

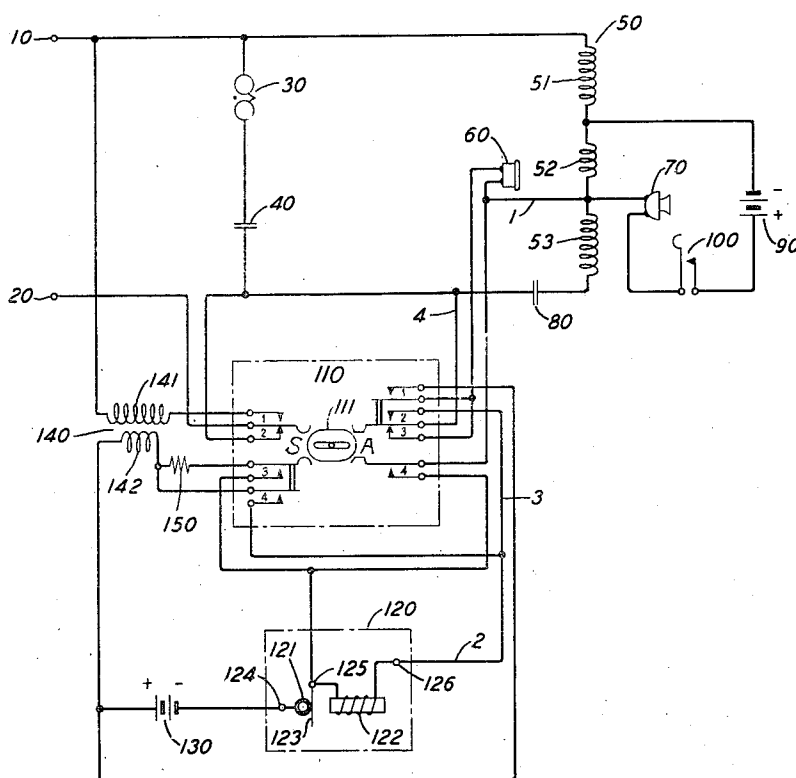
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TELEPHONE SET CIRCUIT

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TELEPHONE SET CIRCUIT

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This invention relates to telephone set circuits.

An object of this invention is to enable signaling from the circuit of a portable telephone set without the use of a hand-operated generator.

Another object of the invention is to enable the means for signaling out of a telephone set to be employed also as a portion of the receiving circuit of the set.

A further object of the invention is so to include amplifying means in the circuit of a telephone set that the amplifying means may be used alternatively for amplifying speech currents incoming to the set and for generating signaling currents for signaling out of the set.

In accordance with the invention, a telephone set circuit may embody amplifying means that, by operation of suitable switching means, may be included in the receiving circuit of the set circuit in order to amplify speech currents incoming thereto; and, alternatively, that, by operation of suitable switching means, may be included in an oscillating circuit for the generation of a signaling current for signaling out of the set circuit. The amplifying means may be a so-called mechanical amplifier, that is, one that includes a receiver element and a microphone element. The oscillating circuit including the amplifying means may be so arranged that the sustained oscillation constituting the signaling current is generated as a result of regenerative feedback connection between the microphone element and the receiver element of the mechanical amplifier.

A more complete understanding of the invention will be obtained from the detailed description that follows when read with reference to the accompanying drawing, the single figure of which is illustrative of a telephone set circuit embodying the invention.

With reference to the drawing, the circuit configuration and the character of the components of the circuit of a telephone set in accordance with this invention are shown. The telephone set comprises a pair of line terminals 10, 20, an incoming signal device or ringer 30, a condenser 40 for connection in series with the ringer, a multiwinding induction coil or transformer 50, a telephone receiver 60, a telephone transmitter 70, a condenser 80 for inclusion in the speech currents circuit of the set, a source of current or local battery 90, a normally open pair of contact springs or contacts 100, a key operated switching means or device 110, an amplifying device or means 120, a source of current or second local battery 130, a second multiwinding transformer or induction coil 140, and a resistor 150.

All of these components may be housed or supported within or on a single container or unit. The receiver and the transmitter may be included in a handset, or in a chest transmitter and headset, and be connected with the circuit through a suitable cord or cords. The telephone receiver may be of the type disclosed in L. A. Morrison et al. Patent 2,220,942, of November 12, 1940, for Acoustic device, and the telephone transmitter may be of the type shown in A. F. Bennett et al. Patent 2,042,822, of June 2, 1936, for Telephone transmitter. The amplifying means may be of the so-called mechanical amplifier type that includes a microphone element 121 and a receiver element 122 having a common diaphragm 123. The mechanical amplifier may be such as is shown in A. F. Bennett et al. Patent 2,242,284, of May 20, 1941, for Mechanical amplifier. The switching device 110 may comprise a manually operable two-position key or button 111, a contact spring pile-up or assembly S and a second contact spring pile-up or assembly A. The key 111 is shown in its neutral or mid-position under which condition contact pairs 1, 3 and 4 of assembly S are open, and contact pair 2 of assembly S is closed, and contact pairs 1, 2 and 4 of assembly A are open and contact pair 3 of assembly A is closed. When the key 111 is operated to the S position, that is, to the left, contact pairs 1, 3 and 4 of assembly S are closed, and contact pair 2 of assembly S is open. When the key 111 is moved or adjusted to its A position, that is, to the right, contact pairs 1, 2 and 4 of assembly A are closed, and contact pair 3 of assembly A is opened. The contact switch 100 may be of the so-called push-to-talk type, that is, pressure applied, for example, by the fingers of the user of the set, is required to maintain the switch closed. Provision of a push-to-talk switch insures that when the set is not in use there is no drain on the local battery 90, and that, when the set is in use, the user when not talking may economize with respect to the local battery 90 as well as minimize noise pick-up by the transmitter. It will be observed that, when the key or button 111 of the switching device 110 is in its mid or neutral position, there is no drain on the second local battery 130, the obvious circuits for that battery being open at contact pairs 3 and 4 of assembly S and at contact pairs 1, 2 and 4 of assembly A.

The multiwinding transformer 50 comprises three windings 51, 52, 53, serially connected with the condenser 80 and contact pair 2 of switch assembly S across the line terminals 10, 20. The transmitter 70, contact pair 100 and the local bat-

tery 90 constitute a series-connected circuit across winding 52 of the induction coil. The receiver 60 and contact pair 3 of switch assembly A are serially connected across the series-connected transformer winding 53 and condenser 80. The windings of transformer 50 are wound on a common core and together with the receiver and transmitter constitute an anti-side tone circuit of the type shown in schematic in Fig. 1 of K. S. Johnson, Patent 1,396,760, of November 15, 1921, for Signaling circuit. The winding 53 is proportioned so as to include sufficient resistance to constitute the balancing resistance or network in shunt with the receiver.

When signaling current is incoming to the telephone set circuit at the terminals 10, 20 thereof, supplied, for example, over a suitable line, for example, the standard stranded steel wire telephone pair such as is used in military field telephone systems, and from an exchange or switchboard, for example, at the field headquarters point, the ringer 30 is actuated over a path from line terminal 10, ringer 30, condenser 40, contact pair 2 of switch assembly S to terminal 20. With the receiver 60 at his ear and the transmitter 70 adjacent his mouth, the called party, after closing the push-to-talk switch 100, may respond and transmit speech currents out of the set circuit through the line terminals 10, 20, and receive speech currents incoming over the telephone line through the terminals 10, 20.

If the attenuation over the telephone line or pair is severe, or if the noises or other disturbances in the vicinity of the set circuit are unduly great, the speech currents incoming to the set circuit may be amplified in the receiver 60 by adjusting the key or button 111 of the switching device 110 to its A position. Contact pairs 1, 2 and 4 of switch assembly A are closed and contact pair 3 of switch assembly A is opened as a result of this adjustment, and the amplifying means 120 is connected in the receiving circuit of the set. The opening of contact pair 3 of assembly A opens the normal circuit for the receiver 60, and the closure of contact pairs 1 and 4 of assembly A closes a local circuit for the receiver 60 that comprises receiver 60, contact pair 4 of assembly A, microphone element 121 of the amplifying means, local battery 130, contact pair 1 of assembly A back to the receiver 60. Closure of contact pairs 2 and 4 of assembly A substitutes the receiver element 122 of the amplifying means for the receiver 60 over the following circuit: Common terminal of windings 52 and 53 of transformer 50, wire 1, contact pair 4, receiver element 122, wires 2, 3, contact pair 2, wire 4, to the line terminal side of condenser 80. For this adjustment of the switching device 110, incoming speech currents do not directly traverse receiver 60 but flow through the receiver element of the amplifying means. Since the receiver element is coupled to the microphone element of the amplifying means, and the receiver 60 is connected in series circuit with the microphone element and battery 130, the variation in the resistance of the microphone element in response to the speech current flow in the receiver element produce amplified variations of the current flow in such local circuit, whereby the effects of severe attenuation in the telephone line or of the noise or other disturbing conditions at the telephone set, are overcome or minimized. When the set circuit is not in use, the key or button 111 should be restored to its neutral or mid-position, thereby restoring assembly A to

the condition shown on the drawing, whereby the local amplifying circuit for the receiver 60 is opened, relieving the battery 130 of any strain thereon.

The procedure to be observed when it is desired to signal out of the set is as follows: The key or button 111 of the switching device 110 is adjusted or moved to its S position, whereby contact pairs 1, 3 and 4 of switching assembly S are closed and contact pair 2 of assembly S is open. The opening of the latter-mentioned contact pair 2 disconnects the transmitting, receiving and incoming signaling circuit from across the line terminals. Closure of contact pair 1 of assembly S connects the secondary winding 141 of transformer 140 across the line terminals. Closure of contact pairs 3, 4 of assembly S completes a local circuit for the microphone element of the amplifying means and a local circuit for the receiver element of the amplifying means. The local circuit for the microphone element may be traced from terminal 124, battery 130, primary winding 142 of transformer 140, resistance 150, contact pair 3 of assembly S, terminal 125, microphone element 121 to terminal 124. The local circuit for the receiver element may be traced from terminal 125, receiver element 122, terminal 123, contact pair 4 of assembly S, resistance 150, contact pair 3 of assembly S, back to terminal 125. It is apparent that the resistance 150 is common to the two local circuits for the amplifying means. This resistance constitutes a feedback element for coupling the two local circuits, whereby energy in the local circuit of the microphone element is fed back to the local circuit of the receiver element to be further amplified in the microphone element circuit. This regenerative process, by appropriate proportioning of the resistance 150, may be allowed to proceed to the sustained oscillation point which, with a voice frequency mechanical amplifier of the aforesaid Bennett et al. Patent 2,242,284, may provide an electric wave of a frequency of the order of 1000 cycles per second. The electric wave generated in the microphone element local circuit is induced in the secondary winding of the transformer 140 and applied through the terminals 10, 20 to the telephone line connected to the latter. At the central office or switchboard, the signaling current transmitted thereto from the telephone set circuit may be employed to actuate a relay to energize a line lamp or to operate a signal drop.

Although this invention has been disclosed with reference to what is believed at this time to be a preferred embodiment thereof, it will be understood that it is not limited thereto but is capable of other exemplifications without departing from the spirit or scope of the inventive concept disclosed.

What is claimed is:

1. A telephone set circuit including means for generating signaling current to be transmitted out of said circuit, said means comprising an amplifier, a normally-open feedback connection for said amplifier, and means to close said connection for regenerative feedback therethrough whereby said amplifier generates sustained current for transmission out of said set circuit.

2. A telephone set circuit including line terminals, an incoming-signal circuit, a speech current receiving and transmitting circuit, said signal and speech circuits being normally connected across said terminals, and means for signaling out of the set circuit through said line terminals,

said means comprising an amplifier, a normally-open feedback connection for said amplifier, and means simultaneously to disconnect said incoming-signal circuit and said speech circuit from said line terminals, to connect said signaling-out means to said line terminals, and to close said feedback connection for regenerative feedback through the latter.

3. A telephone set circuit comprising means for signaling out of said circuit, said means including a mechanically interconnected microphone element and receiver element, a multiple winding transformer, a resistor, a normally-open series circuit comprising said microphone element, a source of current, one transformer winding and said resistor, a normally-open series circuit for said receiver element comprising said receiver element and said resistor, and means to close said normally-open circuits whereby said normally-open circuits are regeneratively interconnected through said resistor.

4. A telephone set circuit comprising a receiving circuit including a receiver, an amplifier, and means for connecting said amplifier in circuit with said receiver to amplify speech currents incoming to said receiving circuit and alternatively for connecting said amplifier so as to oscillate for signaling out of said set circuit.

5. A telephone set circuit comprising a speech current receiving circuit including a receiver, an amplifier, means for connecting said amplifier in circuit with said receiver to amplify speech currents incoming to said receiving circuit, and means for interconnecting the output and the input of said amplifier for regenerative feedback such that the amplifier is caused to generate oscillations for signaling out of said set circuit.

6. A telephone set circuit comprising a speech current receiving circuit including a receiver, an amplifier of the type including a microphone element and a receiver element, means for connecting said amplifier in said receiving circuit to amplify speech currents incoming to said receiving circuit, and means to interconnect said microphone and receiver elements so that the amplifier generates oscillations for signaling out of the set circuit.

7. A subscriber's station comprising a receiving circuit including a receiver, a transmitting circuit including a transmitter, means for signaling out of said set circuit, and line terminals to which said circuits are connected; said means comprises a mechanically-interconnected microphone element and receiver element, a multiple winding transformer, a resistor, a normally-open series circuit comprising said microphone element, a source of current, one transformer winding and said resistor, a normally-open series circuit for said receiver element comprising said receiver element and said resistor, and means to close said normally-open circuits whereby said normally-open circuits are regeneratively interconnected through said resistor, the oscillatory current in the transformer winding being transmitted out of the station through a second transformer winding and said line terminals.

8. A telephone set circuit comprising a speech current receiving set including a receiver, an amplifier of the type including a microphone element and a receiver element, means for substituting the amplifier-receiver element in said receiving circuit for said receiver and for connecting

said amplifier-microphone element in a series circuit with said receiver to amplify speech current incoming to the receiving circuit, and means for interconnecting said microphone and receiver element so that the amplifier generates oscillations for signaling out of the set circuit.

9. A telephone set circuit including means for generating signaling current for transmission out of said circuit, said means comprising an amplifier of the type including a microphone element and a receiver element, a normally-open feedback connection for interconnecting said microphone element and said receiver element, and means to close said connection for regenerative feedback therethrough.

10. A telephone set circuit including means for generating signaling current for transmission out of said circuit, comprising an amplifier of the type including a microphone element and a receiver element, a normally-open local circuit for said microphone element including an impedance, a normally-open local circuit for said receiver element including said impedance, and means to close said normally-open circuits whereby said local circuits are regeneratively interconnected through said impedance.

11. A telephone set circuit including means for generating signaling current for transmission out of said circuit, said means comprising an amplifier including a microphone element and a receiver element, a normally-open local circuit for said microphone element including a resistance, a normally-open local circuit for said receiver element including said resistance, and means for closing said normally-open local circuits whereby said local circuits are regeneratively interconnected through said resistance.

12. A telephone set circuit including line terminals, an incoming signal circuit, a speech current receiving and transmitting circuit, said signal and speech circuit being normally connected across said terminals and said speech circuit including a receiver, an amplifier comprising a microphone element and a receiver element, a normally-open feedback connection between said microphone and receiver elements, means for simultaneously substituting the amplifier-receiver element for said receiver in the speech circuit and for connecting said receiver and the amplifier-microphone element in a local series circuit, and means for simultaneously disconnecting said incoming signal circuit and said speech circuit from said line terminals, closing said feedback connection to establish regenerative interconnection between the microphone element and the receiver element, and connecting said regeneratively coupled amplifier to said line terminals.

13. A telephone set circuit including line terminals, a speech current receiving and transmitting circuit, an amplifier, means for connecting said amplifier in said speech circuit for the amplification of speech current received therein, and means for converting said amplifier into an oscillator for the generation of current for signaling out of said set circuit.

14. The circuit of claim 13 in which said converting means simultaneously disconnects the speech circuit from the line terminals, establishes an oscillatory regenerative connection within the amplifier, and connects the converted amplifier to the line terminals.

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