

Witnesses:

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