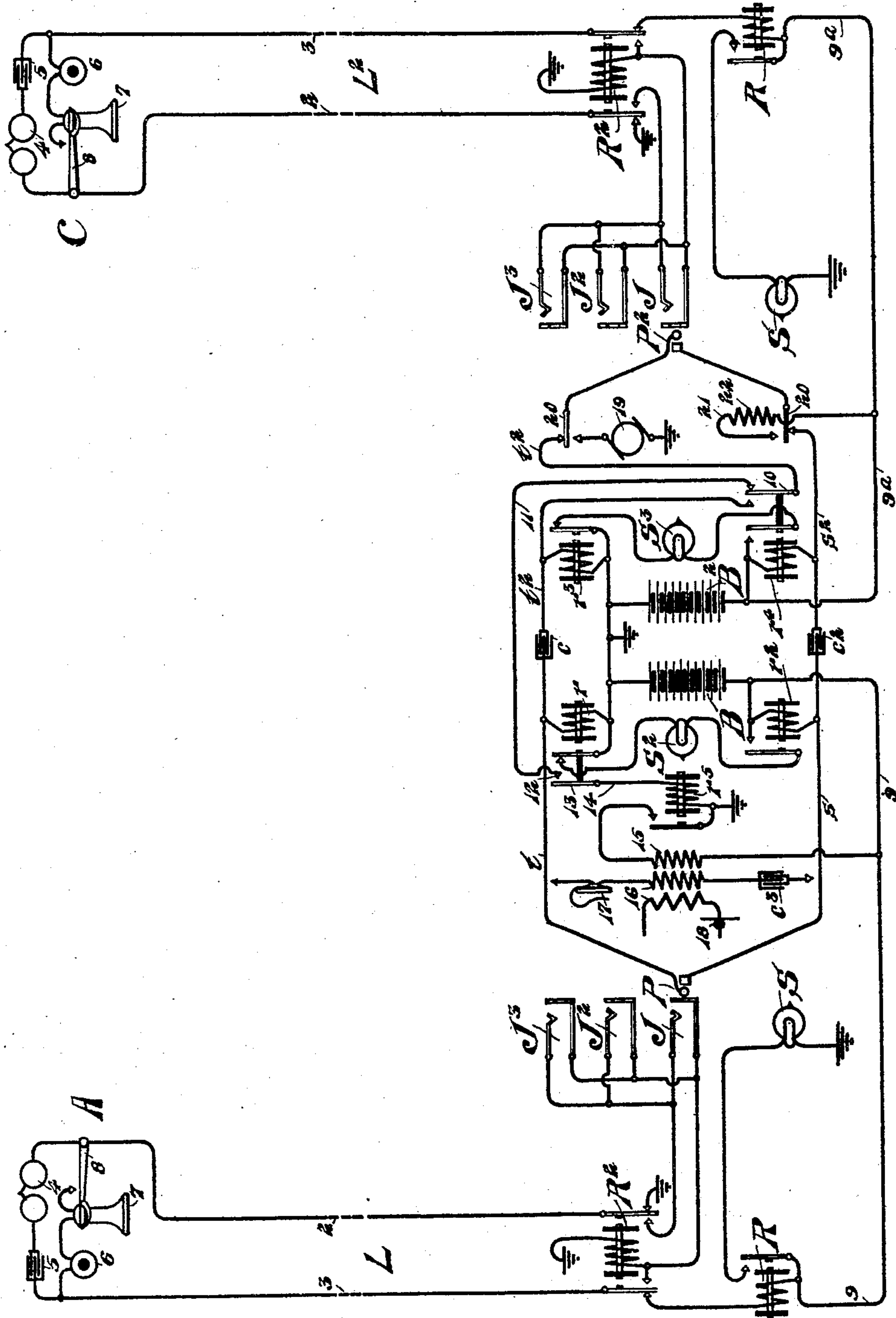


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 TESTING SYSTEM FOR TELEPHONE LINES,
 APPLICATION FILED JUNE 29, 1903.

907,751.

Patented Dec. 29, 1908.



Witnesses.
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UNITED STATES PATENT OFFICE.

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TESTING SYSTEM FOR TELEPHONE-LINES.

No. 907,751.

Specification of Letters Patent.

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To all whom it may concern:

Be it known that I, WILLIAM W. DEAN, a citizen of the United States of America, and 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 improvements in testing systems for telephone lines.

In my Reissue Patent No. 12,090, dated March 3rd, 1903, I have shown and described a testing system in which the test relay is normally connected with the testing strand of the cord circuit, said relay being common to all of the cord circuits at each operator's position and therefore normally connected with all of said cord circuits.

In my present invention I prefer to isolate the common portion of the testing circuit from the cord circuits, so that in case of the short circuiting of one of said cord circuits, or if there is general leakage in all of the switchboard cords in some particular operator's position, the said test relay or other device in the common portion of the cord circuit is not operated and the whole position thrown out of use. It has been proposed to normally isolate the said common portion of the testing circuit through contacts of the listening key. In my present invention I propose to accomplish said isolation through contacts of a relay associated with the cord circuit and preferably through one of the supervisory relays associated with the answering end thereof, whereby when a connection is established with the calling line by means of a cord circuit the said test relay is suitably connected with the calling plug of said cord circuit for the purpose of testing.

My invention is illustrated in the accompanying drawing in which the same reference characters are used throughout to designate like parts, and in which is shown a diagram of a telephone system embodying one form of my improvement.

Referring to the figure, L and L² indicate two subscribers' lines extending in two limbs 2 and 3 from their respective substations A and B to the central office. At each substation a call 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 included in a second bridge

whose normal discontinuity is maintained by the switch-hook 8.

At the central office each line is fitted as usual with a line signal S, an answering jack J, and a plurality of multiple jacks J² and J³. The line conductor 2 is normally grounded but is adapted during conversation to be connected with the tip conductor of the jack section of the line, while the sleeve conductor 3 of the telephone line is normally connected with common conductor 9 or 9^a extending to the live pole of the battery B or B² and including the winding of the line relay R which controls the local circuit of the line signal S, said line conductor 3 being connected with the sleeve side of the jack section of the line during conversation. The cut-off relay R² has its winding connected to ground from the sleeve conductor of the jack section of the line.

The operator's cord circuit comprises an answering plug P and a calling plug P² having tip and sleeve contacts adapted to register with the corresponding contacts of the spring jacks of the lines when the plug is inserted therein. The tip contacts of said plugs are joined by the flexible strands *t* and *t*² and the interposed condenser *c*, while the sleeve contacts of said plugs are connected together by the similar strands *s* and *s*² and the interposed condenser *c*². The supervisory relays *r* and *r*² together with the battery B are bridged across the answering end of the cord circuit and control the local circuit of the supervisory signal S², while similar relays *r*³ and *r*⁴ are together with the battery B² bridged across the calling end of the cord circuit and control the local circuit of the supervisory lamp S³. The tip strand *t*² of the cord circuit is normally open at contacts of said relay *r*⁴ and the forward portion of said strand is normally connected by the movable contact 10 of said relay *r*⁴ with the conductor 11 leading to the forward contact 12 of the tip supervisory relay *r*. The coöperating movable contact 13 of the latter relay is joined by the conductor 14 with the high resistance and high impedance test relay *r*⁵, whose opposite terminal is grounded, this relay being adapted when operated to close the local circuit through the tertiary winding of the operator's induction coil 16 from the battery B.

The operator's head telephone 17, the sec-

ondary of her induction coil 16, and the condenser c^3 are adapted to be bridged across the answering end of the cord circuit by means of any suitable listening key, while her transmitter 18 and the primary winding of her induction coil are charged from any suitable source of current and which may be the battery B or B^2 . A suitable ringing generator 19 is adapted to be connected with the tip strand t^2 of the cord circuit by the operation of the tip spring 20 of the ringing key, the sleeve spring 20 of said key being simultaneously operated so as to connect the sleeve strand through conductor 21 including resistance 22 with the live pole of battery B^2 .

Under these conditions it is obvious that the test relay r^5 is normally isolated through contacts of the tip supervisory relay r from the cord circuit so that in case any of said circuits become deranged said relay is not operated thereby, but is ready to respond whenever a cord circuit that is in working condition is used.

In the operation of the system, the subscriber A calls by taking up his receiver, thereby completing a path for current from the battery B over his telephone line and operating the line relay R to close the local circuit of the line signal S. Upon observing this signal the operator inserts the calling plug P of her cord circuit in the answering jack of the calling line and connects her head telephone with the cord circuit to receive the order from the subscriber. The insertion of the calling plug P completes a path for current from the battery B over the sleeve strand s of the cord circuit and through the cut-off relay R^2 of the telephone line to ground. This cut-off relay is therefore operated to sever the normal connections of said line conductors and to connect them with the switchboard section of the telephone line. Since the subscriber's receiver is off its hook current from the battery B flows over the metallic telephone line and through the supervisory relay r in the cord circuit, thereby operating the latter and connecting the test relay r^5 through its contacts 12 and 13 with the forward portion of the tip strand t^2 of the cord circuit ready for testing. At the same time the local circuit of the supervisory lamp S^2 is opened by said relay r and the lamp remains unlighted. If the called line is idle the test rings thereof are connected with ground and since the tip of the plug P^2 is likewise grounded through the test relay, no flow of current results; but if the said line is busy its test rings are connected with battery B or B^2 and a flow of current through said test relay results. The test relay thereupon closes the local circuit through the tertiary winding of the operator's induction coil and she receives a click in her receiver to indicate that the line is busy. Assuming that the line is found idle, the operator in-

serts the calling plug P^2 in one of the multiple jacks of the telephone line with the result that the supervisory relay r^4 is operated to disconnect said test relay r^5 from the cord circuit and to complete the cord strand t^2 , the cut-off relay R^2 of the called line being simultaneously operated to place the called line in condition for conversation and to prevent the line signal from operating. The ringing generator 19 is then connected with the cord circuit by the depression of the springs 20, 20 of the ringing key, the cut-off relay being maintained operated during ringing by current from the battery B^2 over conductors 9^a and 21. After the subscriber has been called, but before his response, the supervisory signal S^3 is lighted, but upon his response the tip supervisory relay r^3 is energized by current from the battery B^2 over the telephone line and said signal is rendered inert. During conversation the batteries B and B^2 furnish current to the substation for the operation of the transmitters. The operator's set can now be connected with the cord circuit to converse with either subscriber without connecting the test relay therewith. At the termination of the conversation the receivers are returned to their hooks and the circuits of the relays r and r^3 opened. The local circuits of the supervisory lamps S^2 and S^3 are therefore closed. These indicate to the operator that the conversation is finished, when she takes down the connection and restores all parts to normal condition. The test relay is thus connected with the cord circuit only during the time that the calling plug is connected with the calling line and the calling plug is not connected with the called line. In case of leakage at the operator's position or the short circuiting of the strands of the cord circuits while not in use, the test relay is not operated and the operator's position is not thus thrown out of use by such accidental derangement of some of the cord circuits, the ordinary operation being carried out with those cord circuits that are in proper working condition.

Obviously certain modifications of the system here shown and described may be made without departing from the spirit or scope of my invention and it is to be understood that, though I have shown my invention in a specific form, I do not wish to be unduly limited thereto.

I claim:

1. In a telephone testing system, the combination with a plurality of cord circuits, of a test responsive device common to said cord circuits, said device being normally isolated from said cord circuits through contacts of the answering supervisory relay actuated over the telephone line, substantially as described.

2. In a telephone testing system, the com-

5 bination with a plurality of cord circuits, of a test responsive device common to said cord circuits, supervisory relays associated with the cord circuits, said responsive device having its circuit controlled through contacts of one of said relays under control of the calling subscriber, and another of said relays under control of the operator, substantially as described.

10 3. In a telephone testing system, the combination with a plurality of telephone lines, of a plurality of cord circuits to establish connections therewith for conversation, a central source of common current associated
15 with said cord circuits and adapted to be included in the telephone lines during connections to furnish current for conversation, a testing conductor common to said cord circuits but normally disconnected therefrom,
20 means associated with the answering ends of the cord circuits and under control of the calling subscribers for automatically connecting said conductor with any of said cord circuits for the purpose of making a busy
25 test, and means associated with the calling ends of said cord circuits for disconnecting the testing conductor without disconnecting the operator's listening set, substantially as described.

30 4. In a telephone testing system, the combination with a plurality of cord circuits, of a testing conductor common to said cord circuits but normally disconnected therefrom, and means energized over the calling tele-
35 phone line to actuate contacts in the circuit of said conductor thereby connecting said conductor with any of said cord circuits, substantially as described.

40 5. In a telephone testing system, the combination with a plurality of telephone lines, of a plurality of cord circuits to establish connections therefor for conversation, a central source of common current associated with said cord circuits and adapted to be in-
45 cluded in the telephone lines during connections to furnish current for conversation, a testing conductor common to said cord circuits but normally disconnected therefrom, and electro-magnetic means associated with

each cord circuit and energized over the call- 50 ing telephone line and actuating contacts in the circuit of said conductor for connecting said conductor with the corresponding cord circuit when a connection is established there-
55 by with a called subscriber's line, substantially as described.

6. In a telephone testing system, the combination with a plurality of telephone lines, of a plurality of cord circuits to establish connections for conversation with said lines, 60 supervisory relays associated with said cord circuits to efface the calling supervisory signals, a testing conductor common to said cord circuits normally isolated therefrom and from the operator's communicating set, and 65 means for automatically connecting said conductor with any of the cord circuits through the medium of said supervisory relays, substantially as described.

7. In a telephone testing system, the com- 70 bination with telephone lines, of a cord circuit, a testing device therefor, an electromagnetic winding energized over a calling telephone line when a connection is estab-
75 lished therewith to connect said testing device with the tip of the calling plug, and a second electromagnetic winding to disconnect said device therefrom when the cord circuit is connected with the called subscriber's line, substantially as described. 80

8. In a telephone testing system, the combination with a cord circuit, of tip and sleeve supervisory relays at each end of said cord circuit, a testing device normally isolated from the cord circuit by contacts of the tip 85 supervisory relay of the answering end of the cord circuit and adapted to be isolated from the cord circuit during conversation by the actuation of the sleeve supervisory relay associated with the calling end of the cord cir- 90 cuit, 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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EVA A. GARLOCK.