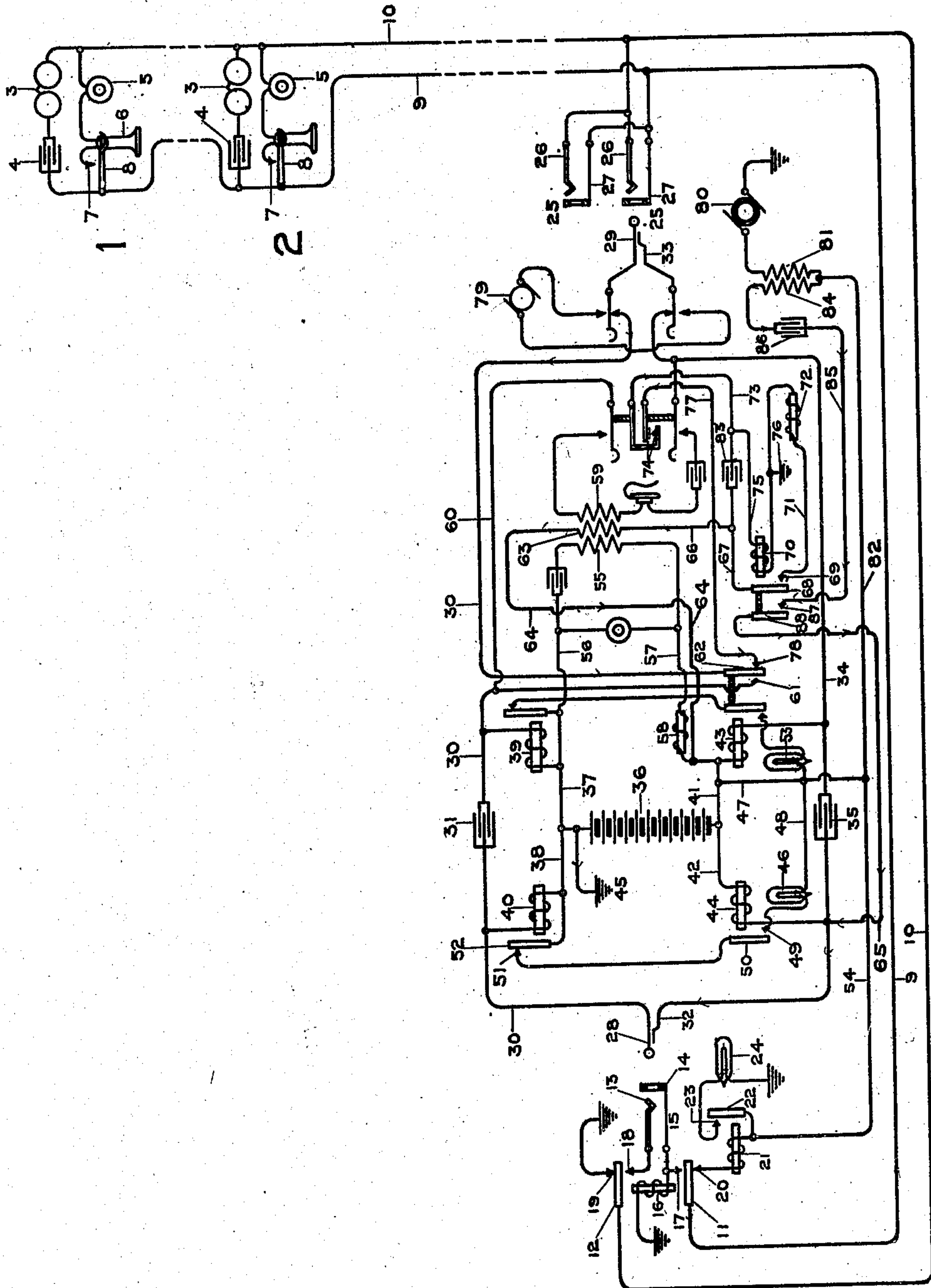


C. S. WINSTON.
TELEPHONE TESTING SYSTEM FOR PARTY LINES.
 APPLICATION FILED MAY 31, 1905.

900,458.

Patented Oct. 6, 1908.



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TELEPHONE TESTING SYSTEM FOR PARTY-LINES.

No. 900,458.

Specification of Letters Patent.

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Application filed May 31, 1905. Serial No. 263,028.

To all whom it may concern:

Be it known that I, CHARLES S. WINSTON, 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 Telephone Testing Systems for Party-Lines, of which the following is a specification.

My invention relates to a special test system for use on party line telephone systems.

In telephone systems having more than one station upon a single line when a subscriber calls central and desires to communicate with another subscriber whose station is located upon the same telephone line, the operator upon noticing the signal of the calling subscriber will insert an answering plug in the answering jack of the line of the calling subscriber. After ascertaining the number of the station desired the operator will touch the tip of her calling plug to the test terminal of a multiple jack of the line called for, in the usual manner, to ascertain the idle or busy condition of the line. Due to the fact that the line tested is the line of the calling subscriber as well as the line of the called subscriber, and to the fact that the answering plug is connected with the answering jack of the line, the line will test busy in the usual manner and the calling subscriber will be informed of the busy condition of the line. The above busy test will be received each succeeding time a subscriber upon a party line attempts to call another subscriber upon the same line unless the operator should notice from the numbers of the calling and called-for stations that said stations are located upon the same line. During the busy hours of the day the operator would probably not notice that such was the case and parties upon the same line would be denied intercommunication.

My invention has for one of its objects the provision of a testing system or circuit in which testing current of a special character, or current adapted to produce a special tone in the operator's receiver is adapted to flow when a party line is tested in response to a call from one of the stations upon said line. Under such circumstances, in accordance with my invention, a special testing circuit is closed, which is adapted to produce a special tone in the operator's receiver, and notify the operator that the called station is located upon the same line

as the station of the calling subscriber. The operator upon receiving the test of special tone will notify the calling subscriber to hang up his receiver until she has signaled the station called for. Upon the response of the called subscriber the two stations will be in connection for conversation, due to the fact that the answering plug is inserted in the answering jack of the line.

For the purpose of revealing the principle of my invention, I have illustrated in the accompanying drawing a party line telephone system, a central office equipment and one method or circuit arrangement for the testing current of special tone.

In the drawing only two subscribers' stations—1 and 2 are shown although any number of stations may be provided, each of said stations having a call bell 3 and condenser 4, preferably connected in a permanent bridge of the line conductors, a transmitter 5 and receiver 6 being connected in a second bridge of the line, said second bridge having the normal continuity of its circuit broken at the contact point 7 by the switch hook 8 when the receiver 6 is not in use. It will be understood that any suitable substation apparatus may be used in lieu of that described. The line conductors 9 and 10 extend from the substations to the central office, said conductors terminating in contact springs 11 and 12, said springs being normally disconnected from the tip and sleeve terminals 13 and 14 of the answering jack 15 of the line. A suitable cut-off relay 16 is legged to ground from the sleeve terminal 14 of the answering jack as shown, said relay being adapted to connect the jack terminals with the external line circuit, through front contacts 17 and 18 thereof and said line springs 11 and 12. One of the back contacts 19 of said relay is connected to ground, the other back contact 20 thereof being connected with the winding of the line relay 21, said line relay being adapted to control through its normally-open contacts 22 and 23 the circuit of the line signal 24. The answering jack 15 is shown opposite the answering plug of the cord circuit, the multiple jacks 25 of the line having their tip contacts 26 and sleeve contacts 27 legged from the opposite sides thereof, are shown opposite the calling plug of the cord circuit.

The operator's cord circuit which I have shown for the purpose of illustrating the

operation of my invention, is provided with a calling and an answering plug, the tip contact 28 of the answering plug being connected to the tip contact 29 of the calling plug by means of a flexible cord strand 30 containing a condenser 31, the sleeve contacts 32 and 33 of said plugs being similarly united by means of the flexible strand 34 containing the condenser 35. A central source of current consisting of the battery 36, adapted to furnish current to the substation transmitters and for operating the signals at the central office, is preferably bridged between the strands 30 and 34 of the cord circuit, said bridge consisting of conductors 37 and 38 connecting one pole of said battery with the cord strand 30, said conductors including the coils of supervisory relays 39 and 40. The opposite pole of said battery is connected with the cord strand 34 by means of conductors 41 and 42 containing respectively the coils of supervisory relays 43 and 44. One pole of the battery 36 is grounded at 45. A pair of supervisory signal lamps 46 and 53 are connected with one pole of said battery by means of conductors 41 and 47, the circuit of the lamp 46 being controlled through the normally-open contacts 49 and 50 of the supervisory relay 44 and the normally-closed contacts 51 and 52 of the supervisory relay 40. The circuit of supervisory signal 53 is similarly controlled over a circuit including the normally-open contacts of the supervisory relay 43 and the normally-closed contacts of supervisory relay 39. The line relay 21 is connected with the battery 36 by means of conductors 41, 47 and 54.

The operator's telephone set, consisting of a transmitter and a condenser included in a local circuit with the primary winding 55 of an induction coil, is adapted to receive current from the battery 36 over conductors 56 and 57, a retardation coil 58 preferably being included in conductor 57. The secondary winding 59 of the induction coil, the operator's receiver and a condenser, are adapted to be bridged across the strands of the cord circuit by means of a suitable listening key, one contact of said key being connected with the cord strand 30 by a conductor 60. Cord strand 30 is normally severed by contacts 61 and 62 of the supervisory relay 43, said contacts being adapted to move with but being insulated from the contacts of said relay for controlling the circuit of the supervisory signal 53. A tertiary winding 63 is provided for the operator's induction coil, one terminal of said winding being connected by conductor 64 with one pole of the battery 36, the opposite pole of which is grounded. The other side of the tertiary winding is connected through conductors 66 and 67, normally-open contacts 68 and 69 of the test relay 70 and conductor 71, containing impe-

dance coil 72, to the ground 76. Test relay 70 is preferably of high resistance and high impedance, and is connected between the ground 76 and the tip of the calling plug 29 through conductors 75 and 73, a pair of normally-open contacts 74 of the listening key, conductor 77, normally-closed contacts 78 and 62 of the supervisory relay 43 and cord strand 30 to the tip 29. A condenser 83 is bridged between conductors 67 and 73 as shown. A suitable ringing generator 79 is adapted to be bridged across the calling end of the cord circuit for sending ringing current over the line in the usual manner.

In the present instance, in accordance with my invention I provide a rotating current interrupter 80, said interrupter being shown in series with primary winding 81 of an induction coil and being preferably connected between the live pole of battery 36 and ground, by means of conductors 41, 47 and 82. The secondary winding 84 of said induction coil is preferably connected with the sleeve cord strand 34 through a condenser 86, conductor 85, a second pair of normally-open contacts 87 and 88 of the test relay 70 and conductor 65. Contact 88 is adapted to move with but is insulated from, contact 68 of said relay. It will be understood that I do not wish to limit my invention to the current interrupter shown nor to the particular method of connecting the same in circuit above described.

The operation of my invention is as follows: Assuming that subscriber 1 desires to communicate with subscriber 2, he will remove his receiver from the hook 8, thus closing a path for current from the battery 36 which may be traced as follows: conductors 41, 47 and 54, winding of line relay 21, back contacts 20 and 11 of the cut-off relay 16, line conductor 9, switch hook 8 and contact point 7, transmitter 5, line conductor 10, back contacts 12 and 19 of the cut-off relay to the grounded pole of the battery 36. The line relay 21 will attract its armature 22 and close the circuit of the line signal 24 from the battery 36 in an obvious manner. Upon noticing the signal the operator will insert an answering plug into the answering jack 15. Current will then flow from battery 36 through conductor 42, supervisory relay 44, sleeve contacts 32 and 14 of the plug and jack and through the cut-off relay 16 to ground, said relay attracting its armatures 11 and 12 and connecting the jack terminals with the limbs of the telephone line through front contacts 17 and 18 of said relay. Current will also flow over line conductor 9 through the substation apparatus, line conductor 10, contacts 12 and 18 of the cut-off relay, tip contacts 13 and 28 of the jack and plug, cord strand 30, supervisory relay 40 and conductor 38 to battery. The energization of the cut-off relay 16 breaks the circuit

of the line relay 21 at contacts 11 and 20 of the cut-off relay, thus retiring the line signal 24, and current flowing through the coils of the supervisory relay 44 closes the circuit of the supervisory signal 46 through the normally-open contacts 49 and 50 of said relay, but since the subscriber's receiver is off its hook the circuit of said supervisory signal is opened at contacts 51 and 52 of the supervisory relay 40, by current flowing through the substation apparatus and through said relay as above described. The supervisory lamp 46 therefore remains inert. The operator then throws her listening key to ascertain the number of the station desired. The operator's transmitter may be supplied with current as shown, from the battery 36.

Assuming that the operator does not notice that the station with which connection is desired is located upon the same line as the station of the calling subscriber, she will proceed to test the idle or busy condition of the line. Due to the fact that the calling subscriber's receiver is off the hook and the answering plug of the cord circuit is inserted in the answering jack of the line, the sleeve contacts of the multiple jacks will be raised to a potential above ground, due to the flow of current from the battery 36 over the line as above described. Upon touching the tip 29 to the sleeve 27 of the multiple jack therefore, current will flow from the sleeve contact 27 of the multiple jack, through the tip 29 of the calling plug, tip strand 30, normally-closed contacts 62 and 78 of supervisory relay 43, conductor 77, contacts 74 of the listening key, conductors 73 and 75, through the winding of the test relay 70 to ground. The test relay 70 will attract its armature 68 which will close a path for current from battery 36, over conductors 41 and 64, tertiary winding 63, conductors 66 and 67, contacts 68 and 69 of the test relay 70, and conductor 71, including the retardation coil 72, to ground and back to the battery. The flow of the above current through the tertiary winding of the operator's induction coil, as the tip of the plug is touched to the test terminal 27, will produce the usual click in the operator's receiver, notifying her that the line is busy. It will be noted that the condenser 83 conductively separates but inductively unites, the two paths for current last described.

Upon receiving a click in her telephone as above described, and failing to notice that the called station is located upon the same line as the station of the calling subscriber, a connection between subscribers located upon the same line would be denied. To remedy such a contingency and in order to notify the operator whenever such a condition exists, I provide a test circuit adapted to produce a test effect or click in the operator's receiver of a special tone. It will be noted

that a path for current is provided from the battery 36 over conductors 41, 47 and 82, primary winding 81 of an induction coil, the brushes and contacts of the current interrupter 80 to ground, and back to the battery. This current, due to the action of the rapidly-revolving interrupter 80 or an equivalent circuit breaker, is induced in the secondary winding 84 of said induction coil. When the tip of the calling plug is touched to the sleeve of a multiple jack in testing and the test relay 70 is energized as above described, a path for said induced current is closed by contacts 87 and 88 of said relay, said path being traced as follows: from the secondary winding 84 through condenser 86, conductor 85, contacts 87 and 88 of the test relay, conductor 65, sleeve conductor 34, sleeve contacts 32 and 14 of the answering plug and jack, contacts 17 and 11 of the cut-off relay, line conductor 9, test terminal 27 of the multiple jack, tip 29 of the calling plug, cord conductor 30, contacts 62 and 78 of the supervisory relay 43, conductor 77, contacts 74 of the listening key, conductor 73, condenser 83, conductor 66, tertiary winding 63, conductor 64 and battery 36 to ground. It will be noted that while the condenser 83 is opaque to the direct current flowing in the two paths heretofore described, between which said condenser is bridged, said condenser is transparent to the high frequency induced current above described, the high impedance of the test relay 70 preventing said current from passing to ground upon one side of said condenser and the impedance coil 72 preventing the induced current from passing to the ground 76 upon the other side of said condenser. The induced current flowing from the secondary winding 84 through the tertiary winding of the operator's induction coil produces a click in her receiver different in tone from the click produced therein by the flow of direct current from the battery 36, said difference being due in part to the rapidity at which the current interrupter is rotated, said click of special tone serving to notify the operator that the station desired is upon the same line as the calling station. It will be noted that as the path of said test circuit of special tone is through the contacts of the answering jack and over a line conductor to the test terminal of a multiple jack of the line, said special test would not be received by the operator when the answering plug was inserted in the jack of a different line from the one tested.

Upon receiving the special test which notifies the operator that station 2 is upon the same line as the station of the calling subscriber, she will request the calling subscriber to replace his receiver upon the hook until the subscriber at station 2 has been signaled. She will then insert the calling plug into a multiple jack of the line, depress her

ringing key and send ringing current over the line in the usual manner to operate the bell of the called subscriber. After signaling the called subscriber, the operator will
 5 withdraw the calling plug from the multiple jack of the line and the subscribers will then be connected for conversation, current flowing from the battery 36 over the line, as above described, and through substations 1
 10 and 2 in multiple, for the actuation of the substation transmitters.

When different lines are connected for conversation by means of the central station apparatus illustrated, current flows through
 15 supervisory relays 39 and 43 and over the tip and sleeve cord strands from battery 36 in the same manner as that described with reference to supervisory relays 40 and 44, but as said portion of the central station ap-
 20 paratus is inoperative during a connection between subscribers upon the same line, it is not thought advisable to describe the circuits of such part of the central station apparatus in detail, the circuit of the other portion of
 25 said apparatus clearly illustrating the operation of the special test circuit. Upon the conclusion of the conversation the subscribers return their receivers to their respective hooks, thus breaking the circuit flow over
 30 the line and through the supervisory relay 40, which releases its armature 52, closing the circuit of the supervisory lamp 46. Upon noticing the signal the operator will remove the answering plug 28 from the jack 15
 35 which will restore all parts to normal condition.

It will be understood that the special test circuit illustrated is intended to represent only one method of embodying my invention
 40 in a practical form and said circuit arrangement as illustrated may be changed without departing from the spirit of my invention.

What I claim as new and desire to secure by Letters Patent is:

45 1. In a testing system, the combination with a telephone line having a busy testing terminal, of an operator's testing contact for testing the busy condition of the line, a test-
 50 ing circuit including a portion of the talking circuit of the answering end of the cord adapted to be closed when a busy line is tested, and means associated with said circuit for interrupting the current flow therein, whereby when said circuit is closed a special
 55 tone is produced in the operator's receiver, substantially as described.

2. In a testing system, the combination with a telephone line having a busy testing terminal, of an operator's testing contact for
 60 testing the busy condition of the line, a cord circuit for making connection with the line, a testing circuit including a portion of the answering end of the sleeve talking strand, closed when a busy line is tested, and a suit-
 65 able current interrupter associated with said

circuit for interrupting the current flow therein, whereby when a busy line is tested a special tone is produced in the operator's receiver, substantially as described.

3. In a testing system, the combination 70 with a telephone line having a busy testing terminal, of an operator's testing contact for testing the busy condition of the line, an alternating current testing circuit, an electro-magnetic device for connecting said circuit 75 with the answering end of the sleeve voice current conductor when a busy line is tested, said circuit being adapted to produce a special tone in the operator's receiver, substantially as described. 80

4. In a testing system, the combination with a telephone line having a busy testing terminal, of a cord circuit for making con- 85 nection with the line, an operator's testing contact for testing the busy condition of the line connected with the tip strand of the cord circuit, and an alternating current testing circuit including a portion of the answering end of the sleeve talking strand, said circuit 90 being adapted to produce a special tone in the operator's receiver when a busy line is tested, substantially as described.

5. In a testing system, the combination with a telephone line having a busy testing 95 terminal, of a cord circuit for making connection with the line, an operator's testing contact for testing the busy condition of the line, an alternating current testing circuit including a portion of the sleeve strand of the cord circuit and a line conductor, and 100 means for closing said circuit when a busy line is tested, said circuit being adapted to produce a special tone in the operator's receiver, substantially as described.

6. In a testing system, the combination 105 with a telephone line having a busy testing terminal, of a cord circuit for making connection with the line, an operator's testing contact associated with the tip strand of the cord circuit for testing the busy condition of 110 the line, and an induced alternating current testing circuit including a sleeve strand of the cord circuit and a line conductor, said circuit being adapted to produce a special tone in the operator's receiver when a busy 115 line is tested, substantially as described.

7. In a testing system, the combination with a telephone line having a busy testing terminal, of a cord circuit for making con- 120 nection with the line, an operator's testing contact for testing the busy condition of the line, a direct current testing circuit, an alternating current testing circuit including a sleeve strand of the cord circuit and a por- 125 tion of one line conductor, and electro-magnetic means for closing both said circuits when a busy line is tested, said alternating current circuit being adapted to produce a special tone in the operator's receiver, sub- 130 stantially as described.

8. In a testing system, the combination of a telephone line having a testing terminal, of a cord circuit having tip and sleeve strands for making connection with the line for conversation, a direct current testing circuit and an interrupted current testing circuit, a test relay for closing said circuits energized over the tip cord strand, and a condenser bridged between said direct current testing circuit and the energizing circuit for said relay, said condenser being in the path of said interrupted current testing circuit, substantially as described.

9. In a testing system, the combination with a plurality of substations, of a telephone line extending from said stations to a central office, a plurality of connecting circuit will be completed over said testing terminal associated with said cord circuit, a testing circuit and means whereby said circuit will be completed over said testing terminal and a talking strand of the answering end of the cord circuit, only when said line is in connection with the answering end of said cord circuit, substantially as described.

10. In a testing system, the combination with a plurality of substations located upon a telephone line, of a plurality of connecting contacts for said line at the central office, a cord circuit, a testing terminal associated with said cord circuit, a signal circuit adapted to be closed over said testing terminal when said line is in connection with a second cord circuit, and a different signal circuit adapted to be closed over said testing terminal and a portion of the talking circuit of the answering end of the cord circuit, when said line is in connection with the answering end of said first cord circuit, said testing circuits transmitting signals of different characteristic sounds to the operator, substantially as described.

11. In a testing system, the combination with a telephone line, of a plurality of substations upon said line, and a plurality of test contacts for said line at the central office, a cord circuit, a testing terminal associated with said cord circuit, a signal circuit adapted to be closed over said testing terminal and the answering end of the sleeve talking strand of a cord circuit when it is connected with the test contact of the calling line, and means whereby a signal of different character will indicate when a different telephone line has been tested, substantially as described.

12. In a testing system, the combination with a telephone line, of a plurality of substations upon said line, and a plurality of

testing contacts for said line at the central office, a cord circuit, a testing terminal associated with said cord circuit, a busy test circuit adapted to be closed when the cord test terminal is connected to the test terminal of the busy line, and a tone signal circuit adapted to be closed over a portion of the answering end of the sleeve talking strand when said line is busy by its connection with the answering end of said cord circuit, substantially as described.

13. In a testing system, the combination with a telephone line, of a plurality of substations upon said line, and a plurality of testing contacts for said line at the central office, a cord circuit and a testing terminal associated with said cord circuit, a plurality of testing circuits adapted to be closed by the connection of said cord testing contact with the testing contact of a busy line, each of said testing circuits furnishing a distinctive signal one being completed over the answering end of the sleeve talking strand of a cord circuit said circuits being adapted to be closed under different busy conditions of said telephone line whereby the condition of the line may be determined by the busy test, substantially as described.

14. In a testing system, the combination with a cord circuit, of a testing conductor for said cord circuit, including the coil of a test relay, a distinctive current adapted by the actuation of said test relay to be connected with the answering end of one of the talking strands of said cord circuit, and means when the answering end of said cord circuit is connected to one of the jacks of the telephone line, whereby said distinctive current will be inductively transmitted to the operator's receiver when said testing conductor is connected to another terminal of said line, substantially as described.

15. In a testing system, the combination with a telephone line having a plurality of subscribers connected therewith, of a plurality of testing terminals connected with one of the talking strands of said line during conversation, and means for connecting a distinctive current with the test contact of said telephone line when one subscriber of said line requests connection with a second subscriber of the same line, 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:

C. B. CAMP,
E. F. GRIER.