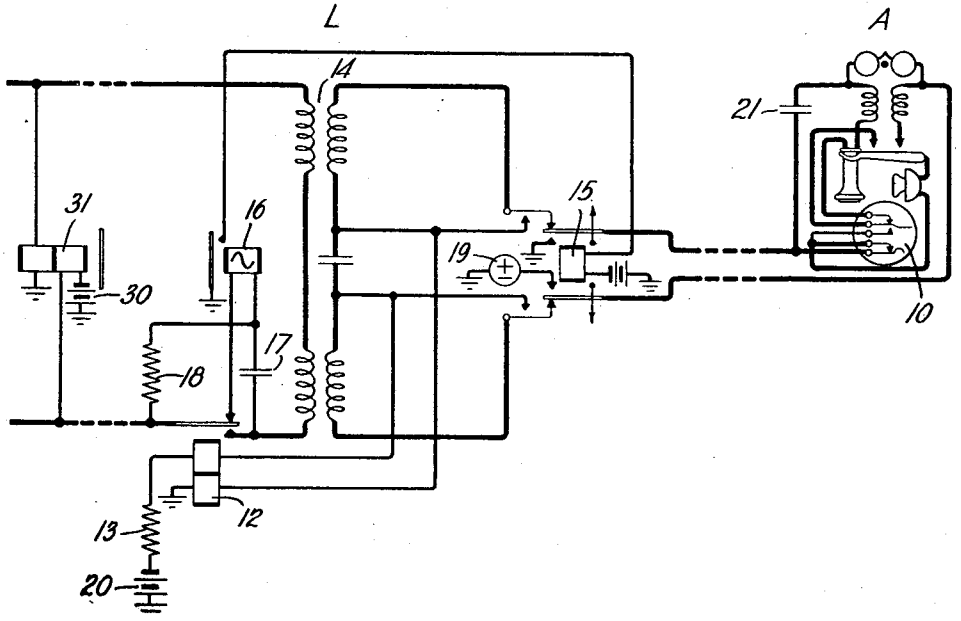
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TELEPHONE SYSTEM

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TELEPHONE SYSTEM.

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This invention relates to telephone systems and more particularly to such systems wherein telephone connections are established over long lines through the use of impulse transmitters.

Line circuits which are employed in systems of this general character are usually provided with a pulsing relay for repeating dial pulses in the establishment of an automatic connection, and an alternating current responsive ringing relay with its associated condenser for the transmission of signals. The opening and closing of the line conductors effected by the operation of the pulsing relay causes the condenser associated with the ringing relay to alternately charge and discharge, the charge being effected by the battery usually associated with systems of this type. It has been found that these capacity discharges cause the untimely operation of the ringing relay which results in the transmission of false signals.

Among the arrangements suggested to obviate this unstandard condition is the use of slow operating relays in the ringing circuit. When applied to long range signaling, however, this arrangement has been found objectionable since the combined effect on the ringing current of the increased impedance of the long line circuit and the sluggish characteristics of the ringing relays is such as to render it incapable of properly energizing the relay.

It is therefore the object of this invention to improve the transmission of signals over long transmission lines.

This object is attained in accordance with a feature of the invention by placing the ringing relay and its associated condenser in bridge of the pulsing contacts of the pulsing relay and providing a dissipating path for the condenser discharges effected during the establishment of an automatic connection. This arrangement permits the use of a comparatively sensitive ringing relay in the ringing circuit, thereby minimizing the effect of the increased impedance of the long line circuit on the transmission of signals.

The invention will be readily understood from the following detailed description made with reference to the accompanying drawing which shows a portion of a long line circuit terminating in a subscriber's dial station at which calls, by way of the long line circuit, may be initiated and terminated.

For the sake of simplicity it will be assumed that a subscriber at the dial substation A proceeds to initiate a call and in the usual manner removes the receiver from the switchhook and actuates the dial 10 in accordance with the number of the connection desired. The line L is permanently associated with the subscriber's line terminating at substation A.

It will now be noted that the pulsing relay 12 is bridged across the pulsing contacts of dial 10 so that for each closure of the pulsing contacts of the dial, relay 12 operates in a circuit extending from grounded battery 20, resistance element 13, upper winding of relay 12, lower right hand winding of repeating coil 14, back contact and lower armature of relay 15, through the subscriber's station equipment including the closed pulsing contacts of dial 10, upper armature and back contact of relay 15, upper right hand winding of repeating coil 14, lower winding of pulsing relay 12 to ground. Relay 12 operates in this circuit in accordance with the setting of dial 10, closing and opening the line circuit to repeat the dial pulses in the further completion of the connection.

Under normal conditions of the line circuit L, the ringing relay 16 and its associated condenser 17 are bridged across the normally open pulsing contacts of relay 12. When relay 12 operates in response to the actuation of dial 10, the ringing relay 16 is intermittently removed from association with the line circuit, but the condenser 17 is maintained in the circuit in series with the resistance element 18. It will be observed that condenser 17 is normally charged to the full capacity of the line circuit L, it being understood that in accordance with general practice a source of potential such as battery 30 is associated with the line circuit to render the interruptions thereof by the pulsing relay, effective in setting switches in the further completion of the connection. The battery 30 is shown associated with the windings of a double wound relay 31 which is the condition in general practice. The dashed portions of line L indicate the omis-

sion of other relay contacts the disclosure of which is not necessary for a complete understanding of the invention.

During the time of the forward travel of the armature of relay 12, i. e., between the opening of its back contact and the closing of its front contact, condenser 17 is maintained in the line circuit to the exclusion of relay 16 and in series with resistance element 18 and accordingly holds its charge. When relay 12 is fully operated, i. e., when its front contact is closed, a dissipating path for the charge on condenser 17 is established, which includes the resistance element 18 and the armature and front contact of relay 12 whereupon condenser 17 discharges. The circuit for relay 16 being opened at this time, this relay is not affected by the surge caused by the discharging of condenser 17. When relay 12 restores and opens its front contact, the dissipating path just mentioned is opened and condenser 17 again charges through resistance 18 to the full capacity of the line circuit, so that, when relay 12 is fully restored and its back contact closed there is no further current flow in the condenser circuit.

Relay 16 is reassociated with the line circuit in multiple with resistance element 18 and since there is no current flow in the condenser circuit this relay will not operate.

It is apparent from the foregoing that though condenser 17 associated with ringing relay 16 is subject to alternate charging and discharging effected by the closing and opening of the line circuit, relay 16 is not affected by these capacity disturbances. It is also evident that the pulsing relay operates effectively not only to regulate the association of the ringing relay with the line circuit, in such a manner as to render it immune to surges caused by the discharging of its associated condenser, but also to repeat dial pulses in the establishment of an automatic connection.

In the case of a call emanating from some distant station and destined for the subscriber at substation A, it will be assumed that the connection to the substation A has been completed and that ringing current has been applied to the line L. Relay 16 responds to this current and in operating establishes an obvious circuit for relay 15. In attracting its armatures relay 15 connects the ringing current source 19 and ground to the ring and tip conductors, respectively, of the connection, whereupon the subscriber at substation A is signaled in the usual manner.

It will be noted that the operation of relay 15 also effects the short circuiting of the right hand windings of repeating coil 14. This feature, coupled with the slow releasing characteristic of relay 15 and the make-before-break contacts thereof, insures against the transmission of objectionable clicks to the receiver at the calling station. At the end of the ringing period relay 16 restores opening the energizing circuit for relay 15 which releases slowly, removing the ringing current source 19 from the line and reassociating the right hand windings of repeating coil 14 therewith. It is to be observed that owing to the make-before-break contacts of relay 15 the short circuits about the right-hand windings of repeating coil 14 are maintained for a short period of time, so that the charge accumulated on the condenser 21 associated with the equipment at substation A and on the line conductors themselves is rendered ineffective to cause a surge through the repeating coil windings. In this manner the transmission of objectionable clicks back over the line is obviated. The charge on the line conductors and condenser 21 may vary in strength depending upon at what value of potential the ringing current was interrupted and whether it was of a negative or positive polarity with respect to the current source 20, associated with the pulsing relay 12.

What is claimed is:

1. In a telephone system, the combination of a line circuit, a dial, a pulsing relay actuated by said dial to intermittently interrupt the continuity of said line circuit, and an alternating current relay bridging the contacts of said pulsing relay and adapted to be intermittently associated with said line circuit upon the actuation of said dial.

2. In a telephone system, the combination of a line circuit, an alternating current relay normally associated with said line circuit, a condenser normally connected in series with said alternating current relay, a resistance element, a dial, and a pulsing relay controlled by said dial to intermittently interrupt the continuity of said line circuit, and upon its operation to remove said alternating current relay from said line circuit and maintain said condenser in said line circuit in series with said resistance element.

3. In a line circuit, a resistance element, an alternating current relay, said resistance element and said alternating current relay forming two branches of a parallel circuit, a condenser in series with said parallel circuit, and means for intermittently opening one of the branches of said parallel circuit and maintaining said condenser in series with the other of said branches, only.

4. In a telephone system, a calling substation, a line circuit, a pulsing relay and an alternating current relay associated with said line circuit, and means at said substation for intermittently actuating said pulsing relay to intermittently disconnect said A. C. relay from said line circuit during the establishment of a connection over said line circuit.

5. In a telephone system, the combination of a dial station, a line circuit, a dial at said dial station, a ringing relay associated with said line circuit and a pulsing relay operated in response to the actuation of said dial to intermittently remove said ringing relay from said line circuit during the initiation of a call at said dial station by way of said line circuit.

6. In a telephone line circuit, a pulsing relay intermittently interrupting the continuity of said line circuit, a ringing relay bridging the contacts of said pulsing relay, a condenser normally connected in series with said ringing relay and charged to the full capacity of said line circuit upon each operation of said pulsing relay, and means for dissipating the charge on said condenser and rendering said ringing relay immune thereto.

In witness whereof, I hereunto subscribe my name this 28th day of January, 1928.

LANGFORD J. BOWNE.