

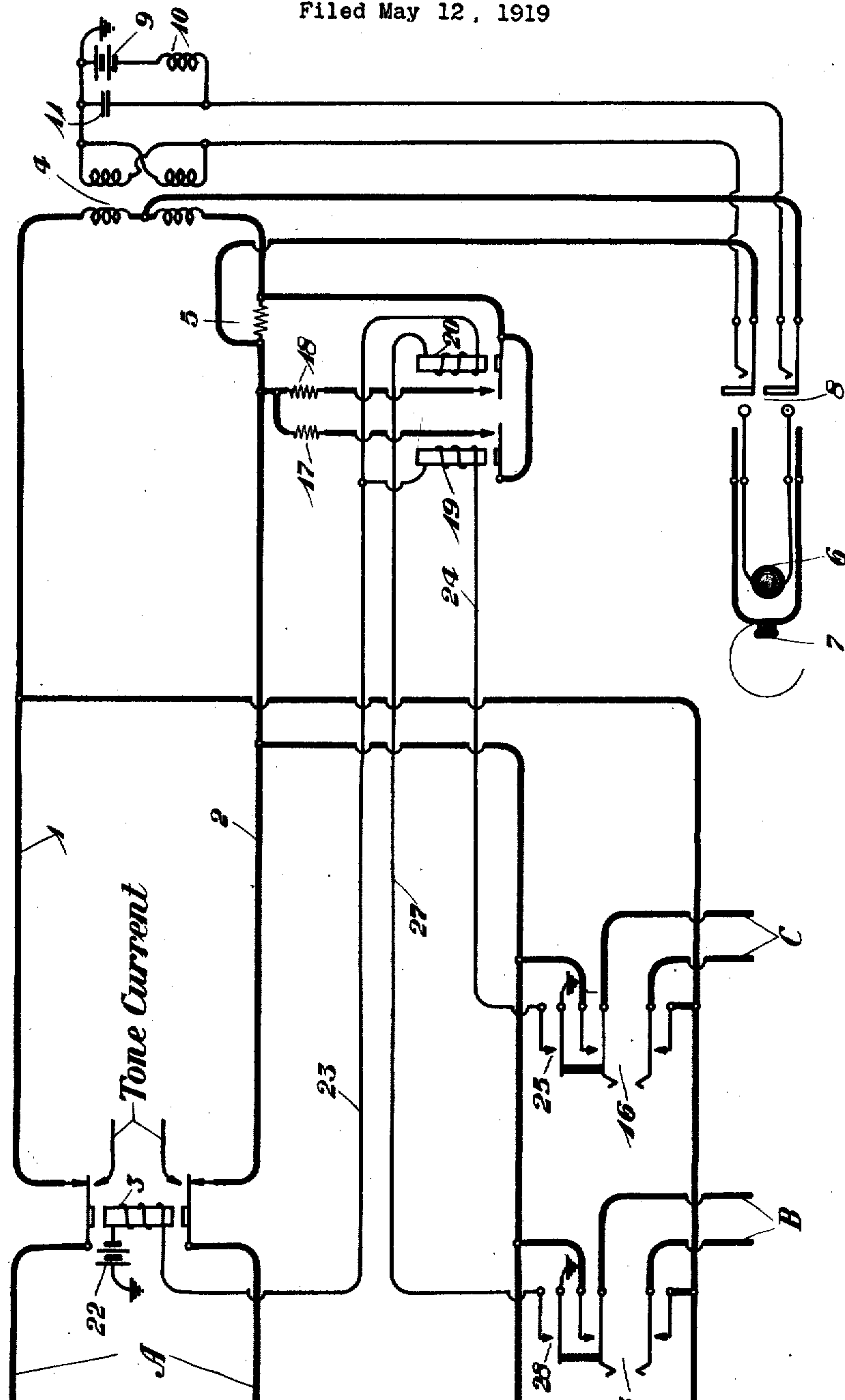
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APPARATUS AND CIRCUITS FOR PREVENTING SIDE TONE

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APPARATUS AND CIRCUITS FOR PREVENTING SIDE TONE.

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To all whom it may concern:

Be it known that I, JOHN F. TOOMEY, residing at New York, in the county of New York and State of New York, have
5 invented certain Improvements in Apparatus and Circuits for Preventing Side Tone, of which the following is a specification.

Side tone is caused by the flow of current from the transmitter of a telephone
10 sets.

Side tone is caused by the flow of circuits from the transmitter of a telephone set through the receiver thereof. It is objectionable because the user of a telephone
15 hears in the receiver not only the voice of the person with whom he is engaged in conversation, but also his own voice, as well as noises reaching his transmitter from adjacent sources. One well known manner in which
20 side tone may be eliminated consists in balancing the line by a device having like impedance and shunting the receiver across the line, so that, like the galvanometer of a balanced Wheatstone bridge, it receives
25 no current from the transmitter of the same set. The balancing impedance is fixed in value and generally designed to balance the average subscriber's line. Although this arrangement is satisfactory for sets which are
30 usually connected to lines of about equal length and impedance, it is ineffective to prevent considerable side tone in sets which are frequently connected to lines of widely differing impedance characteristics, and the
35 side tone is particularly objectionable when such sets are located in noisy places, such as central offices. The set of a toll tandem operator, for example, is particularly subject to noise, for when this set is balanced
40 for the local call circuits it is far out of balance for toll call circuits, and vice versa.

To reduce the side tone under such conditions, this invention provides apparatus and circuits whereby the balancing impedance is varied automatically according to
45 the impedance of the line with which the set is associated.

This invention may be readily understood by considering the following description,
50 with reference to the accompanying drawing which, in diagrammatic form, shows one arrangement of the apparatus and circuits embodying this invention.

In this drawing, reference character A
55 designates a long distance call circuit nor-

mally associated by means of a relay 3 with switchboard conductors 1 and 2. In series with these conductors is connected the secondary winding of a transformer 4 and an impedance device 5. A telephone trans-
60 mitter 6 of an operator's set may be associated with the primary winding of transformer 4 by means of the tip contacts of jacks 8. The current for the transmitter is supplied by a battery 9 in series with a re-
65 actance coil 10, and a condenser 11 is shunted across the battery and the retardation coil, as usual, to afford a path of low impedance to the voice currents. The receiver
70 7 may be bridged across conductor 2 and the midpoint of secondary winding of transformer 4 by means of the sleeve contacts of the jacks 8. The impedance of the de-
75 vice 5 is approximately equal to that of the line A so that the drop of potential therein is substantially equal to the drop in the line. The points at which the receiver 7 is connected to the circuit are therefore of
80 equal potential relative to current impressed on conductors 1 and 2 by transformer 4 so that none of the output current of the trans-
mitter enters the receiver. In other words, receiver 7 is conjugate to transmitter 6.

Reference characters B and C designate local call circuits differing in length from
85 each other and from circuit A, which call circuits may be associated with conductors 1 and 2 by means of keys 15 and 16, respectively. These circuits are of much lower
90 impedance than the toll line A and impedance 5 is too large for a proper balance. To lower the impedance of the device 5 there are provided impedances 17 and 18 which
95 may be connected in parallel with impedance 5 by means of relays 19 and 20 respectively. These relays are connected in series with relay 3, the circuit of relay 19,
100 for instance, extending from battery 22, through the winding of relay 3, conductor 23, relay 19, conductor 24, contact 25 of key 16 to ground. When this key is oper-
ated battery 22 energizes relays 3 and 19 and causes the former of these to disconnect
105 line A from conductors 1 and 2 and apply a source of tone current to the line to indicate that the operator is connected to another call circuit. The relay 19 also closes
its contact and thus connects impedance 17 in parallel with the impedance 5. The im-
110 pedance 17 of such value that the combined

impedance of devices 17 and 5 in parallel is approximately equal to that of line C. Conjugacy between receiver 7 and transmitter 6 is thus maintained. The circuit of relay 20 is the same as that of relay 19 except that it extends through the wire 27 to ground at contact 28 on key 15, so that this relay is operated in conjunction with relay 3 when the operator manipulates key 15. Relay 20 connects impedance 18 in parallel to impedance 5, the impedance of device 18 being of such value that the parallel impedance of devices 5 and 18 is substantially equal to that of line B. Conjugate relationship between receiver 7 and transmitter 6 is thus maintained when the telephone set is associated with circuit B.

It is readily understood that, although only three lines are shown herein, any number of other lines of different impedances may be associated with the set by additional keys and connections, and that proper balance for each of these may be maintained by other impedances controlled by other relays. It should further be noted that all the lines of approximately like impedance may have the same balancing impedance device associated therewith. Thus it is rendered possible by this invention to obtain for each line sufficiently close balance to render the side tone practically ineffective to interfere with the conversation.

Although only one form of embodiment of the invention is shown and described herein it is readily understood that various changes and modifications may be made therein within the scope of the following claims without departing from the spirit and scope of the invention.

What is claimed is:

1. In combination, a plurality of telephone lines, a telephone set, an impedance device associated with said set and adapted to be connected in series in one of said lines, and means for associating said set with any one of said lines and adjusting the impedance of said impedance device according to the impedance of the line with which said set is associated.

2. In combination, a plurality of telephone lines, a telephone set normally connected to one of said lines, an impedance device normally associated with said set for balancing currents from the transmitter of said set to the said line and associated impedance, in respect to the effect of said currents on the receiver, and means for selectively associating the set with another of said lines instead of with said one line, and for changing the impedance of said device to accord therewith.

3. In combination, a telephone set, a plurality of telephone lines one of which is normally connected with said set, switching devices for selectively associating any other

said line with said set, an impedance device corresponding to said normally connected line, said impedance device being normally connected to said telephone set, supplemental impedance devices adapted to be connected to modify the impedance afforded by the first mentioned impedance device, relays for said supplemental impedance devices for associating them with the lines to balance the currents from the transmitter of said telephone set to the line and associated impedance, with respect to the effect of said currents on the receiver of said set, and circuits for said relays governed by the said switching devices.

4. In combination, a plurality of telephone lines, a telephone set, a first relay normally associating one of said lines with said set, an impedance device for balancing currents from the transmitter of said telephone set to the line and associated impedance, in respect to the effect of said currents on the receiver of said set, a switching device for associating another of said lines with said set, a second impedance device, a second relay for associating said second device with said set in balancing relationship and a circuit for governing said first and second relays by said switching device.

5. In combination, a telephone line, an impedance device associated therewith for balancing the impedance of the line, a telephone set having its receiver and transmitter associated with said line approximately in conjugacy, a second telephone line, means for dissociating said first line from said set and associating said second line therewith, and means for changing the impedance of said device into substantial balance with said second line.

6. In combination, a telephone line, an impedance device associated therewith for balancing the impedance of the line, a telephone set having its receiver and transmitter associated with the line approximately in conjugacy, a second telephone line, a switching device for associating said second line with said set, a relay for dissociating said first line from said set, a correcting impedance device, a relay for associating said correcting impedance device with said first impedance device and a circuit for controlling said relays by said switching device.

7. In combination, a telephone set comprising a transmitter and a receiver associated in conjugate relationship, a plurality of telephone circuits differing in impedance, means for selectively associating said set with said circuits, and means for retaining said transmitter and receiver in substantial conjugacy irrespective of the telephone circuit with which the set is associated.

8. In combination, a transmitter, a re-

ceiver, a circuit comprising a line and a local impedance, in which circuit said transmitter and receiver may be connected in conjugate relationship, and means to change their connection to a line of different electrical characteristics and at the same time change the local impedance so as to preserve the conjugate relationship of said transmitter and receiver.

9. In combination, a transmitter, a receiver, a plurality of lines, an adjustable impedance, and means to connect said transmitter and receiver with any one of said lines and at the same time to adjust the said impedance, said connection and adjustment being such that the said transmitter and receiver are in all cases in conjugate relationship.

10. In combination, a plurality of telephone lines, a telephone set, an impedance device associated with said set and adapted

to be balanced against the line for currents from the transmitter of said set, and means for associating said set with any one of said lines and simultaneously adjusting the impedance of said impedance device according to the impedance of the line with which said set is associated.

11. In combination, a plurality of telephone lines, a telephone set having its transmitter and receiver associated with one of said lines in conjugate relationship, an impedance device in the line, and means for associating said set with any other line and adjusting the impedance of said impedance device according to the impedance of the line with which said set is associated.

In testimony whereof I have signed my name to this specification this 8th day of May, 1919.

JOHN F. TOOMEY.