

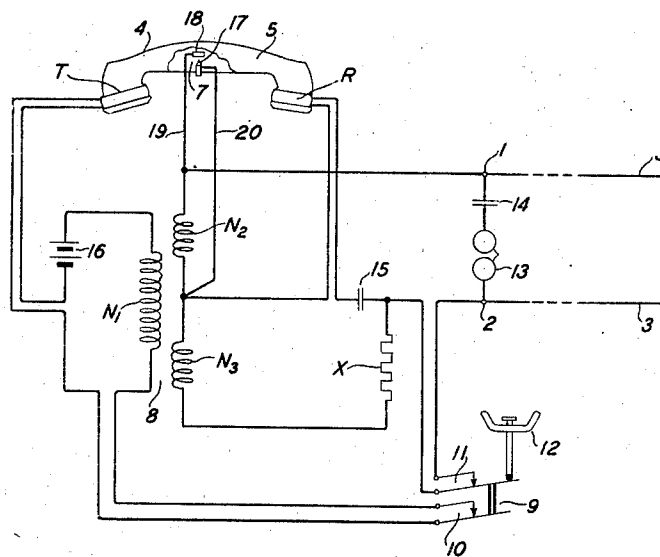
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TELEPHONE STATION CIRCUIT

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TELEPHONE STATION CIRCUIT

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This invention relates to anti-sidetone subscriber station circuits and, more particularly, to an arrangement for controlling the effect of room noise in the telephone receiver of such circuits.

In an ideal anti-sidetone telephone substation circuit no current would be produced in the receiver of the circuit during transmitting out of the circuit, that is, during agitation of the transmitter of the circuit by the vocal output of the user thereof, nor, during receiving, would any interfering alternating current be produced in the receiver as a result of room noises effective to agitate the transmitter. This result generally is predicated upon a circuit arrangement in which the components, together with the telephone line to which the station circuit is connected, constitute the arms of a bridge proportioned to be balanced with respect to the currents generated by the transmitter, the receiver being connected to the points of equal potential. In practice, this condition is not realized for a number of reasons. The station circuit may be designed for a particular or an average line and is in fact used with a different line or with one that does not conform to the characteristics of the average line. Hence the condition of balance is not attained. In a station circuit including a transformer or induction coil, a receiver, a transmitter, and a line balancing network, the practically attainable characteristics of the components limit the extent to which the ideal design may be realized. It is practically difficult, furthermore, with commercial considerations in mind, to match the impedance characteristics of the line balancing network to the telephone line for all frequencies to be transmitted to and from the line and the telephone station circuit. In practice, the line balancing network is usually a simple resistance, whereas the line impedance is a function of frequency. A small amount of sidetone usually is not objectionable but if the receiver or transmitter in such a circuit should be replaced by a more efficient instrument sidetone might rise beyond the tolerable level. On the other hand, the unbalance between the line balancing network and line impedances in a particular installation might produce a similar end effect. Although such increase in the sidetone level is objectionable during transmitting out of the station circuit, effective use of the station circuit for transmitting purposes is not necessarily precluded. The increased effect in the receiver, however, during receiving, of room noises effective on the transmitter may seriously impair the effectiveness of

the station circuit for listening purposes in that the weak telephone currents incoming from the telephone line may be so interfered with as to be masked or rendered unintelligible in part or as a whole.

An object of this invention is to eliminate room noise effects in the receiver of an anti-sidetone subscriber station circuit during receiving at the station.

Various expedients to minimize or to eliminate room noise effects in the receiver of a station circuit during receiving have been proposed. These have usually involved the provision of means to short-circuit the transmitter alone, or to short-circuit the transmitter and a local battery therefor, or to open the transmitter circuit. The first-mentioned expedients have the drawback of wasting local battery current, and the last that of producing a "click" in the receiver and in the line or at the distant station upon the opening and subsequent closing of the circuit.

In accordance with the invention, an anti-sidetone subscriber station circuit may comprise a receiver, a transmitter, a multiwinding induction coil and a network for balancing the impedance of the telephone line connecting the station circuit to another station circuit or to a telephone exchange or central office. The transmitter and one winding of the induction coil may be connected in a local series circuit including a local battery for the transmitter. The receiver may be connected in series with a second winding of the induction coil across a pair of line terminals to which the telephone line would be connected. A third winding of the induction coil and the line balancing network may be connected in shunt with the receiver. The network may be a resistance included in the third winding. A normally-open switch is connected across the second winding, and is adapted to be operated to closed condition by the station user during receiving at the station. Closure of the switch short-circuits the winding across which it is connected and thereby effectively short-circuits the other winding of the induction coil, and simultaneously connects the telephone receiver directly across the line terminals. Hence, room noises effective on the transmitter are precluded from producing interfering currents in the receiver. At the same time, the transmitter local circuit remains unchanged, that is, the direct current flowing in the transmitter or its associated induction coil winding is not interrupted or opened, nor is either the transmitter or its serially-connected induction coil winding directly short-cir-

cuted. As a consequence, these possible origins of receiver "click" or of wasteful drain on the local battery are eliminated.

A more complete understanding of the invention will be obtained from the detailed description that follows, taken with reference to the attached drawing, the single figure of which illustrates an embodiment of the invention.

The telephone substation circuit shown in the drawing comprises a pair of line terminals 1, 2 for connection to a telephone line 3 leading to another telephone station circuit or to a telephone exchange or central office; a hand telephone or handset 4 comprising a transmitter T, for example, of the variable resistance type; a receiver R, and a finger-operated push-button or switch 7 mounted in the handle portion 5 of the handset; a three-winding transformer or induction coil 8 comprising windings N₁, N₂ and N₃ and a line balancing network X, which may comprise a resistance included in the winding N₃; and a spring assembly 9 comprising circuit-controlling contact pairs 10, 11. The latter are shown closed, the condition they assume when the handset is removed from the cradle plunger support 12. With the handset on the support, the plunger operates on the spring assembly to open the contact pairs 10, 11. A serially-connected station signal or ringer 13 and condenser 14 may be connected across the line terminals. A condenser 15 may be connected in series with the receiver to prevent flow of line direct current through the receiver. A local source of current, for example, a battery 16, is provided at the station to supply current for the transmitter.

When the handset is removed from its support, closure of the contact pair 10 completes a local series circuit for the transmitter that comprises the transmitter, the battery, winding N₁ and contact pair 10. Closure of contact pair 11 completes a series circuit for the receiver across the line terminals comprising terminal 1, winding N₂, the receiver, condenser 15, contact pair 11, terminal 2. The winding N₃ and balancing network X remain connected across the series-connected receiver and condenser 15. The circuits just described constitute a local battery anti-sidetone telephone station circuit of the type disclosed in G. A. Campbell U. S. Patent 1,254,472, of January 22, 1918, particularly with reference to Figs. 1 and 4 thereof. If the line 3 has the characteristics of the particular line or the average line for which the station circuit was designed, and if the transmitter and the receiver have the characteristics assumed in such design, sidetone in the receiver during transmitting and receiving through the line terminal will be absent or negligible. If, however, in the particular system or installation the impedance of the line and that of the line balancing network are markedly disproportionate, or the transmitter or receiver is of considerably higher efficiency than initially contemplated, the sidetone developed in the receiver during transmitting and receiving may be appreciable. If not of a level to produce "singing," sidetone during transmitting can be tolerated since it does not affect intelligibility of the outgoing telephone currents, that is, the currents generated when the transmitter is agitated by the vocal output of the user. During receiving, however, the sidetone in the receiver resulting from alternating currents generated by agitation of the transmitter by room noises may be sufficient to interfere with the weak incoming telephone currents to such an extent as to mask the

latter or to render them partly or wholly unintelligible. This latter condition is corrected in accordance with the invention by providing the station circuit with means to connect the receiver directly across the line terminals and, in effect, to remove the transmitter from the circuit. The normally open contact pair 17, 18 of the switch 7 are connected over conductors 19, 20 to the ends of the line winding N₂ of the transformer 8. When contact 17 of the switch 7 is depressed by the fingers of the user to engage with the contact 18, the winding N₂ is short-circuited. It can be shown that in an ideal transformer short-circuiting one winding thereof for which the number of turns is not zero, short-circuits all the windings of the transformer. Short-circuiting winding N₂, therefore, effectively short-circuits the winding N₁ and the winding N₃, and even though current may be generated in the transmitter, such currents are not reproduced in either winding N₂ or N₃. At the time the winding N₂ is short-circuited, the serially-connected receiver and condenser 15 will be connected directly to the terminals 1, 2 and the incoming telephone current will be effective in the receiver without interference from sidetone resulting from room noises that may be agitating the transmitter. During transmitting the manual pressure on the switch 7 is released to remove the short-circuit on the winding N₂. Since there is no actual short-circuit placed across the winding N₁ or the transmitter, and since the local battery circuit remains unaffected, there is no abrupt flux change in the winding N₁ that might evidence itself as an objectionable "click" at the beginning and the end of the receiving or listening period, nor is the normal battery drain altered.

Although the invention has been illustrated with reference to a single embodiment, it will be understood that it is not limited thereto but is of a scope evidenced by the appended claims.

What is claimed is:

1. In combination with a telephone substation circuit adapted to be connected with a telephone line and including a multiwinding transformer and a transmitter connected in a local circuit with one of the windings of the transformer, a source of direct current for the transmitter, and means to effectively short-circuit the transformer windings during non-talking periods, while permitting direct current flow to be maintained substantially unchanged in the transmitter.

2. In combination with a telephone substation circuit adapted to be connected with a telephone line and comprising a multiwinding transformer and a transmitter connected in a local circuit including one of the transformer windings, a source of direct current for the transmitter, and means connected across another transformer winding to effectively short-circuit the transformer windings during non-talking periods while permitting direct current flow to be maintained substantially unchanged in the transmitter.

3. A telephone substation circuit adapted to be connected with a telephone line, said circuit comprising a multiwinding transformer, a transmitter, a source of direct current for said transmitter, said transmitter, current source and a winding of the transformer being connected in a local circuit, and means to effectively short-circuit the windings of the transformer during non-talking periods, while permitting direct current flow to be maintained substantially unchanged in the transmitter.

4. A telephone substation circuit adapted to be

connected with a telephone line, said circuit comprising a multiwinding transformer, a transmitter, a receiver, a source of direct current for said transmitter, said transmitter, current source and a transformer winding being connected in a local circuit, said receiver and a transformer winding being included in a receiving circuit, and means for effectively short-circuiting all transformer windings during receiving without interfering with receiving in said receiver, said means allowing current flow to be maintained substantially unchanged in said transmitter.

5. A telephone substation circuit adapted to be connected to a telephone line, comprising line terminals, a receiving circuit including a receiver and an induction coil winding serially connected across said line terminals, a local transmitter circuit inductively coupled to said receiving circuit and comprising a transmitter, a battery and a second induction coil winding, and means for disabling the induction coil when receiving at said substation, for transmission of alternating current from the local transmitter circuit to said receiver and for connecting said receiver directly across the line terminals.

6. A telephone substation circuit adapted to be connected to a telephone line, comprising line terminals, a receiving circuit including a receiver and an induction coil winding serially connected across said line terminals, a local transmitter circuit inductively coupled to said receiving circuit and comprising a transmitter, a battery and a second induction coil winding, and means for short-circuiting the first-mentioned winding and connecting said receiver directly across the line terminals.

7. A telephone substation circuit adapted to be connected with a telephone line, comprising line terminals, a multiwinding induction coil, a transmitter, a receiver, a local circuit for said transmitter including said transmitter and one winding of the induction coil, a line circuit comprising a second winding of said induction coil and said receiver connected across said line terminals, and means for short-circuiting said second coil winding during receiving at the substation,

whereby alternating currents generated in the transmitter are precluded from being introduced into the receiver during receiving.

8. A telephone substation circuit adapted to be connected with a telephone line, comprising a handset including a transmitter, a receiver and a manually-operable normally-open switch, a multiwinding induction coil and a line balancing network, a first circuit including said transmitter and one winding of said induction coil, a second circuit including said receiver and a second winding of the induction coil, and a third circuit including a third winding of the induction coil and the line balancing network, said circuits being inductively coupled through said windings, said switch being connected across one of said windings and being adapted for closure during receiving at the substation to short-circuit the windings of the induction coil, whereby alternating currents generated in the transmitter during receiving are precluded from appearing in the receiver.

9. A telephone substation circuit adapted to be connected with a telephone line, comprising line terminals, a handset including a transmitter, a receiver and a manually-operable normally-open switch, a battery, a multiwinding induction coil and a line balancing network, a local circuit including said transmitter, said battery and one winding of said induction coil, a second circuit including said receiver and a second winding of the induction coil connected across said line terminals, and a third circuit including a third winding of the induction coil and the line balancing network connected in shunt with the receiver, said circuits being inductively connected through said windings, and said switch being connected across the second winding and adapted for closure during receiving at the substation to short circuit said second winding and to connect the receiver directly across the line terminals, whereby alternating currents generated in the transmitter during receiving are precluded from appearing in the receiver.

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