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TELEPHONE CIRCUIT

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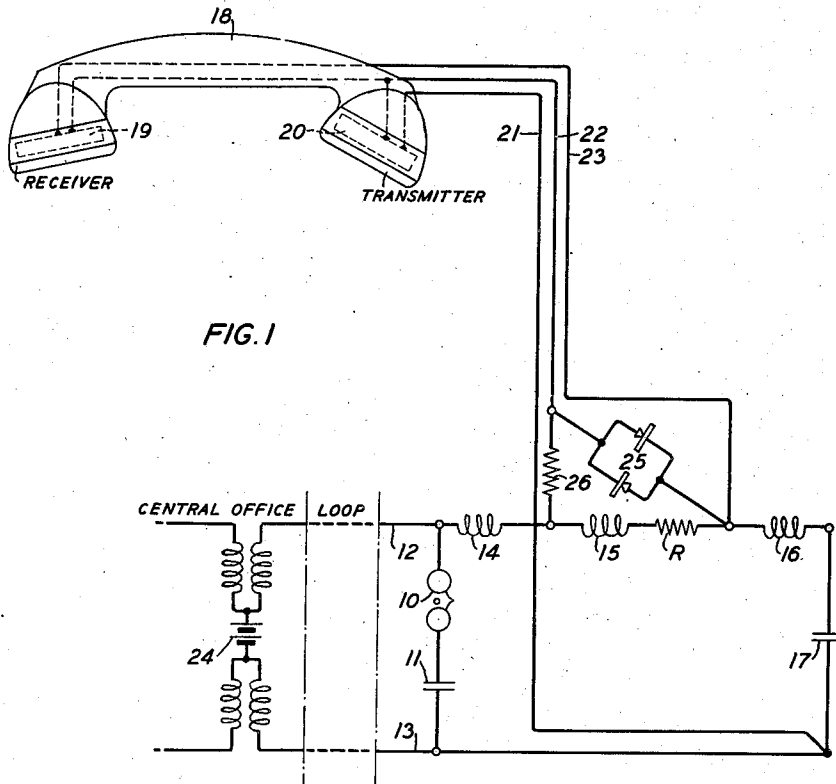
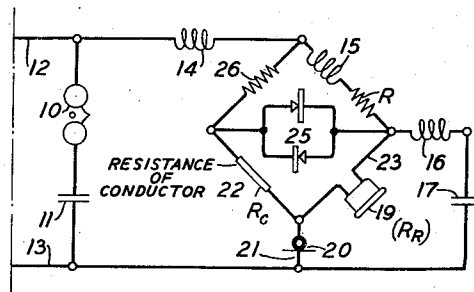


FIG. 2



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TELEPHONE CIRCUIT

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4 Claims. (Cl. 179—81)

This invention relates to telephone circuits and, more particularly, to substation circuits for telephone sets including a hand telephone having transmitter and receiver units connected to the subset by a multiconductor cord, one of the conductors being connected to both of the telephone units.

In telephone substation circuits, a non-linear resistance element, such as a copper-oxide rectifier, may be utilized to protect the receiver from currents resulting from unduly high voltages, transient or otherwise, impressed upon or induced in the telephone line. The non-linear resistance element should be located in a branch of the telephone circuit where it may be effective to protect the receiver but will have no appreciable effect upon the energy transmitted from the telephone set. A satisfactory arrangement is obtained in telephone sets having an anti-side tone circuit by connecting the non-linear resistance element in the receiver mesh of the circuit. However, it has been found that in sets wherein there is a conductor common to the receiver and transmitter units of the hand telephone, a direct current potential drop occurs in this common conductor so that the non-linear resistance is biased by the direct current supply to the telephone set.

One object of this invention is to substantially eliminate any bias from the non-linear resistance in telephone sets, due to the direct current supply to the set.

In accordance with one feature of this invention, an auxiliary resistance is provided in the substation circuit to balance the potential drop in the common conductor aforementioned, whereby the flow of a biasing current in the non-linear resistance is substantially or entirely prevented.

The invention and the foregoing and other features thereof will be understood more clearly and fully from the following detailed description with reference to the accompanying drawing in which:

Fig. 1 is a circuit diagram of a telephone circuit illustrative of one embodiment of this invention; and

Fig. 2 is a diagram of a portion of the substation circuit illustrated in Fig. 1 with the various impedances rearranged in more conventional bridge formation to facilitate understanding of this invention.

Referring now to the drawing, the substation circuit, shown to the right of the loop in Fig. 1, is of the anti-side tone type and comprises the

elements of a telephone subset, such as a ringer 10 in series with a condenser 11 and bridged across the line conductors 12 and 13, an induction coil having three windings 14, 15 and 16, the winding 15 having a resistance R , and a second condenser 17. A hand telephone 18, forming a part of the telephone set, comprises a receiver 19, which may be of the bipolar type, and a transmitter 20, for example of the carbon granule type, which are connected to the subset by a cord having three conductors 21, 22 and 23, the conductor 22 being common to the transmitter and receiver as shown.

The substation circuit is connected through the loop to the central office at which there is located a battery 24 for supplying direct current to the telephone set.

To protect the receiver 19 from currents resulting from unduly high voltages, transient or otherwise, which may appear in the telephone line 12, 13, a non-linear resistance element 25 is provided in shunt with the receiver 19 as shown. The element 25 may be composed, for example, of a pair of copper-oxide rectifiers connected in opposing multiple. Such an element, as is known, has a very high resistance when relatively low voltages are impressed across the terminals thereof and has a relatively low resistance at high voltages. Hence, when unduly high voltages appear in the subset circuit, the resistance element 25 effectively protects the receiver 19 against current surges.

It will be seen that, because of the condenser 17, direct current cannot flow in the receiver mesh of the circuit, that is, through the circuit from battery 24, over line conductor 12, winding 14, cord conductor 22, receiver 19, conductor 23, condenser 17 and line conductor 13 back to the battery 24. However, some current may flow in the transmitter mesh, that is through the circuit from battery 24, through line conductor 12, winding 14, cord conductor 22, transmitter 20, cord conductor 21 and line conductor 13 back to the battery 24. Hence, because of the potential drop in the common conductor 22, a bias will be placed across the non-linear resistance element 25.

In accordance with one feature of this invention, such a bias is minimized or eliminated by providing an auxiliary resistance 26 in the substation circuit. As shown clearly in Fig. 2, this resistance 26 forms one arm of a Wheatstone bridge, the other arms being the winding 15, R , the resistance, R_R , of the receiver 19, and the

resistance, R_c , of the cord conductor 22. The resistance 26 has a value equal to

$$\frac{R}{R_R} \cdot R_c$$

so that for normal conditions no bias appears across the non-linear resistance element 25.

It will be noted that although the bridge arrangement balances out direct current bias, it does not balance out speech currents, so that for the latter the element 25 is effectively connected across the receiver 19 and the winding 15.

Although a specific embodiment of the invention has been shown and described, it will be understood that it is but illustrative and that various modifications may be made therein without departing from the scope and spirit of this invention as defined in the appended claims.

What is claimed is:

1. A telephone circuit comprising a pair of line conductors, a transmitter, a receiver, a connection from one terminal of said transmitter to one of said line conductors, a connection from one terminal of said receiver to the other of said line conductors, a common resistive connection between the other terminal of said receiver and transmitter, a non-linear resistance element connected between said second connection and said resistive connection, and means including a resistance connected between said other line conductor and the point of connection between said non-linear resistance and said common connection for neutralizing the potential drop in said common connection.

2. A telephone substation circuit comprising a pair of line conductors, a transmitter, a receiver, means including three conductors connecting said transmitter and receiver to said line conductors and forming transmitter and receiver circuits having a common branch including one of said conductors, said receiver circuit having a blocking condenser therein, a non-linear resistance element in shunt with said receiver and connected to said common conductor,

and means for balancing out the direct current potential drop in said common conductor comprising a resistance connected in said common branch.

3. A telephone circuit comprising a pair of line conductors, means for impressing a direct current potential between said conductors, a pair of series circuits connected across said conductors, one of said circuits including a transmitter, a receiver and a resistance, said receiver being between said transmitter and said resistance, the other of said circuits including said transmitter and a pair of resistances, said receiver and said first and pair of resistances constituting arms of a balanced Wheatstone bridge, and a non-linear resistance connected between the common terminal of said pair of resistances and the common terminal of said receiver and said first resistance.

4. A telephone substation circuit comprising a pair of line conductors, a transmitter, a receiver, a three-conductor cord one of the conductors of which is common to said transmitter and receiver, and the other two of which are individual to said transmitter and receiver, an induction coil having a resistive winding in series with one of said line conductors, the transmitter conductor being connected to the other of said line conductors and the receiver conductor being connected to one terminal of said winding, a balancing resistance connected between said common conductor and the other terminal of said winding, and a non-linear resistance connected across said balancing resistance and said winding, said balancing resistance having a value substantially equal to

$$\frac{R}{R_R} \cdot R_c$$

where R is the resistance of said winding, R_c is the resistance of said common conductor, and R_R is the resistance of said receiver.

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