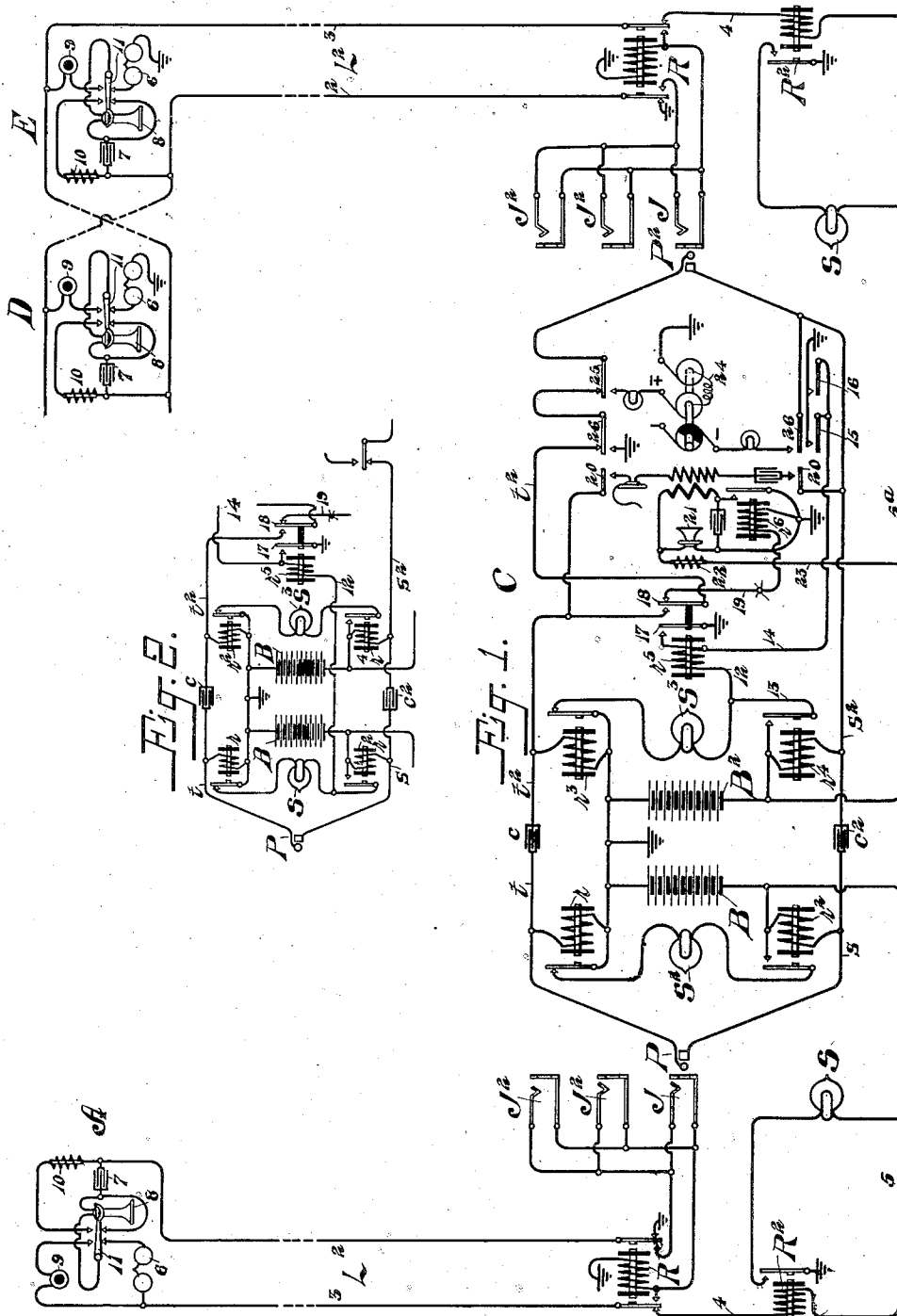


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PATENTED FEB. 26, 1907.

W. W. DEAN.
TELEPHONE SYSTEM.
APPLICATION FILED FEB. 7, 1903.



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TELEPHONE SYSTEM.

No. 845,533.

Specification of Letters Patent.

Patented Feb. 26, 1907.

Application filed February 7, 1903. Serial No. 142,292.

To all whom it may concern:

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

In my Reissue Patent No. 12,090, dated March 3, 1903, I have shown and described a telephone system in which the cord-circuit is provided with a relay actuated over a portion of the talking-circuit for disconnecting or severing the testing-circuit and for placing the metallic line in condition for conversation.

The present invention relates to the same general system; but for the purpose of controlling the testing-circuit and the talking-circuit I provide an auxiliary relay which is preferably initially operated by means of extra contacts provided upon the ringing-key.

The invention further contemplates locking said auxiliary relay after the operation of the ringing-key and to provide the same with operating-current through the closed contacts of a supervisory relay that is actuated over a portion of the talking-circuit during an established connection. This arrangement results in maintaining said auxiliary relay actuated during the connection and after the called subscriber has been called.

My invention is illustrated in the accompanying drawings, in which the same reference characters are used throughout to indicate like parts, and in which—

Figure 1 is a diagram of two subscribers' lines and the central-office apparatus by which they may be connected for conversation, and Fig. 2 is a diagram showing a modified form or arrangement of the actuating-circuit of the auxiliary relay.

Referring to Fig. 1, L and L² indicate subscribers' lines extending in two limbs 2 and 3 from their respective substations to the central office, at which latter point they are provided with answering-jacks J and with any suitable number of multiple jacks J³, normally disconnected from the external line-circuit, but adapted to be connected therewith during conversation by means of the forward contacts of the cut-off relays R, which are legged to ground from the sleeve-conduc-

tors of the switchboard-sections of the lines. The line conductor 2 is normally grounded or connected with a common return at the central office; while the conductor 3 is normally joined through a contact of said cut-off relay R with the conductor 4, leading to the line-relay R², which controls through its normally open contacts the circuit of the line-signal S, which is preferably in the form of a small incandescent lamp, said relay R² being thence connected by conductor 5 with the live pole of a grounded battery B. The line L² is shown as of the polystation type and is provided at the central office with apparatus similar to that of the line L and is connected by means of conductor 5^a to the live pole of a second battery B². The substation apparatus is of the same type as is shown in my Patent No. 747,331, dated December 15, 1903, and consists, generally speaking, of a bell 6, normally in circuit with a condenser 7 in the path of ringing-current, and a receiver 8, transmitter 9, and retardation-coil 10, adapted to be suitably connected in the circuit by the switch-hook 11 when the receiver is taken up and the call-bell branch broken. At the two stations upon the line L² the bells are legged to ground from the opposite sides of the line, while at station A the bell is connected in the metallic line. The operator's equipment includes a cord-circuit provided with an answering-plug P and a calling-plug P², each having tip and sleeve contacts adapted to register with the corresponding contacts of the spring-jacks of the lines. The tip-contacts of the plugs are joined by the strands *t* and *t*² and the interposed condenser *c*, while the sleeve-contacts are electrically connected by the flexible strands *s* and *s*² and the interposed condenser *c*². The battery B is bridged across the answering end of the cord-circuit and includes upon either side supervisory relays *r* and *r*², which control, the former through its normally closed contacts and the latter through its normally open contacts, the local circuit of the supervisory lamp or signal S³, associated with the answering-plug. The battery B² is similarly connected with the calling end of the cord-circuit and contains in its path the relays *r*³ and *r*⁴, controlling the local circuit of the supervisory lamp S², associated with the calling-plug. An auxiliary relay *r*⁵ has its winding upon

one side joined by conductor 12 with the conductor 13, leading to one of the normally open contacts of the sleeve-relay r^4 , while upon its other side said relay is connected by a branch 5 14 with the contacts 15 and 16 of the ringing-key, which are adapted when actuated to ground the said branch 14. Said relay is provided with a contact 17, adapted to close a locking-circuit for said relay, and with a 10 second contact 18, adapted normally to open the tip-strand t^2 of the cord-circuit and to close the forward portion thereof upon the conductor 19, which leads to the high-impedance and high-resistance test-relay r^6 , the 15 opposite terminal of which is grounded. The operator's head-telephone is adapted to be bridged across the calling end of the cord-circuit by the springs 20 20 of the listening-key while her transmitter 21 is preferably charged 20 from the battery B^2 through the retardation-coil 22, included in conductor 23. The primary winding of the operator's induction-coil together with a condenser are in shunt of the transmitter, and a point upon said shunt 25 between the condenser and primary winding is connected with the forward contact of said test-relay r^6 , the armature of which is grounded. The ringing-generator 24 is adapted to be connected between the ground 30 and the tip side of the line by the ringing-key springs 25 25 and between ground and the sleeve side of the line by the operation of spring 26 26.

The operation is as follows: The subscriber 35 at the station A in taking up his receiver to call the central office closes a path for current from the battery B, located at the central office over the telephone-line and through the line-relay R^2 , thus actuating the line-signal S. Upon observing this signal the operator 40 inserts the answering-plug P of an idle cord-circuit into the answering-jack J of the calling-line and depresses her listening-key 20 to receive the order of the subscriber. 45 The act of making the connection closes a path for current through the cut-off relay R from the battery B, which actuates said relay to cut off the line-relay and to connect the switch-board section of the line with the 50 external line-circuit. The sleeve supervisory relay r^2 is also actuated at this time to close a local circuit of the supervisory signal S^2 ; but owing to the fact that the subscriber's telephone is in use the tip supervisory relay r receives current over the metallic line from 55 said battery B and is actuated to open the circuit of the supervisory lamp, which therefore remains inert. Ascertaining that it is a subscriber located upon the line L^2 who is 60 wanted, the condition of the line is tested in the usual manner by touching the tip of the calling-plug to the test contact or ring of one of the multiple jacks of the said line. Normally these test contacts or rings are ground- 65 ed, and since the tip-contact of the plug P^2 is

also normally grounded through the spring 18 of auxiliary relay r^5 , conductor 19, and the test-relay r^6 no flow of current results and no busy click is received. When the line is connected for conversation; however, the test-rings are connected through the sleeve-strand of the connected cord-circuit with the live pole of a battery, and when the grounded tip of the plug is brought into contact there-with a sufficient flow of current results to actuate said test-relay and permit a flow of current through the operator's induction-coil. This causes a click in the operator's receiver and indicates to her that the line is busy. Assuming that the line is found idle, the calling-plug is inserted in one of the multiple 80 jacks and the proper set of ringing-key contacts operated. In case the subscriber A is wanted springs 25 and 16 of the ringing-key are depressed, which connects the generator 85 24 with the tip side of the line and calls the wanted subscriber. Closing the spring 16 upon its ground-contact completes a path for current through the auxiliary relay r^5 from the live pole of the battery B^2 through the 90 normally open contacts of the sleeve supervisory relay r^4 , which is now actuated over the sleeve-strand s^2 of the cord-circuit and through the cut-off relay R of the line and thence over conductors 13 and 12, through 95 said relay r^5 , conductor 14, and spring 16 to ground. As soon as this relay operates its locking-circuit is closed through contact 17, which serves to prevent demagnetizing the same as long as the sleeve-relay r^4 is magnetized. At the same time spring 18 of said relay disconnects the test-relay and completes the strand t^2 for talking. If the subscriber D 100 is wanted, the ringing-springs 26 and 15 of the operator's ringing-key are depressed, with the result that the ringing-generator 24 is connected with the sleeve side of the line and calls the wanted subscriber. It is desired to maintain the relay r^4 and a cut-off relay R actuated during ringing, so that the 110 relative resistances of these parts are suitably proportioned to permit of this action during the period of sending the ringing-current. The resistance of the relays r^4 and of the cut-off relay R should be sufficient to prevent short-circuiting the ringing-current, and 115 owing to the pulsating nature of said current they will be maintained actuated. By means of the spring 15 the initial operation of said auxiliary relay is secured and which 120 is afterward locked, as before described. After calling the subscriber, but before his response, the lamp S^2 is lighted by current from the battery B^2 ; but as soon as he takes up his receiver current over the metallic line 125 actuates the tip-relay r^3 to render said signal inert. At the termination of the conversation the subscribers return their receivers to the hooks, thus deenergizing relays r and r^3 , thereby closing the circuits of the super- 130

visory signals, which are lighted to indicate the fact to the operator that conversation has ceased. Upon observing these signals the operator withdraws the plugs and takes down the connection, thus restoring all parts to normal condition.

In Fig. 2 the conductor 12 leads from the relay r^2 to the normally open spring-contact of the answering-sleeve relay r^2 , whereby when said sleeve-relay is actuated current is derived from the battery B to actuate said auxiliary relay. Otherwise the connections are the same as in Fig. 1. This arrangement permits of the use of ringing-keys that open the sleeve-strand s^2 of the cord-circuit during ringing without affecting the operation of said auxiliary relay. It is attended with the disadvantage that when the calling subscriber wishes a second connection with a different party it is necessary for the operator to first withdraw the answering-plug from the calling-line before the second line can be tested. In Fig. 1 the latter objection does not exist.

While I have described two forms of the invention and which have been worked out for commercial purposes, I do not intend in all respects to thus limit the invention, since it is obvious that the same may be embodied in various forms. For example, the test-relay r^2 may obviously be replaced by any other test-receiving device and the impedance and resistance devices may be entirely separate from the test-responsive device. The operator's receiver may be connected in a common portion of the testing-circuit or in any other suitable manner to receive the busy test.

I claim—

1. In a telephone system, the combination with a telephone-line having a plurality of testing-contacts, of a cord-circuit, a relay associated therewith to control the continuity of the portion of the testing-circuit associated with the cord-circuit, said relay being initially actuated over a local circuit independent of the talking-circuit and a supervisory relay associated with the cord-circuit and adapted to control the circuit of said first-mentioned relay.

2. The combination with telephone-lines having testing-contacts, of a cord-circuit, testing apparatus comprising a testing-termi-

nal to cooperate with said testing-contacts, a testing-conductor connected with said test-terminal, a relay to control said testing apparatus, means to actuate said relay in calling the wanted subscriber, and further means including a supervisory relay to prevent its deenergization throughout the remainder of the connection, substantially as described.

3. In a telephone system, the combination with a telephone-line, of a cord-circuit to establish connections with the line for conversation, a busy-testing circuit completed over a portion of the talking-circuit, said testing-circuit being common to a plurality of cord-circuits, means for removing said testing-circuit during conversation, a supervisory relay for controlling said means, said means being actuated over a circuit independent of the talking-circuit, substantially as described.

4. In a telephone system, the combination with a telephone-line, of a cord-circuit, a testing-circuit completed over the tip-strand of the cord-circuit, a common testing device included in said testing-circuit, a relay to sever said common portion of the testing-circuit from the tip-strand of the cord-circuit, said relay being actuated over a circuit independent of the talking-circuit, the supervisory relay associated with the cord-circuit and adapted to control the circuit through said first-mentioned relay, substantially as described.

5. In a telephone system, the combination with a telephone-line, of a cord-circuit, a testing-circuit completed over one of the strands of the cord-circuit, said testing-circuit having a portion common to a plurality of cord-circuits, a relay for removing said common portion during conversation, means for initially operating said relay during ringing, a locking-circuit for said relay to maintain the same actuated during the remainder of a connection, and a supervisory relay for controlling said locking-circuit, substantially as described.

Signed by me at Chicago, county of Cook, State of Illinois, this 29th day of January, 1903.

WILLIAM W. DEAN.

Witnesses:

ROBERT LEWIS AMES,
GAZELLE BEDER.