

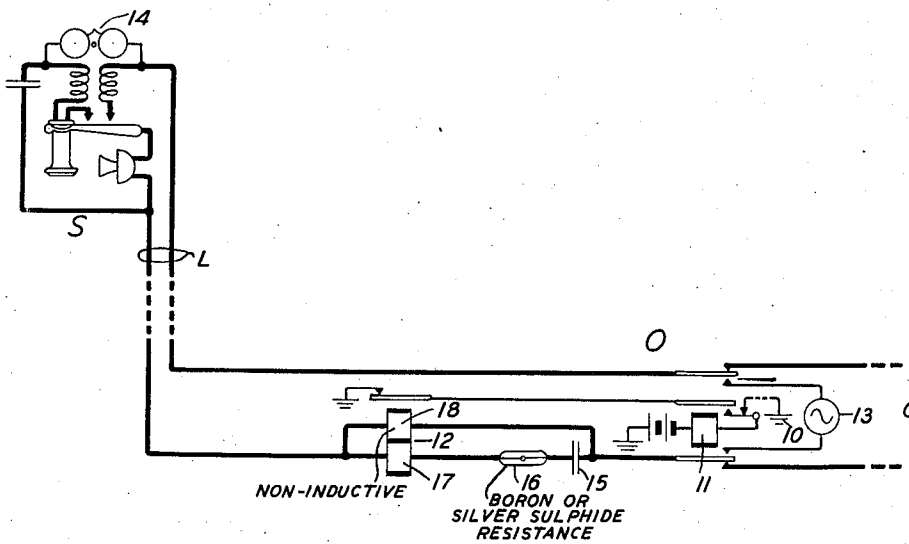
Feb. 13, 1940.

D. F. JOHNSTON ET AL

2,189,769

TELEPHONE SIGNALING SYSTEM

Filed May 4, 1938



INVENTORS: D.F. JOHNSTON
J.B. SHIEL

BY

H. J. Higginsman

ATTORNEY

UNITED STATES PATENT OFFICE

2,189,769

TELEPHONE SIGNALING SYSTEM

Donald F. Johnston, Pelham, and John B. Shiel,
Glen Head, N. Y., assignors to Bell Telephone
Laboratories, Incorporated, New York, N. Y., a
corporation of New York

Application May 4, 1938, Serial No. 205,906

4 Claims. (Cl. 179-18)

This invention relates to signaling systems and more particularly to machine ringing systems as employed in telephony.

It is common practice in certain phases of telephone communication to employ what is generally called "machine ringing" in signaling a called subscriber. In such cases a combination of alternating current and superimposed direct current is automatically connected to an idle subscriber's line circuit upon seizure thereof for the purpose of actuating the signaling device at the called subscriber's station. The removal of the receiver at the called station, in response to the incoming signal, causes a decrease in the resistance of the line circuit in a well-known manner with the result that a relay whose windings are traversed by the ringing current and which is normally unresponsive thereto, operates upon the increase of current incident to the decrease in line resistance to disconnect the ringing current from the line. This automatic disconnection of the ringing current from the line circuit is known as "tripping" and the relay which controls the disconnection is generally referred to as the "tripping relay."

It is the object of this invention to provide, in a telephone signaling system, a simple, economical and dependable arrangement for tripping machine ringing.

This object is attained in accordance with a feature of the invention by including in series with the operating winding of the tripping relay a resistor having a characteristic such that it offers a high resistance to the flow of current during the ringing period and when subjected to an increased voltage incident to the response of a called subscriber, its resistance decreases to such a value as to permit sufficient current to traverse the operating winding of the relay to cause its operation. The relay is provided with a non-inductive winding connected across the serially connected operating winding and resistor which, upon the removal of the receiver at the called subscriber's station, experiences an increased current flow causing the voltage drop across the resistor to increase sufficiently to effect the breakdown thereof and the consequent increase of current in the operating winding of the relay. The relay accordingly operates causing the disconnection of the ringing current source from the line circuit.

The invention will be readily understood from the following detailed description made with reference to the accompanying drawing which illustrates schematically, a subscriber's station S con-

nected, by means of the line circuit L, to a central office O at which are located the necessary instrumentalities for signaling the station S and for tripping the machine ringing in accordance with the features of the invention.

In describing the system disclosed in the drawing it will be assumed that the line L leading to station S has been seized by a connector switch in accordance with well-known practice and as a consequence of which ground potential, indicated at 10, will be connected to the winding of relay 11. Relay 11 accordingly operates and at its inner upper armature and front contact locks itself to ground at the back contact and armature of tripping relay 12. At the outer upper armature and lower armature of relay 11 the continuity of the tip and ring conductors of the connector link C is interrupted and a source of ringing current 13 is connected to the subscriber's line circuit L. The ringer 14 being bridged across the line L is actuated by current from the source 13 to produce an audible signal at the station S.

The ringing current traverses a path including the front contact and lower armature of relay 11 and thence in parallel through condenser 15, resistor 16 and operating winding 17 of relay 12 and through the winding 18 and thence through the ringing bridge at station S and back to the source 13 by way of the outer upper armature and front contact of relay 11. The resistor 16 offers a high resistance to the flow of current from source 13 so that the operating winding 17 of relay 12 is substantially devoid of current while the current flowing through the non-inductive low resistance winding 18 is not of sufficient magnitude to set up a potential across the resistor 16 sufficient to cause it to break down. The relay 12 accordingly remains unoperated.

When the subscriber at station S removes the receiver from its switchhook in response to the incoming signal to connect the receiver and transmitter to the line, the line resistance is materially reduced. This reduction in line resistance results from the shunting, by the switchhook contacts, of the high impedance ringer 14. Due to this decrease in line resistance, the winding 18 of relay 12 experiences an increase of current from source 13 with the result that the potential drop across the resistor 16 is increased to such a value as to cause the resistor to break down, its resistance being materially reduced as a result. The resistance of the path including the operating winding 17 of relay 12 is accordingly reduced

to such an extent as to allow sufficient current to traverse it and operate the relay 12.

In operating, relay 12 opens the locking circuit for relay 11 which relay releases, it being understood that the ground 10 is no longer available due to the functioning of the connector switch circuit, as is well known.

Relay 11 released, disconnects the source 13 from the line circuit L and restores the continuity of the tip and ring conductors of the circuit C.

The resistor 16 may be made of silver sulphide or boron, each of which elements is known to exhibit an abnormally high resistance at voltages below a certain value, known as the breakdown value, and whose resistance diminishes materially when subjected to voltages exceeding the breakdown value.

What is claimed is:

1. In a telephone system, a line circuit, a subscriber's station thereon, a signal device at said station, a source of signaling current, means responsive to the seizure of said line circuit for connecting said source of signaling current thereto to cause the actuation of said signal device, and means effective when the subscriber at said station responds to the actuated signal by removal of the receiver from its switchhook for automatically disconnecting said source of current from said line circuit, said means including a relay having a non-linear resistor connected in series with the operating winding thereof and with said source of signaling current and a non-inductive winding connected in shunt with said operating winding and its serially connected resistor.

2. In a telephone system, a line circuit, a subscriber's station thereon, a signal device at said station, a source of signaling current, means responsive to the seizure of said line circuit for connecting said source of signaling current thereto to cause the actuation of said signal device, and means effective when the subscriber at said station responds to the actuated signal by removal of the receiver from its switchhook for automatically disconnecting said source of current from said line circuit, said means including a relay having a silver sulphide resistor connected in

series with the operating winding thereof and with said source of signaling current and a non-inductive winding connected in shunt with said operating winding and its serially connected resistor.

3. In a telephone system, a line circuit, a subscriber's station thereon, a source of current, means responsive to the seizure of said line circuit for connecting said source of current to said line, a relay having an operating winding, a non-linear resistor, said operating winding and said resistor being connected in series with each other and with said source of current when said source of current is connected to said line circuit, said resistor normally constituting a high resistance to the flow of current from said source through said operating winding, and means effective upon the removal of the receiver at said station for effecting a diminution in the resistance of said resistor, said means including a non-inductive winding on said relay connected in parallel with said serially connected operating winding and resistor.

4. In a telephone system, a line circuit having a subscriber's station thereon, a signal device at said station, a source of signaling current, means automatically responsive to the seizure of said line circuit for connecting said source of signaling current to said line to effect the operation of said signal device, a tripping relay having an operating winding included in the line circuit in series with said source of current, a resistor in series with the operating winding of said relay for limiting the flow of current in said winding during the ringing period to a value insufficient to cause said relay to operate and a non-inductive winding on said relay connected in shunt with said serially connected operating winding and resistor which functions in response to a decrease in the line resistance incident to the response of the subscriber to the actuated signal to lower the resistance of said resistor and thereby permit sufficient current to traverse the operating winding of said relay to cause the relay to operate.

DONALD F. JOHNSTON.
JOHN B. SHIEL.