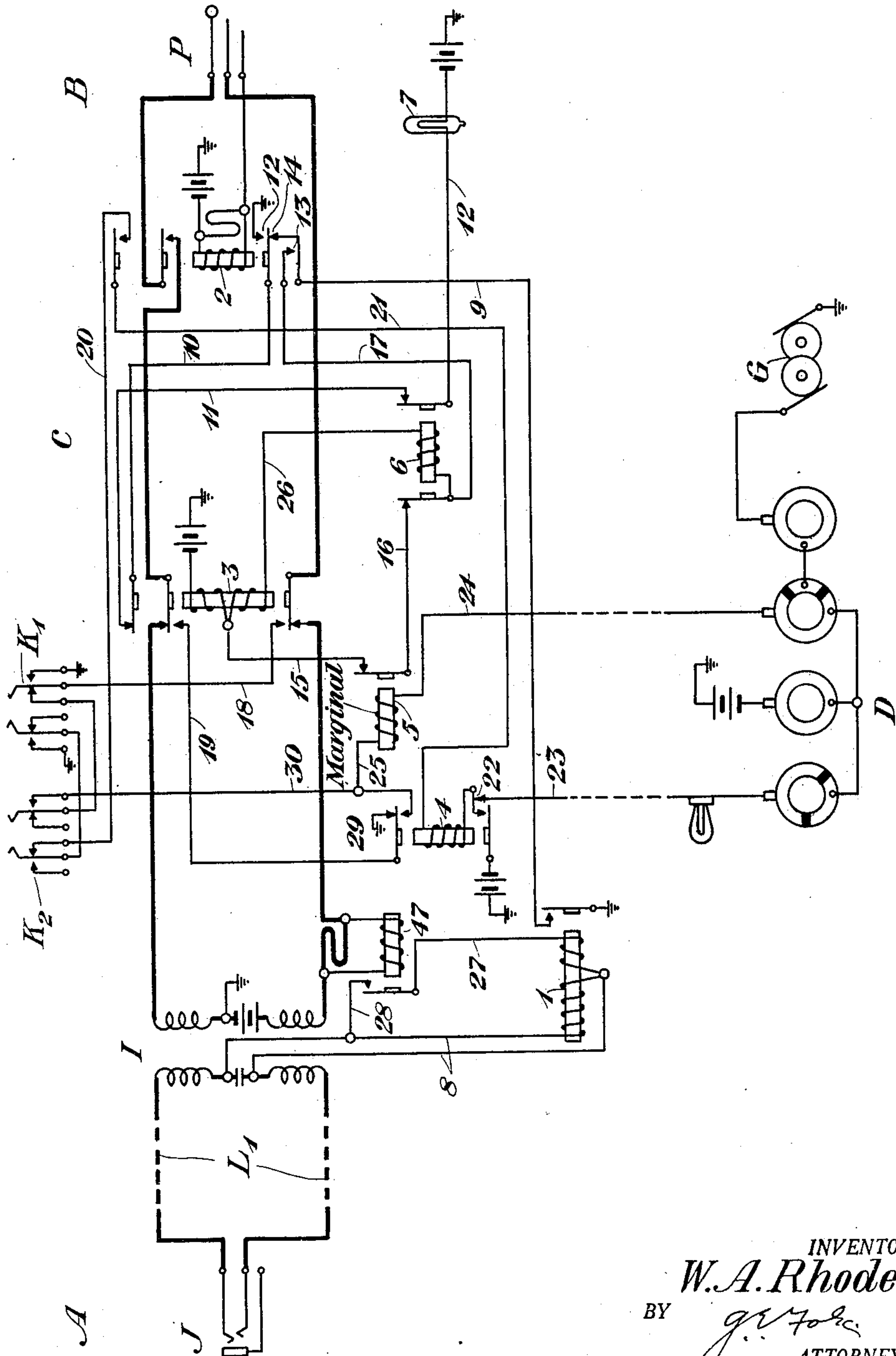


W. A. RHODES.
MACHINE RINGING SYSTEM.
APPLICATION FILED MAR. 1, 1918

1,370,558.

Patented Mar. 8, 1921.



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MACHINE RINGING SYSTEM.

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Specification of Letters Patent.

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To all whom it may concern:

Be it known that I, WILLIAM A. RHODES, residing at New York, in the county of New York and State of New York, have
5 invented certain Improvements in Machine Ringing Systems, of which the following is a specification.

This invention relates to trunk lines employed in connection with telephone systems
10 and more particularly relates to the signaling arrangements associated therewith. One of the objects of the invention consists in the provision of means for reducing and substantially eliminating the possibility of
15 of disturbances being caused in the receiver at subscribers' stations by the signaling arrangements associated with the trunk line. Other and further objects of the invention will be clear from the detailed description
20 to be given later.

In signaling organizations for party telephone lines, commonly known as machine ringing systems, it is customary to transmit ringing currents to the subscribers' stations
25 on the line selectively over the two sides of the line. This affords a signaling means for distinguishing between stations connected to different sides of the same line conductor. These signals are produced by a source
30 of signaling current associated with the line through an interrupter mechanism and the particular side of the line over which the ringing current is to be sent out is determined by a series of switching means or
35 mechanically locking keys under control of the operator. Upon the operation of these keys and a ringing relay, which connects the ringing apparatus to the line, ringing current will be transmitted over the line until the subscriber at the called station responds. When the called station responds,
40 the ringing relay is released and serves to disconnect the ringing apparatus from the talking conductors of the trunk and complete the talking circuit thereover. In former signaling organizations of this type it has been customary to release this relay by closing a short-circuit about the winding thereof. It has been found in practice, however, that
45 when this relay is released by a short-circuit, there is a tendency for the armature to rebound due to some interplay of forces between the moving magnetic circuit of the relay and the short-circuited winding. Such
55 rebounding of the armature of the relay in

question is very undesirable as it effects a rapid closing and opening of the talking conductors of the trunk a number of times before the armature comes to rest. This produces a disturbance in the receiver at
60 the called station by causing fluctuations in the current flow to such a station. These fluctuations moreover are repeated back to the calling station and give rise to a disturbance in the receiver at that station as
65 well.

When the present invention is made use of the ringing relay which serves to disconnect the ringing current from the talking conductors of the trunk is so arranged that
70 when the called subscriber responds a circuit is closed through a differential winding thereof so that the relay is released differentially rather than by a short circuit. Releasing the relay in this manner eliminates the possibility
75 of the armature rebounding from anything but a mechanical source and accordingly substantially reduces the receiver disturbance.

The invention may now be more fully understood with reference to the accompanying drawing which illustrates the preferred form of circuit arrangements of the invention. In the figure is shown a transmission
80 line L_1 interconnecting two distant stations A and B. At the station B the transmission line terminates in the trunk C which terminates in the plug P adapted to be inserted in the jack of a called line. The trunk circuit C includes the repeating coil I. Associated
85 with the left hand windings of the repeating coil I by means of conductors 8 is the relay 1 which includes a winding of high resistance and a winding of low resistance. The relay 1 responds to current coming in
90 over the line L_1 from the station A and its operation serves to close a circuit through the signal lamp 7. Connected to the sleeve contact of the plug P is the relay 2 which operates when the trunk circuit is connected
100 with a called line. Under the control of the relay 2 is the relay 3 which includes two windings differentially arranged. The operation of the relay 3 serves to open the talking strands of the trunk circuit C and
105 to connect them, upon the operation of the keys K_1 or K_2 , to a ringing mechanism D which is associated with the trunk circuit. The ringing mechanism D includes a generating apparatus G and a source of con-
110

tinuous current and an interrupter. The ringing current from the apparatus D is applied to the talking strands of the trunk circuit through the winding of a marginal relay 5. Associated with the keys K_1 and K_2 is the relay 4 which in conjunction with one of the keys determines over which of the talking conductors the ringing current shall be transmitted. When the called subscriber responds, the resistance in the circuit including the winding of the marginal relay 5 is sufficiently reduced so that this relay responds. The operation of the relay 5 opens a shunt about one of the windings of the relay 3 and the circuit formerly including only one of the windings of relay 3 now includes both windings of the relay 3 and the winding of the relay 6. As the windings of the relay 3 are arranged differentially, the relay 3 will be released and will allow the talking circuit to be closed. The relay 6 now serves to control the lamp 7 for supervisory purposes. Associated with one of the talking conductors of the trunk circuit is the relay 47 which serves to close a low resistance shunt about the high resistance winding of the relay 1 and thereby increase the flow of current over the trunk L_1 in order to operate supervisory apparatus (not shown) at the station A.

The invention may now be more fully understood from the following description of its operation. If the operator at station A connects one of her cord circuits with the trunk line L_1 , current from the station A is transmitted over the sides of the line L_1 and over the conductors 8 and through the higher resistance winding of the relay 1, thereby energizing the relay 1. The energization of relay 1 closes the following circuit: from ground, armature and contact of relay 1, conductor 9, contact 14 and armature of relay 2, conductor 10, armature and contact of relay 3, conductor 11, contact and armature of relay 6, conductor 12, filament of signal lamp 7 to battery and ground. The closing of this circuit operates the signal lamp 7 which serves as a guard signal. Upon ascertaining over a call circuit what connection is desired the operator at station B inserts the plug P of the trunk circuit C into the jack of the line to be called. If the ringing arrangements on the line to be called are connected to the tip side of the line and are operated when current is transmitted over that side of the line, the operator throws the key K_1 . When the plug P is inserted into the jack of the called line, the relay 2 which is connected to the sleeve contact of the plug P_2 is energized. The energization of relay 2 opens the circuit formerly closed through the signal lamp 7 at contact point 14 but applies a ground at contact 12 to said circuit. The energization of relay 2 closes the following circuit: from

ground and battery, upper winding of relay 3, conductor 15, contact and armature of relay 5, conductor 16, contact and armature of relay 6, conductor 17, contact 13, conductor 9, contact and armature of relay 1 to ground. This energizes relay 3 which opens the talking circuit of the trunk circuit and connects the talking conductors thereof to the conductors 18 and 19. When the key K_1 is thrown ground is applied to the ring conductor of the trunk circuit as follows: from ground, contact of key K_1 over conductor 18, contact and lower armature of relay 3 and the ring conductor of the trunk circuit. The operation of the key K_1 also closes the following circuit: from ground, contacts of key K_1 and key K_2 , over conductor 20, contact and armature of relay 2, conductor 21, winding of relay 4, contact 22, and over conductor 23 to battery and ground located in the ringing mechanism D. The closing of this circuit energizes relay 4 which locks its armatures in their attracted position. The energization of relay 4 causes it to pull up its upper armature and ringing current is now transmitted from the ringing mechanism D to the tip conductor of the trunk circuit as follows: from the ringing generator G, over conductor 24, winding of relay 5, conductor 25, contact and armature of relay 4, conductor 19, contact and armature of relay 3, and over the tip conductors of the trunk circuit and the called line to the ringing apparatus connected to the tip conductor of the called line.

By the above described means it will be seen that ringing current is transmitted over one side of the line and through the ringing mechanism at the subscriber's station and back over the other side of the line to ground. Ringing current will be intermittently transmitted over this circuit until the subscriber at the called station removes his receiver from the hook whereupon the resistance in the circuit will be sufficiently reduced so that the marginal relay 5 which is included in the circuit will be operated. The operation of the marginal relay 5 by pulling up its armature opens the shunt formed by conductors 15 and 16 about the lower winding of relay 3 and allows the circuit including the upper winding of relay 3 to be completed as follows: from ground and battery, upper winding of relay 3, lower winding of relay 3, over conductor 26, winding of relay 6 and over conductor 17 as formerly pointed out. As the windings of relay 3 are arranged differentially, the closing of this circuit will deenergize the relay 3 and thereby disconnect the talking conductors of the trunk circuit from the conductors 18 and 19 of the ringing circuit and allow the talking circuit of the trunk line to be completed.

The circuit including the signal lamp 7

which was broken upon the former energization of relay 3 is now, upon the deenergization of relay 3, held open by the energization of relay 6. When the talking circuit of the trunk line is completed by the deenergization of relay 3 the relay 47 which is included in one of the talking strands is energized and closes a low resistance shunt about the high resistance winding of relay 1 including the conductors 27 and 28, thereby increasing the current flow over the circuit to extinguish the supervisory signal at station A. When the called subscriber hangs up the receiver and the talking connection is terminated, the relay 47 is deenergized and the aforementioned low resistance shunt is opened again. This causes the supervisory signal at station A to respond and the operator thereat will remove her cord circuit from the trunk line L_1 and thereby deenergize the relay 1, which by allowing its armature to retract will open the following formerly closed circuit: from ground, contact and armature of relay 1, conductor 9, contact 13, conductor 17, winding of relay 6, conductor 26, windings of relay 3 to battery and ground. The opening of this circuit will release the relay 6 which will then allow the circuit including the signal lamp 7 to be closed. The signal lamp 7 will accordingly respond and inform the operator at station B to disconnect.

If the ringing apparatus at the called station is connected to the ring conductor of the line and it is desired to send ringing current thereto, the key K_2 is thrown. Ground is then applied to the tip conductor of the trunk circuit upon the energization of relay 3 as follows: from ground 29, contact and armature of relay 4, conductor 19, contact and armature of relay 3 and over the tip conductors of the lines. Ringing current from the mechanism D is transmitted over the ring conductors of the lines as follows: from the ringing mechanism D over the conductor 24, winding of relay 5, conductors 25 and 30, contacts of key K_2 and key K_1 , conductor 18, contact and armature of relay 3 and over the ring conductors of the lines to the ringing apparatus at the subscriber's station. As the further operations of these arrangements when the key K_2 is thrown are similar to the operations which take place when the key K_1 is thrown, the description thereof will be omitted.

While the invention has been disclosed as embodied in certain specific arrangements which are deemed desirable, it will be understood that it may be embodied in many widely varied organizations without departing from the spirit of the invention as defined in the appended claims.

What is claimed is:

1. In a transmission system, a telephone

line, a link circuit including a source of current and a differentially wound relay, means for completing a talking circuit in said system over the back contacts of said relay, means for completing a ringing circuit in said system over the front contacts of said relay, means responsive to the connection of said link circuit to said line for energizing said relay, and means controlled by said telephone line for releasing said relay differentially.

2. In a transmission system, a telephone line including substation apparatus, a link circuit including a source of current and a differentially wound relay, means for completing a talking circuit in said system over the back contacts of said relay, means for completing a ringing circuit in said system over the front contacts of said relay, means responsive to the connection of said link circuit to said line for energizing said relay, a second relay in said link circuit and responsive to the removal of the receiver from the switchhook at said substation, and means controlled by said second relay for controlling said first relay.

3. In a transmission system, a telephone line including substation apparatus, a link circuit including a source of current and a differentially wound relay, a shunt path about one of the windings of said relay, means for completing a talking circuit in said system over the back contacts of said relay, means for completing a ringing circuit in said system over the front contacts of said relay, means responsive to the connection of said link circuit to said line for completing a circuit through one of the windings of said relay and over said shunt path thereby energizing said relay, and means controlled by the removal of the receiver from the switchhook at said substation for opening said shunt path thereby releasing said relay differentially.

4. In a transmission system, a telephone line, a link circuit including a source of current and a differentially wound relay, means for completing a talking circuit in said system over the back contacts of said relay, means for completing a ringing circuit in said system over the front contacts of said relay, means responsive to the connection of said link circuit to said line for energizing said relay, means controlled by said telephone line for releasing said relay differentially, and switching means in said link circuit controlling the application of ringing current from said source to said ringing circuit.

In testimony whereof, I have signed my name to this specification this ninth day of February, 1918.

WILLIAM A. RHODES.