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W. H. MARTIN

FOREIGN POTENTIAL DETECTING DEVICE

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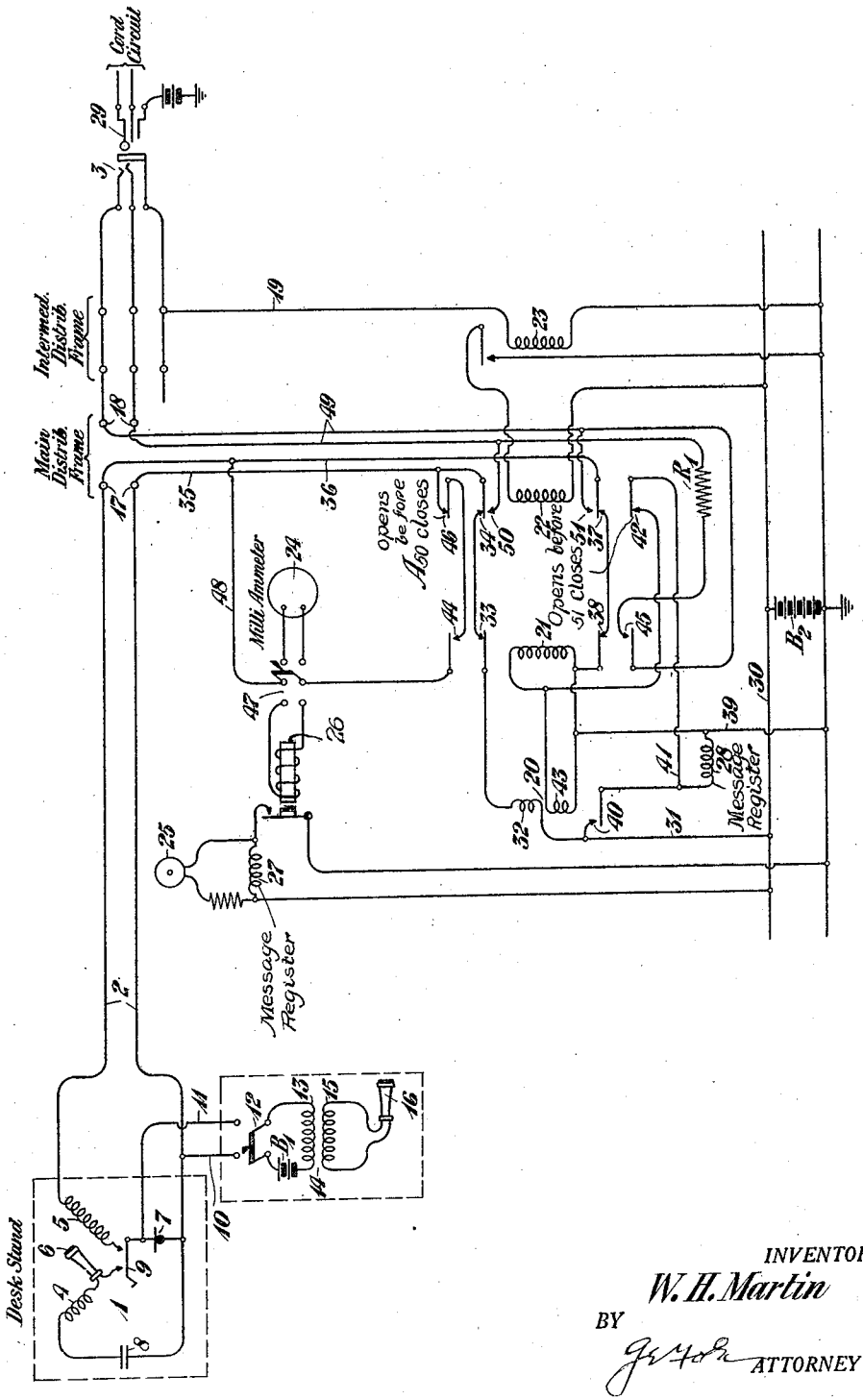

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UNITED STATES PATENT OFFICE.

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FOREIGN-POTENTIAL-DETECTING DEVICE.

Application filed January 5, 1921. Serial No. 435,150.

To all whom it may concern:

Be it known that I, WILLIAM H. MARTIN, residing at New York, in the county of Bronx and State of New York, have invented certain Improvements in Foreign Potential Detecting Devices, of which the following is a specification.

This invention relates to electrical testing devices and especially to an arrangement for determining the presence of foreign potentials upon a signaling circuit, such as a telephone subscriber's line circuit.

As is well known, various arrangements have been devised and used for the secret overhearing of conversations. Certain of these involve the use of the transmitter of a telephone subscriber's set which, when the receiver is on the hook, may be energized by means of a source of foreign potential, that is, some source other than that which is applied to the telephone line at the central office, so that the said transmitter is adapted to transmit any sounds that may fall thereon to a receiver connected with what may be termed the "overhearing circuit" and thereby the sounds will be overheard. It is sometimes customary to provide such overhearing circuit with a switch whereby the said circuit may be opened and the source of foreign potential may be removed from the transmitter when the telephone subscriber attempts to use his telephone for the purpose of receiving or making a call. It may be readily seen that such an overhearing or detecting device may be installed upon a telephone set without the knowledge of the telephone subscriber and also without the knowledge of the company operating the telephone line.

It is the object of this invention to provide a simple and effective arrangement for detecting the presence of such foreign potentials upon a telephone circuit without visiting the subscriber and also to prevent the subscriber from detecting that his line is being tested by the telephone company for the presence of such foreign potential.

This invention will be better understood from the following description when read in connection with the attached drawing which shows one from of embodiment of the said invention.

In the drawing, a subscriber's telephone set 1 is connected by means of the line wires 2 with the switchboard, located in the telephone office, terminating therein in a jack 3. The telephone set, which is indicated schematically by 1, comprises the windings of the induction coil 4 and 5, a receiver 6, a transmitter 7, a condenser 8 and a hook switch 9. Effectively bridged across the said transmitter are the conductors 10 and 11, which terminate on two of the contacts of the switch 12, which is placed preferably at the same place where the listener is located. This switch is adapted, when closed, to bridge across the transmitter, a battery B_1 and one of the windings 13 of the transformer 14, the other winding of which 15 is connected with the receiver 16 by means of which sounds impressed upon the transmitter 7 may be overheard. The conductors 2 terminate upon the contact 17 of the main distributing frame in the terminal room of the central office. This line would normally be cross-connected at the main distributing frame to the contacts 18 and would extend thence through the intermediate distributing frame to the jack 3 at the switchboard. However, when such line is under observation and test for the existence of foreign potentials thereon, the cross-connection at the main distributing frame is opened and the said line is looped through the circuit indicated at A. The insertion of this circuit between the subscriber's line and the switchboard may be effected by the use of specially designed plugs, which are inserted at the main frame in place of the heat coils and also by placing a connector upon the sleeve contact of the intermediate distributing frame, thereby connecting the conductor 19 to the sleeve contact, the purpose of which connection will be made clear hereafter.

The circuit A comprises the relays 20, 21, 22 and 23, which are designed to control automatically the apparatus for determining the presence of a foreign potential and also to effect the signaling of the operator whereby the normal operations may be carried on. Connected with the circuit A is a battery B_2, which is designed to furnish the current to operate the relays of the circit A. The determination of the presence and the magnitude of a foreign potential may be made either by means of a milliameter 24 or by means of a buzzer 25, which is controlled by means of a relay 26. Message registers 27 and 28 are also associated with the circuit for the purpose of registering the number of calls, the manner of doing which will be made clear later. A resistance R_1 is intended to be bridged across the circuit to the switchboard

in order to operate the line relay (not shown) and thereby to give a signal to the operator. Associated with the jack 3 at the switchboard is a plug 29 of a cord circuit, which may be of any well known subscriber type.

Having in mind the foregoing description of the various parts of this apparatus, the invention will be clearly understood from the following description of its mode of operation.

Let it be assumed that the receiver 6 at the subscriber's station 1 is upon its hook, and that the switch is open, so that no current will flow from the battery B_2 at the central office over the said line. Let it also be assumed that the switch 12 at what may be termed the listening point, is closed, so that current flows from the battery B_1 through the transmitter 7 and the winding 13 of transformer 14. Any sounds, therefore, that might fall upon the diaphragm of the transmitter 7 may be heard by means of the receiver 16. Having in mind this situation, let it now be assumed that the subscriber at station 1, desiring to make a call, removes his receiver from the switch 9. The operation of the hook switch closes the line circuit through the winding 5 and transmitter 7, thereby allowing current to flow from the battery B_2 at the central office over conductors 30 and 31, winding 32 of relay 20, contact 33 of relay 21, contact 34 of relay 22, conductor 35 to and through the subscriber's set and thence through conductor 36, contacts 37 and 38 respectively of relays 22 and 21 and conductor 39 to the grounded side of the battery B_2. Relay 20 will be operated by the flow of current through winding 32 and will close its contact 40. This operates message register 28 and also allows the current to flow over a circuit from battery B_2, conductor 31, contact 40, conductor 41, contact 42 of relay 22 and through the winding 43 of relay 20 and the winding of relay 21 and conductor 39 of the grounded side of battery B_2. This causes relay 20 to be locked up and also results in the operation of relay 21, thereby opening contacts 33 and 38 and closing contacts 44 and 45. By the opening of contacts 33 and 38 the battery B_2 is removed from the line circuit and remains disconnected therefrom so long as relay 21 is operated. The removal of this battery from the line circuit is necessary in order to enable the detection and measurement of any foreign potential on the said line circuit. By the closing of contact 44, a circuit is established from the said contact through a meter connected with the switch 47, conductor 48 over the upper line conductor and through the winding 5 and the transmitter 7 (across which is bridged the source of potential B_1), thence over the lower line conductor to conductor 35, contact 46 of relay 22, to contact 44 of relay 21. If it is assumed that the switch 47 is operated toward the right, the circuit just traced will be connected through the ammeter 24. Consequently the battery B_1 at the listening point which is bridged across the transmitter 7, is also in effect bridged across the said ammeter and consequently the presence of the said battery will be made known and the magnitude of the current will be determined. An alternative method for the detection of the foreign potential, which comprises the use of a relay 26, a buzzer 25 and a message register 27, is also shown. If, for example, the switch 47 were operated toward the left, the battery B_1 would cause a flow of current through the winding of the polarized relay 26 to operate the buzzer 25 and also the message register 27, which are connected in parallel across the source of current B_2. Message register 27 counts how often the buzzer rings. The reading of it in connection with the reading on message register 28, which registers the number of calls made by the subscriber, indicates on how many occasions when the subscriber called, the foreign potential was on the line.

Simultaneous with the act of detecting the presence and the magnitude of the foreign potential, the relay 21 through the closing of its contact 45, closes a circuit through the resistance R_1 and the conductors 49 which causes the operation of line relay and the glowing of a signal at the switchboard. Upon the receipt of this signal the operator inserts the plug 29 of the cord circuit in the jack 3, thereby permitting the current to flow over the sleeve contact of the said jack, and over conductor 19 which, as stated heretofore, was connected with the sleeve contact at the intermediate distributing frame by means of a suitable connector and thence through relay 23 to ground. This causes the operation of relay 23 which by the closing of its contact, in turn causes the operation of relay 22. When the relay 22 operates, contacts 34, 37, 42 and 46 are opened and contacts 50 and 51 are closed. The effect of the opening and of the closing of the said contacts is to disconnect the apparatus of the testing circuit from the line circuit and to connect the line circuit over the said contacts 50 and 51, directly with the circuit at the switchboard.

Relay 22 is so designed that when energized its outer contacts 42 and 46 open before contacts 50 and 51 close, thereby removing the testing apparatus of the testing circuit from the line circuit and releasing relays 20 and 21 before connecting the subscriber's line circuit through to the switchboard in the normal way. Current for talking over the subscriber's line circuit is then supplied in the normal way over the cord

circuit from the central office battery. When the operator removes the plug from the jack at the switchboard relay 23 is de-energized thereby which in turn releases relay 22 and the system is restored to its initial condition. If, on the other hand, the operator desires to call the subscriber, the insertion of the plug in the jack 3 will energize relays 23 and 22 and thereby connect the operator with the subscriber.

It will be seen that this arrangement provides means for momentarily disconnecting the central office battery from the subscriber's line circuit when the subscriber removes his receiver from its hook, and connecting during that period of time across the said line circuit a device sensitive to direct current, whereby any abnormal source of direct current potential which may be connected with the said line circuit may be detected. There is always a small interval of time after the operation of the line relay and the flashing of a signal at the switchboard until the operator answers the call by inserting plug 29 of the cord circuit into the line jack 3. This time is sufficient for the indication of the foreign current by some sensitive detecting device. When plug 29 of the cord circuit has been inserted, the subscriber's line circuit is automatically connected through to the switchboard so that the call may be handled in the normal way. The circuit furthermore, provides means for automatically disconnecting the detecting devices and their controlling relays from the subscriber's circuit when the said circuit is connected through to the switchboard for normal talking purposes.

Although this invention has been disclosed as embodied in the particular form, it is apparent that it is capable of embodiment in other and different forms, without departing from the spirit and scope of the appended claims.

What is claimed is:

1. In a signaling system, the combination with a telephone subscriber's line of a source of foreign potential having means to impress it across the said line only when the said subscriber's line is in operating condition, a telephone switchboard and means to automatically show the presence of such foreign potential and to effectively connect said line to said switchboard.

2. In a signaling system the combination with a telephone subscriber's line circuit of a source of potential normally foreign to the said circuit having means to effectively connect it thereto, a testing circuit connected with the said line circuit arranged to indicate the presence of the said foreign potential whenever a call originates upon said line circuit and means to automatically operate the line signal after a test has been made.

3. In a signaling system, the combination with a line circuit having its transmitting device normally disconnected therefrom, means foreign to the said line circuit designed to energize the said transmitting device and arranged to be disconnected therefrom, and indicating means arranged to be connected automatically with the said line circuit to show the presence of the said foreign energization means when the said transmitting device is effectively connected with the said line circuit.

4. In a signaling system, the combination with a telephone subscriber's line circuit having a microphone associated therewith, but normally effectively disconnected therefrom, a listening circuit comprising a source of potential and an indicating instrument having means to bridge it across the said microphone, and testing means having means for its automatic connection with the said line circuit whenever the said microphone is effectively connected thereto in order to originate a call upon said line circuit.

5. In a signaling system, the combination with a telephone line having a substation set connected thereto, of a source of foreign potential, having means to bridge it across the transmitter of the said substation set, and current indicating means having means for its automatic connection with the said line circuit by the operation of the hook switch of the said substation set, to indicate the presence of the source of foreign potential across said transmitter.

6. In a signaling system, the combination with a telephone subscriber's line adapted to have a potential impressed thereon from a source normally foreign to the said subscriber's line, a testing circuit inserted in the said subscriber's line having means associated therewith controlled by the operation of the substation set to disconnect the normal source of talking current from the said line, and to connect therewith an indicating instrument to show the magnitude of the foreign potential.

7. In a signaling system, the combination with a telephone subscriber's line adapted to have a potential impressed thereon from a source normally foreign to the said subscriber's line, a testing circuit inserted in the said subscriber's line having means associated therewith controlled by the operation of the substation set to disconnect the normal source of talking current from said line, means to connect an indicating device across the said line and means to bridge a resistance across the line relay of the said subscriber's line circuit, whereby the line lamp associated therewith may be operated.

In testimony whereof I have signed my name to this specification this 4th day of January, 1921.

WILLIAM H. MARTIN.