(No Model.)

C. E. SCRIBNER.

TELEPHONE CIRCUIT.

No. 563,322. Patented July 7, 1896.

Fig. 1

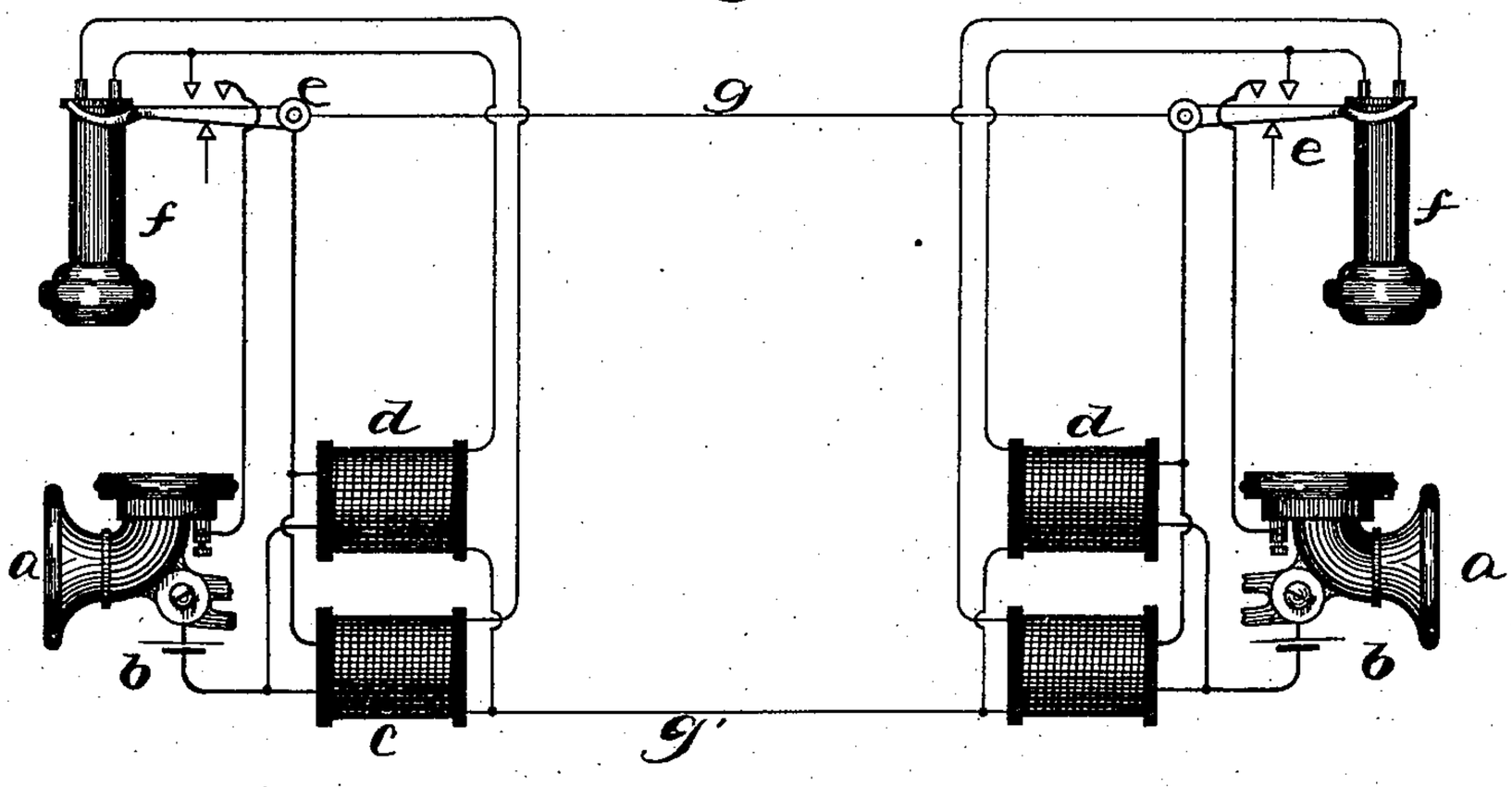
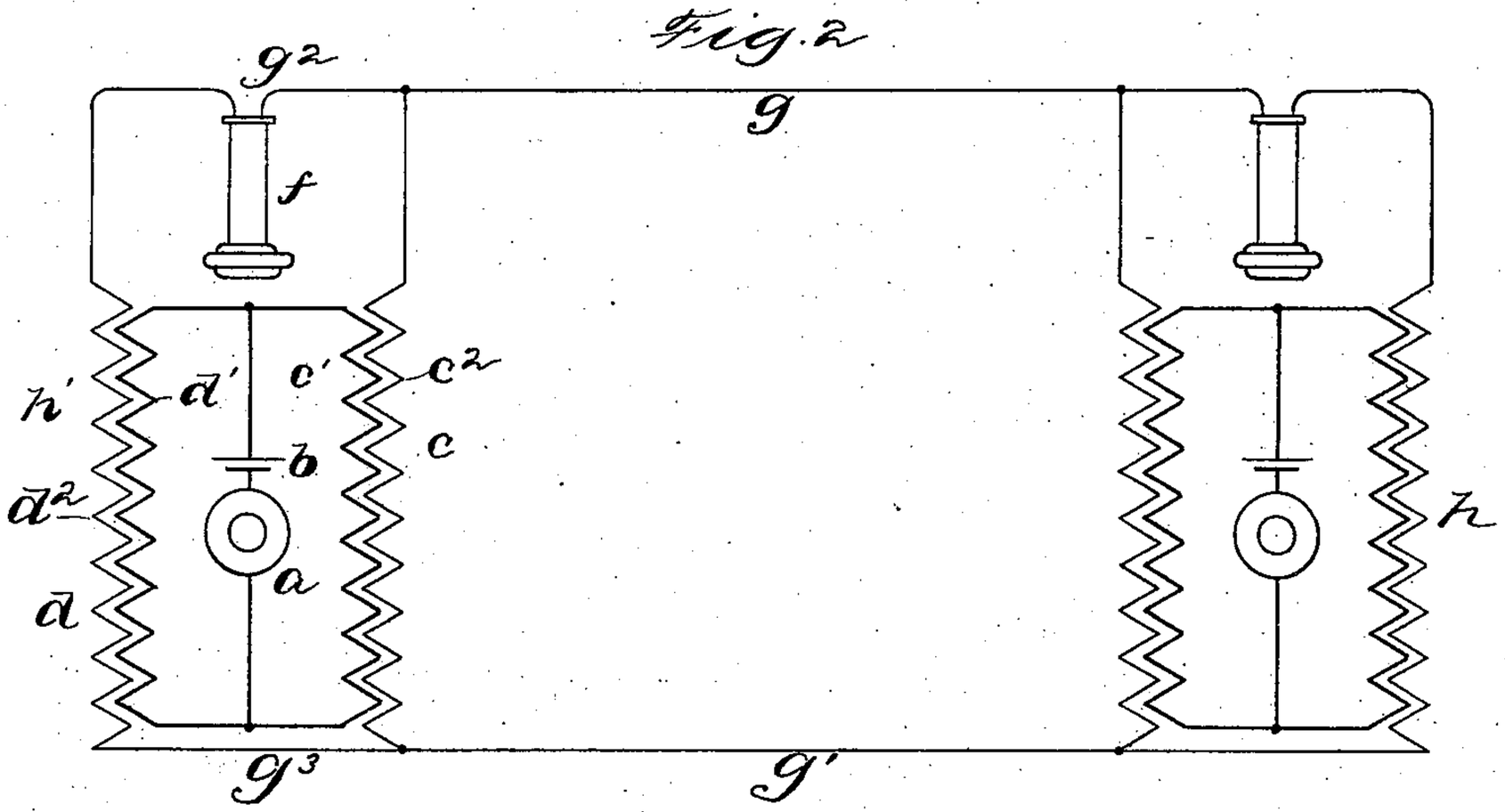


Fig. 2



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UNITED STATES PATENT OFFICE.

CHARLES E. SCRIBNER, OF CHICAGO, ILLINOIS, ASSIGNOR TO THE WESTERN ELECTRIC COMPANY, OF SAME PLACE.

TELEPHONE-CIRCUIT.

SPECIFICATION forming part of Letters Patent No. 563,322, dated July 7, 1896.

Application filed June 16, 1893. Serial No. 477,860. (No model.)

To all whom it may concern:

Be it known that I, CHARLES E. SCRIBNER, a citizen of the United States, residing at Chicago, in the county of Cook and State of Illinois, have invented a certain new and useful Improvement in Telephone-Circuits, (Case No. 337,) of which the following is a full, clear, concise, and exact description, reference being had to the accompanying drawings, forming a part of this specification.

My invention relates to the arrangement of telephone-receivers and microphones in connection with each other, its object being to prevent the "side tone" produced in a telephone-receiver by vibrations of its own microphone.

As is well known in the art of telephony, the transmitting-microphone of a set of telephone instruments is ordinarily connected in a local circuit including the primary helix of an induction-coil whose secondary helix is included with the magnet of the telephone-receiver in the line-circuit. With this arrangement the continual accidental vibration of the microphone produces sounds in the telephone-receiver which mask or obscure the vocal sounds reproduced in the receiver while the latter is in use; while when the microphone is in use the tones in the telephone-receiver are frequently so loud as to necessitate the removal of the telephone from the ear, which is inconvenient and may involve the loss of the reply.

In another application, Serial No. 477,859, filed June 16, 1893, (Case No. 336,) I have described a system for accomplishing this same object, in which a telephone-receiver is in parallel circuit with an induction-coil, which acts to produce a condition of no difference of potential between the terminals of the receiver.

In my invention herein I avoid the side tone in the telephone-receiver by placing the receiver and the secondary helix of the microphone induction-coil in separate parallel branches of the line-circuit, the electrical conditions of the two branches being so arranged that a telephonic current from the microphone induction-coil does not find circuit through the other branch of the circuit containing the telephone-receiver, while telephonic current induced at the distant station finds circuit in greater part, or almost wholly, through the branch containing the telephone-receiver. I connect in circuit in the branch including the receiver the secondary helix of an induction-coil whose primary helix is in circuit with the microphone, the mutual induction between the said primary and secondary helices being so adjusted in amount and direction that the electromotive force at the terminal points of the branch containing the receiver is very slightly less than and in the same direction as the electromotive force produced by the main induction-coil in the other branch, so that only an extremely feeble current is shunted through the branch containing the receiver while the microphone is in use; and I construct the main induction-coil in the other branch to have such high impedance as to prevent the shunting through it of telephonic current from the line-circuit, whereby the telephonic current from the distant station is directed through the branch containing the telephone-receiver. I am thus enabled to avoid the side tone in the receiver without detracting from the efficiency of the instrument. Indeed, I produce incidentally an increase of the efficiency of the instruments, since I am enabled to eliminate from the line-circuit the impedance of either the telephone-magnet or the secondary helix of the main induction-coil while the other is performing its function.

My invention is illustrated in the accompanying drawings, and may be more fully described in connection therewith.

In Figure 1 of the drawings I have represented two telephone-stations, each equipped with well-known apparatus and organized in accordance with my invention, the stations being connected together by a telephone-line. Fig. 2 is a diagram showing in simplified form the circuit connections of the same instrument.

In Fig. 1 a long-distance transmitter or microphone *a* is shown at each station in a local circuit including a battery *b* and the primary helices of two induction-coils *c* and *d*. The local circuit is normally maintained open by

means of an ordinary gravity telephone-switch e, adapted to support the telephone-receiver f. The latter is connected in a normally open branch between the telephone-lines g g', the branch being adapted to be closed by means of the switch-contacts of the switch e in the usual manner.

As will be seen in Fig. 2, the secondary helix c^2 of the induction-coil c is connected in a branch between the sides g g' of the line-circuit. The telephone-receiver f is included in another branch of the line-circuit, together with the secondary helix d^2 of the induction-coil d. The primary helices c' and d' of the induction-coils, respectively, are connected in parallel branches of the local circuit including the transmitter a and the battery b. The secondary helix c^2 is constructed in practice to have a high impedance, so as to prevent the shunting through it of telephonic currents over lines g g'. Obviously its impedance does not prevent its successful operation in transmitting telephonic currents to the line-circuit, since it is then the source of electromotive force. The secondary helix d^2 of coil d need not be of especially high impedance. The coil is so adjusted or arranged, however, that when the microphone a is in operation the helix d^2 has impressed upon it an electromotive force sufficient to produce a difference of potential between the points g^2 g^3 very slightly less than the electromotive force generated by the helix c^2 and in the same direction, as represented by the arrows in the figure. This adjustment of the electromotive force of the helix d^2 may be accomplished in any of several well-known ways—for example, by the proper proportioning of the number of turns in the two helices, by varying the mutual induction between them, or by including in the circuit of the primary helix d' a suitable non-inductive resistance.

When the proper adjustment of the potential between points g^2 g^3 has been reached, an undulatory current produced by the microphone a' will induce an electromotive force in the secondary helix c^2, which will create a current in the line-circuit g g'. Only a very small portion of the current will find circuit through the telephone-receiver f and the helix d^2 on account of the opposing electromotive force of the latter helix. Thus the side tone is eliminated while the efficiency of the induction-coil c remains practically undiminished. It will be noted also that the telephone-receiver f is not in circuit in the line while the microphone is in use, whereby its detrimental resistance and self-induction are avoided. On the other hand, when telephonic current produced at the distant station, as at station h in the drawings, flows over lines g g' to the station h', it does not pass through the helix c^2 on account of the great impedance of the helix, but is directed through the telephone f and the helix d^2, thus energizing the receiver-magnets and reproducing in the receiver the sounds spoken into the transmitter at the station h.

The primary helices c' d' of the induction-coils may be connected in series in the same circuit, if desired; but I have found it preferable to place them in parallel, as shown, since in that case currents flowing from the distant station through the helix d^2 will induce in the primary helix d' a current of such direction that its passage through the primary helix c' will induce in its secondary c^2 an electromotive force opposing the passage of current from the lines g g' through the helix c^2, and thus still further increase the efficiency of the system.

Obviously, my invention is not limited to its application in connection with telephones and microphones, but may be employed in any combination of a source of alternating current and a receiving instrument for the same in which it is desirable to prevent the operation of the receiving instrument by the source of current.

Having thus described my invention, I claim as new and desire to secure by Letters Patent—

1. The combination with a line-circuit, of a receiving instrument and a source of current connected with the line at one station, and at another station a receiving instrument and a source of current in different parallel branches of the circuit, and a source of electromotive force in the branch with the receiving instrument adapted to oppose the passage through the receiving intrument of current from the said source in the other branch, substantially as described.

2. The combination in a telephone-circuit, of a source of telephonic undulatory current and a telephone-receiver in separate parallel branches of the circuit, and, included in the branch with the receiving instrument, a source of undulatory or alternating electromotive force corresponding in phase and direction to that of the said source of current and nearly equal in amount to the difference of potential set up between the terminals of the branch including the receiver by the said source of current, whereby the shunting of the telephonic currents from the said source of current through the receiving instrument is prevented, substantially as described.

3. The combination in a telephone-circuit divided into two parallel branches at a station, of a telephone-receiver in one of the branches, and an induction-coil having its secondary helix included in the other branch and its primary helix in circuit with the local microphone, and, included in the branch with the telephone-receiver, a source of undulatory or alternating electromotive force corresponding in phase and direction with that produced by the said secondary helix while the microphone is in operation, the electromotive force of said source being almost or quite equal in amount to the difference of potential produced by the

said secondary helix between the terminals of the branch containing the receiver, whereby the side tone is prevented.

4. In combination in a telephone-circuit divided into two parallel branches at a station, a telephone-receiver in one of the branches, a secondary helix of an induction-coil included in each of the branches, each of said secondary helices being placed in inductive relation with a primary helix connected with means for producing undulatory currents corresponding to sound-vibrations, the secondary helix in the branch with the telephone being adapted to have an electromotive force corresponding in phase and direction to that in the other secondary helix and slightly less in amount than the difference of potential set up between the terminals of the branch including the telephone by the other helix, whereby the side tone in the telephone is avoided.

5. The combination in a telephone-circuit divided into two parallel branches at a station, of two induction-coils having their secondary helices in the different branches, respectively, and their primary helices connected in separate parallel branches of a local microphone-circuit, the secondary helix in the branch with the telephone being adapted to have an electromotive force sufficient to practically prevent the shunting of current from the other branch through the branch containing the telephone, substantially as described.

6. The combination with a telephone-circuit divided into two parallel branches at a station, of a source of telephonic undulatory current in one of the branches, a telephone-receiver in the other branch, and, in the branch with the telephone, a source of undulatory electromotive force corresponding in phase and direction with that of the source of current in the other branch and sufficient in amount to create a difference of potential between the terminals of its branch slightly less than the electromotive force of the source of current in the other branch, the latter branch being constructed to have a high impedance, whereby the shunting through the telephone of telephonic current produced by the source of current in the other branch is prevented while incoming telephonic currents are directed through the telephone-receiver, substantially as described.

In witness whereof I hereunto subscribe my name this 9th day of May, A. D. 1893.

CHARLES E. SCRIBNER.

Witnesses:
ELLA EDLER,
LUCILE RUSSELL.