

H. C. GOLDRICK.
TELEPHONE TESTING SYSTEM.
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911,231.

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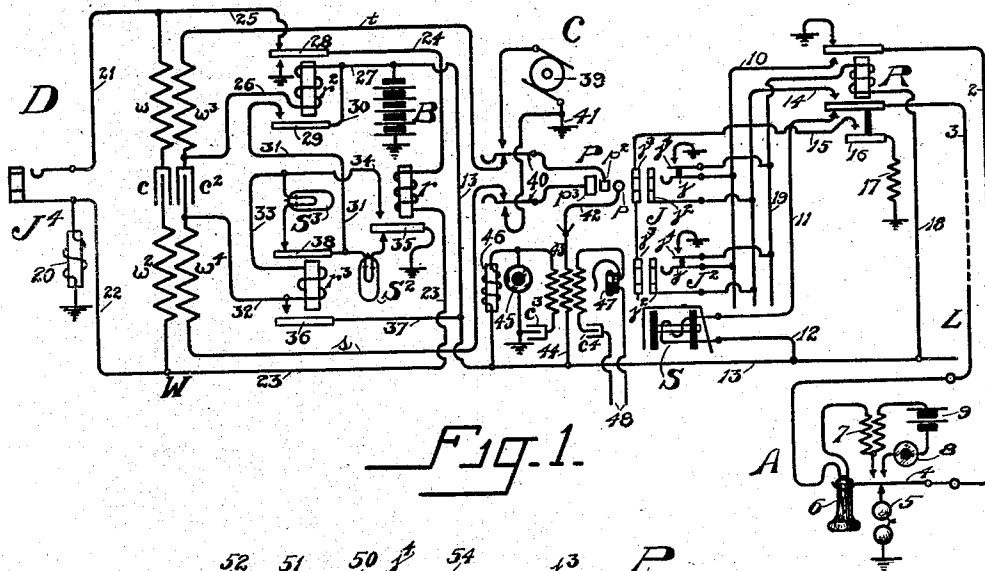


Fig. 1.

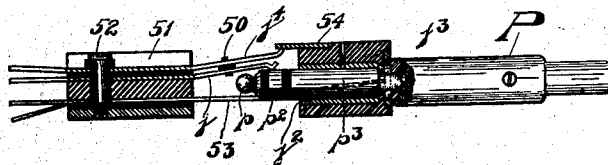


Fig. 2.

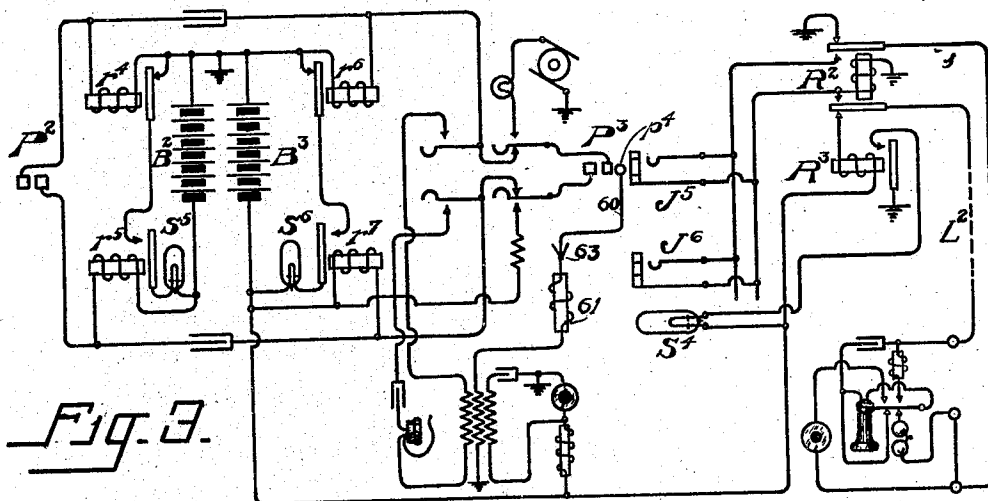


Fig. 3.

Witnesses.
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UNITED STATES PATENT OFFICE.

HARRY C. GOLDRICK, OF INDIANAPOLIS, INDIANA, ASSIGNOR TO KELLOGG SWITCHBOARD & SUPPLY COMPANY, OF CHICAGO, ILLINOIS, A CORPORATION OF ILLINOIS.

TELEPHONE-TESTING SYSTEM.

No. 911,231.

Specification of Letters Patent.

Patented Feb. 2, 1909.

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To all whom it may concern:

Be it known that I, HARRY C. GOLDRICK, a citizen of the United States, residing in Indianapolis, county of Marion, and State of Indiana, have invented certain new and useful Improvements in Telephone-Testing Systems, of which the following is a specification.

In the present application I have disclosed a testing system for telephone lines, which in the form that I prefer to use includes a tip contact upon the testing plug of the operator's connective circuit which is insulated from the talking contacts thereof, and which is connected by a separate conductor with the apparatus by which the test is made known to the operator.

It is usual to employ one of the talking contacts of the connecting plug and a portion of one of the talking strands for busy testing purposes but in my arrangement the testing contact and strand are entirely separate from the talking circuit whereby the apparatus may be simplified and the testing operations carried out in a simple and efficient manner.

The preferred form of my invention is illustrated in the accompanying drawing in which:

Figure 1 is a diagram of a telephone trunk circuit and subscriber's line with which the incoming end of the trunk is adapted to cooperate; Fig. 2 is a detailed view of a springjack and the inserted testing plug, the jack being of the form shown in Fig. 1 as connected with the subscriber's line, and Fig. 3 is a diagram of an operator's cord circuit and a subscriber's line circuit, the latter being of the so-called 2-wire type in which the test rings of the springjacks of the lines are connected with the talking circuit during conversation.

Referring to Fig. 1, the subscriber's line L extends in two limbs 2 and 3 from the subscriber's station A to the central office C where the line is provided with a plurality of springjacks such as J and J² in the multiple switchboard. At the subscriber's station the usual switch hook 4 is arranged to normally connect the call bell 5 between the tip line conductor 2 and ground and when the receiver 6 is removed therefrom to disconnect said bell and connect said receiver and the secondary winding of the induction coil 7 in series between the line conductors 2 and 3.

At the same time the local circuit for the transmitter 8, the local battery 9 and the primary winding of the induction coil 7 is completed. At the central office the line conductor 2 is normally grounded but upon the actuation of the cut-off relay R the said line is disconnected therefrom and connected with the conductor 10 leading to the tip contact *j* of the springjacks J, J², etc. The line conductor 3 is normally connected by means of conductor 11 with the line signal S, whose other terminal is joined by a conductor 12 with a common lead 13 extending from the live pole of the central common battery B. When said cut-off relay R is energized the line conductor 3 is disconnected from the conductor 11 and connected with the conductor 14 leading to the sleeve contacts *j*² of the springjacks. The test rings *j*³ of the springjacks are connected together and thence by wire 15 with the forward contact of a third spring 16 of the cut-off relay R, which spring is in turn grounded through a suitable resistance 17. The cut-off relay R is connected upon one side by conductor 18 with the battery lead 13 and upon the other side by wire 19 leading to auxiliary springs *j*⁴ of the springjack which are thrown into connection with ground contacts when connecting plugs are inserted in the jacks. The trunk circuit shown in this figure is provided at the outgoing end, which is located at a different switchboard section or office D, with a springjack J⁴ and a retardation coil 20 legged to ground from the sleeve contact of the jack.

At the office C the tip and sleeve sides 21 and 22, respectively, of the trunk, are joined together by the windings *w* and *w*² of the repeating coil W and an interposed condenser *c*. The conductor 22 is extended by conductor 23 to one terminal of the trunk relay *r* and whose other terminal is joined by conductor 24 with a spring 28 of a relay *r*² which may be termed the "tip relay", and the normal contact of which spring is connected by a wire 25 with the tip conductor 21 of the trunk. The trunk at this end of the office is provided with a flexible strand of which the conductors *t* and *s* lead to separate contacts upon the connecting plug P which is adapted to be inserted in the jack J or J². The opposite ends of these strands or flexible conductors are joined through windings *w*³ and *w*⁴ of the repeating coil W and a suitable con-

denser c^2 . The tip relay is joined upon one side by conductor 26 with the tip trunk cord strand between the coil w^3 and the condenser c^2 and upon the other side by conductor 27 with the live pole of the battery B. The forward contact of spring 28 of said relay r^2 is grounded while its spring 29 is connected by conductor 30 with said conductor 27, the forward contact of which is joined by conductor 31 with one side of the disconnect signal S^2 , preferably in the form of a small incandescent lamp. A relay r^3 , which for convenience is called the "sleeve relay," is joined upon one side by conductor 32 with the sleeve strand of the cord s between the winding w^4 and condenser c^2 and upon the other side by conductor 33 with one terminal of the ringing signal S^3 , also in the form of a small incandescent lamp, and thence by conductor 34 to the forward contact of grounded spring 35 of the trunk relay r . This sleeve relay r^3 is provided with a spring 36 connected by conductor 37 with the battery lead 13 and adapted to close upon a forward contact which is connected with one terminal of the winding of said relay. A second spring 38 is connected with conductor 31 and with one terminal of the disconnect signal S^2 and its normal or back contact is joined to the second terminal of the ringing signal S^3 . A ringing generator 39 is adapted to be connected with the talking contacts p^2 and p^3 of the plug P through the medium of the ringing key springs 40, one pole of said generator being grounded at 41. For testing purposes a tip contact p of said plug P is connected by means of a flexible strand 42 with the tertiary winding of the operator's induction coil 43 and thence by conductor 44 with the battery lead 13. The operator's transmitter 45, retardation coil 46, condenser c^3 and the secondary winding of her induction coil, partake of the usual arrangement, her head receiver 47 and a suitable condenser c^4 and the secondary of her induction coil likewise being arranged in the usual manner and connected with order wires 48 leading to the opposite end of the trunk as is customary.

I have not shown the cord circuit or the subscribers' lines at the office D but the type of circuit and subscriber's line shown in Fig. 3 are adapted to be used with the trunk of Fig. 1. This trunk is adapted for the usual method of operation; that is, a call being received at the office D for a subscriber whose line terminates at the office C, the operator at the former office depresses her order key and informs the operator at the office C of the connection desired. The operator at the latter office nominates the trunk to be used and immediately tests the condition of the wanted line. If the line is found idle the calling plug is inserted in the jack of the line and the ringing generator operated to call the

said subscriber. If found busy, however, the operator at the D office and the calling subscriber are informed that the line is busy. This testing operation is expeditiously carried out by touching the tip of the plug P to one of the test rings j^3 of the springjack of the wanted line that appears upon her section of the board. If idle it will be noted that the test rings are isolated from ground or other connections but when the line is busy the cut-off relay R is operated and the test rings are connected to ground. The touching of the tip of the plug to an idle line, therefore, produces no click in the operator's receiver, since a complete circuit is not established, but in case the line is busy a complete circuit is established from the live pole of the battery B over conductors 13 and 44, the tertiary winding of the operator's induction coil 43, conductor 42, tip p of the plug, test ring j^3 of the jack, conductor 15, spring 16 of the relay R, and thence through the resistance coil 17 to ground. The current in this path inductively causes a click in the operator's receiver and she is thus informed that the line is busy. Assuming that the line is found idle the testing plug is inserted in the springjack, the contacts p^2 and p^3 of the plug engaging the corresponding contacts j and j^2 of the springjack. The tip contact of the plug, however, does not engage any of the contacts of the springjack and therefore is entirely insulated and isolated during conversation. This arrangement is more fully indicated in Fig. 2 in which the jack springs j and j^2 are shown as being insulated by the stud 50 and secured in position upon the support 51 by a suitable screw 52. The jack ring j^2 is connected with the same support by an intervening strip of metal 53. The plate 54 is connected with ground and is represented in the diagram by the grounded back contacts of springs j^4 . The test rings j^3 are larger than the contacts of the plugs and in addition the sleeve of the plug at this point is grooved, so that said rings do not touch the sleeve of the plug when the latter is inserted in the jack. This ring is connected by the wire or metallic strip shown in dotted lines leading to the fourth terminal at the rear of the support 51. Thus the tip contact p of the plug does not touch any contact while inserted.

To briefly illustrate the operation of the system shown in Fig. 1, aside from its testing features, it may be stated that the connection of the cord circuit with the outgoing end of the trunk results in energizing the trunk relay r by current from said cord circuit, as for instance, from battery B^3 . The insertion of the plug P completes a path for current through the tip relay r^2 from the live pole of the battery B, out over the tip strand t of the tip cord, and thence by way of the tip side of the telephone line through the

grounded bell 5 at the substation, thus energizing said relay also, which results in closing a path for current through the ringing lamp S^3 , which path may be traced from the live pole of said battery B by conductors 27 and 30, spring 29, conductor 31, spring 38 of relay r^3 , lamp S^3 , conductor 34 and spring 35 of relay r to ground. The latter relay, it should be explained, is now energized by current over the sleeve side of the trunk and through the spring 28 of relay r^2 and its forward contact to ground. The ringing signal S^3 is therefore lighted and the signal S^2 is prevented from operating. This condition is maintained until the subscriber takes up his receiver which completes a path for current from the battery B over the metallic telephone line to the substation as before traced, but instead of returning through the grounded bell it now returns over the sleeve side of the telephone line, the sleeve strand s of the trunk cord and thence through conductor 32, relay r^3 , conductors 33 and 34, and spring 35 to ground. This results in energizing the relay r^3 which opens the circuit of the ringing signal S^3 thus retiring the same and indicating to the operator that the subscriber has responded and at the same time closes a locking circuit for itself from the live pole of the battery over conductors 13 and 37, spring 36, its forward contact, thence through the winding of the relay r^3 , conductors 33 and 34 and through the spring 35 to ground. It will be noted that this path over conductors 13 and 37 is in parallel with the path for current through the relay r^2 and out over the telephone line and back to the central office over conductor 32, so that said path short-circuits the former path over the telephone line, deprives the same of current and prevents the tip relay r^2 from being longer energized. At the same time the relay r^3 is not deenergized since its locking circuit is completed and remains completed as long as the trunk relay r is energized. The trunk relay r is now energized over the metallic outgoing end of the trunk, which operates the supervisory signaling apparatus in the cord circuit at said end to notify the operator that the subscriber has responded. At the termination of the conversation relay r^2 is again energized through the grounded signaling bell at the substation, which attracts its spring 28 and permits the supervisory signal in connection with the cord circuit to operate, whereupon the operator takes down the cord circuit, thus depriving the trunk relay r of operating current, so that a path for current is completed through the disconnect signal S^2 , through the attracted spring 29 of relay r^2 and the back contact spring 35 of the relay r . Upon seeing this signal the operator at the office C takes down the connection and restores all parts to normal condition.

This means of testing may be utilized

with line circuits provided with two-point jacks and with cord circuits of the two-strand type, as indicated in Fig. 3. In this figure the subscriber's line L^2 extends from the subscriber's station which is provided with the ordinary arrangement for common battery talking, to the central office where the usual line signals S^4 , two-point springjacks J^5 and J^6 , cut-off relay R^2 and line relay R^3 are provided, the said cut-off relay being operated by current over a portion of the talking circuit. The cord circuit is provided with an answering plug P^2 and a calling plug P^3 each having two talking contacts adapted to register with the corresponding contacts of the springjacks. The usual batteries B^2 and B^3 are associated with the cord circuit for the operation of the supervisory apparatus, including signals S^5 , S^6 controlled by the supervisory relay r^4 , r^5 , r^6 and r^7 . This operation is well understood and needs no further description. The testing plug P^3 , however, is provided with a special tip contact p^4 , which is insulated from the talking contacts of the plug and which is arranged as in Fig. 2 not to engage any of the contacts of the jack when inserted therein. This tip contact is joined by a conductor 60 individually to the calling cord through a common retardation coil 61 and the tertiary winding of the operator's induction coil to ground. When an idle line is tested, therefore, by touching the tip of the calling plug P^3 to the test ring of one of the jacks, no flow of current results since both the tip of the plug and the test ring are connected with ground and are therefore at the same potential. The insertion of a plug in one of the jacks, however, connects the test rings with the live pole of one of the batteries B^2 or B^3 and the application of the grounded testing tip of a plug to one of the test rings results in a flow of current through the tertiary winding of the operator's induction coil and therefore causes a click in her receiver. This flow of current may be reduced to any desired extent by means of the retardation coil 61 or in any other well-known manner. When the plug is inserted as stated above the tip contact does not touch the talking contacts of the jacks and the testing strand for that particular cord circuit is not included in any circuit. As shown by the branching lines from the point 63, the retardation coil 61 and operator's outfit are preferably common to a certain number of cord circuits, preferably to all of the cord circuits at the operator's position; and as similarly indicated in Fig. 1, the strand 42 is individual to the cord, but the operator's set is common to the operator's position.

While I have thus described one practical method of carrying out my invention, I would have it understood that it is not to be

so limited in all respects as various changes may be made therein and still come within its scope and principle.

I claim:

5 1. The combination with a telephone line, of a testing circuit to determine the idle or busy condition of said line, a conducting plug with which said line is adapted to be connected, a central source of current to furnish current for conversation and for testing, 10 said plug having two contacts adapted to connect one with each limb of the line, and a third contact connected with said testing circuit but not adapted to connect with any surface while the other two contacts of said 15 plug are in connection with said line, substantially as described.

2. The combination with a telephone testing system, of a line terminal and a cord terminal; tip, ring and sleeve contacts for said 20 cord terminal, and ring and sleeve contacts for said line terminal adapted to register with like contacts of said cord terminal, a central source of current to furnish talking current to the line during the connection of the cord 25 with the line, a testing circuit completed by the contact of said cord terminal tip with said line terminal sleeve and means whereby said tip terminal will not register with any 30 contact of the line terminal while said ring and sleeve contacts are in connection, substantially as described.

3. The combination with a telephone line, terminating in a plurality of jacks at the central office, a central source of current to furnish current for conversation, of a testing 35 circuit adapted to be completed through one

of the contacts of said jacks, a test receiving device in said circuit said device being common to a plurality of cord circuits, the testing 40 circuits of said cord circuit being integral and free from series contacts during testing, substantially as described.

4. In a telephone system, the combination with a metallic telephone line terminating at 45 the central office in a two-point jack, one contact of said jack being both a testing and a talking contact, a cord circuit, a testing contact upon the calling plug of said cord circuit, said contact being entirely out of metallic connection with the jack when the plug 50 is inserted therein, substantially as described.

5. The combination with a telephone line, of a plurality of jacks having contacts normally disconnected from the limbs of the 55 telephone line, a cut-off relay for the line adapted when actuated to connect the limbs of the telephone line with said contacts, a cord circuit to connect with the line, a calling plug for said cord circuit, said plug having 60 two contacts adapted to register with the contacts of the jack which are connected with the limbs of the telephone line by the actuation of the cut-off relay, and a third 65 contact independent from the contacts of the jack during conversation, and a test receiving device permanently connected with said third contact, substantially as described.

In witness whereof, I hereunto subscribe my name in the presence of two witnesses.

HARRY C. GOLDRICK.

Witnesses:

C. J. LANGDON,
WM. E. ROBESY.