(No Model.)

J. S. STONE.

TELEPHONE CIRCUIT AND APPARATUS.

No. 560,762. Patented May 26, 1896.

Fig. 1.

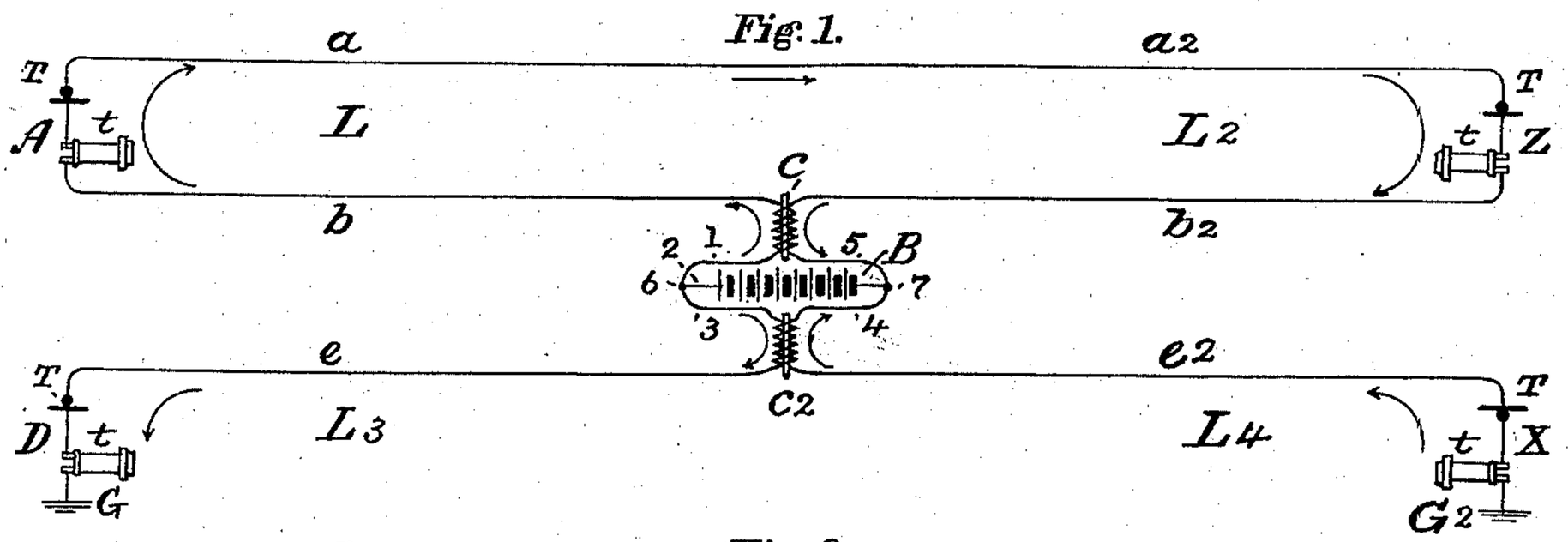


Fig. 2.

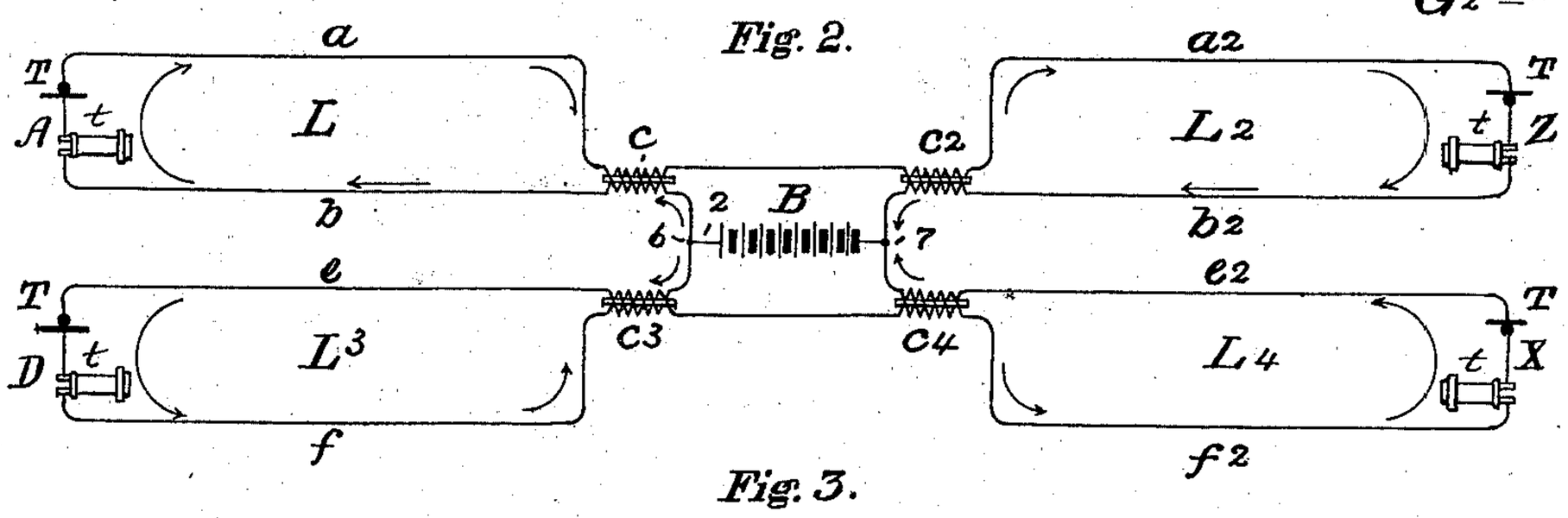


Fig. 3.

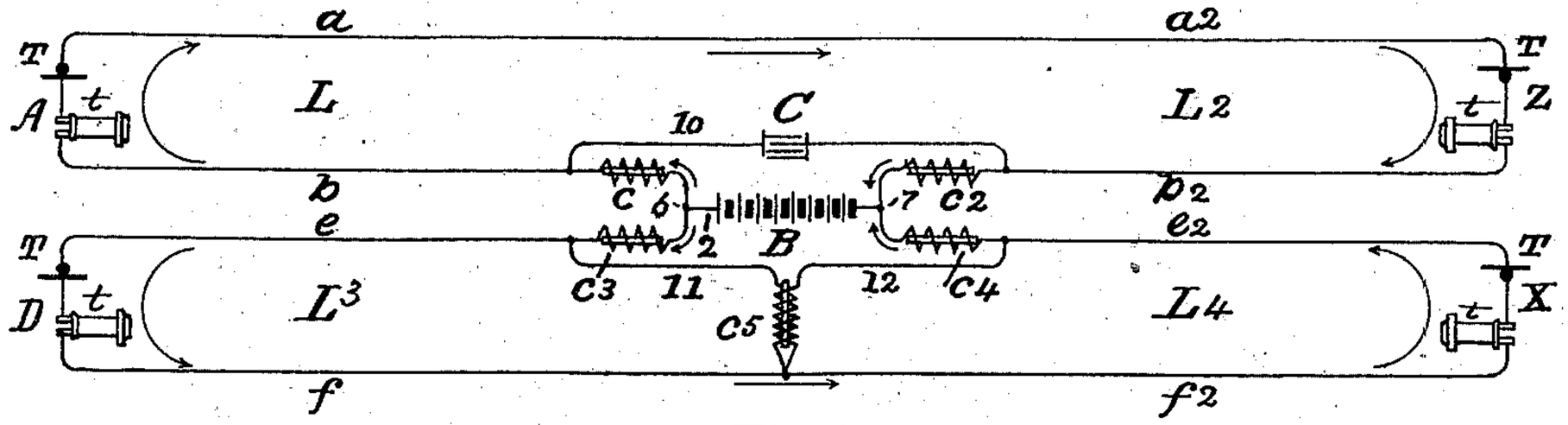


Fig. 4.

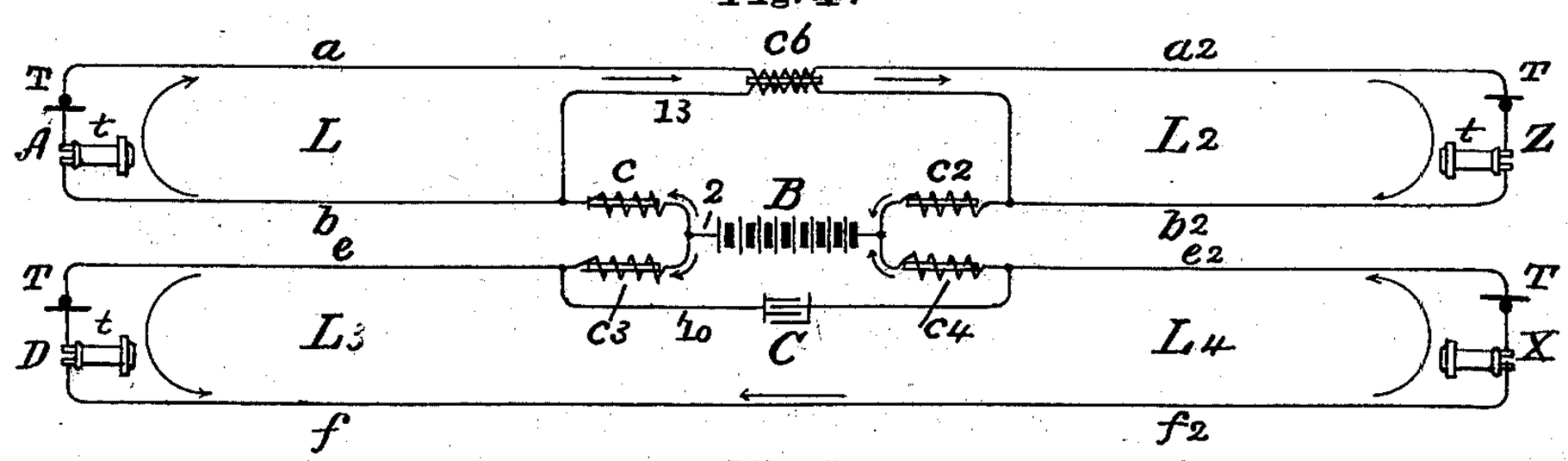
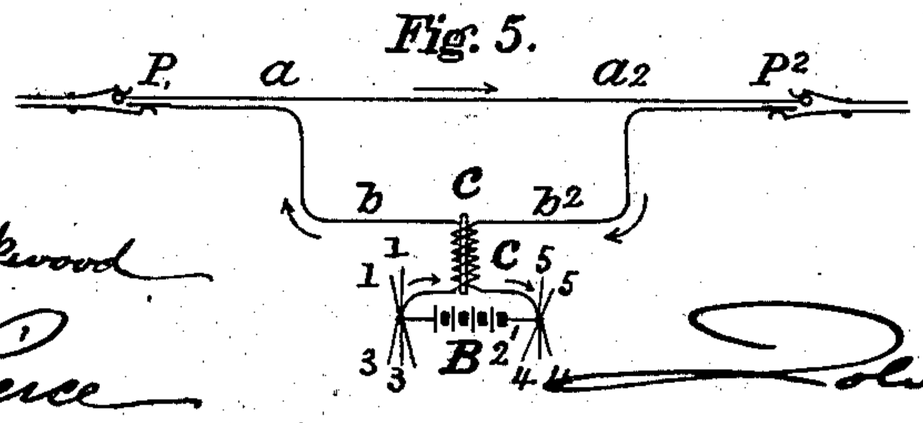


Fig. 5.



Attest.

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TELEPHONE CIRCUIT AND APPARATUS.

SPECIFICATION forming part of Letters Patent No. 560,762, dated May 26, 1896.

Application filed April 2, 1896. Serial No. 585,969. (No model.)

To all whom it may concern:

Be it known that I, JOHN S. STONE, residing at Boston, in the county of Suffolk and State of Massachusetts, have invented certain Improvements in Telephone Circuits and Apparatus, of which the following is a specification.

The present invention relates to the transmission of speech between telephone-substations whose transmitters are supplied with current from a common source located at the central or other convenient station.

It particularly relates to means in such a system of current supply whereby a plurality of substation-circuits may each receive current from the same generator and whereby the said current in any of the circuits may be varied by means of sound-waves without producing telephonic disturbances in the other circuits.

The invention comprises the combination of such a system with an electromagnetic device or an association of electromagnetic devices so constructed and connected in the circuit that the telephonic variations or voice-currents into which the current supplied to any circuit is molded by the operation of the transmitter of such circuit shall have their passage to the receiving-telephone of the same circuit facilitated or promoted, while the passage of the said variations between one circuit and another, or more particularly between the transmitter of one circuit and the receiver of another, shall at the same time be opposed and prevented. This is accomplished by arranging the electromagnetic devices of the circuits respectively so that their windings constitute a repeating induction-coil between the transmitter and receiver belonging to the circuit and constitute choking or impedance coils interposed between the said circuit and any other circuit.

The invention consists, likewise, in associating with the conductors of two connected substation-circuits and in series therewith impedance-coils, which when wound with two helices operate also as repeating-coils, and may be located in the operator's cord-circuit and in series with the low-resistance common source of current, while when wound with one helix they act simply as impedances to prevent the passage of disturbing currents.

I have devised several ways in which the invention may be applied to such circuits—as, first, one such impedance and repeating coil may be used in the sleeve-conductor of the operator's cord-circuit with each plug-sleeve connected in series with one of its helices and with the common battery, and, second, such impedance and repeating coils may be used in each plug-circuit and the tip-conductor thereof connected in series with one of the helices of the first and second coils and the sleeve-conductor connected in series with one helix of the first coil, the common battery, and a helix of the second coil.

The invention also consists in the interposition in one conductor of the cord-circuit and in series therewith of two impedance-coils and the common battery, and of a loop or shunt around said coils and battery, each side of which constitutes a bridge between the two cord conductors, in which are located the helices of an inductive coil in parallel with each other; or, if desired, the said loop or shunt may include one helix of a repeating-coil whose other helix is in series with the opposite cord conductor.

In the several modifications and variations of the invention the impedance and repeating coils are so wound as to be non-inductive to current passing in series through them and through the compound talking-circuit from one connected substation-circuit to the other, and thus to allow their passage, but are inductive to currents passing in parallel thereto from other circuits receiving current from said battery, so as to prevent their circulation.

Variations in the resistance of substation-transmitters produced by their normal operation will cause corresponding variations or voice-currents in the current flowing in the circuit in which they are included; but owing to the impedance and to the relatively low resistance of the common battery these variations of current will not be transmitted to any other circuit receiving current from said battery.

The invention also consists in the combination of the previously-referred-to circuits and of the other circuits which will hereinafter be pointed out.

In the drawings, Figures 1, 2, 3, and 4 each represent four substation-circuits connected into two talking-circuits, both of which are supplied with current from a common battery and with means for preventing reciprocal interference between the associated circuits, all of which embody my invention; and Fig. 5 represents an operator's plug and cord circuit, illustrating a practical arrangement of a detail of the invention.

Fig. 1 represents two metallic subscribers' lines or circuits L and L^2 and two grounded circuits L^3 and L^4, respectively connected for conversation. The two conductors a a^2 and b b^2 of the metallic circuits extend as a compound talking-circuit between the substations A and Z, and include the transmitting and receiving telephones T and t in series at each station. Each of the lower conductors b and b^2 connects through one helix of the impedance and repeating coil c at the central station and by wires 1 and 5 to the points 6 and 7, and include in series the wire 2 and the common battery B, of which the said points 6 and 7 are the polar or terminal connections.

The conductors e and e^2 of the circuits L^3 and L^4 extend from ground connections G and G^2 through the telephones T and t to the central station, each conductor passing through one winding of the helix of the impedance and repeating coil c^2, so that the said two windings are in series in the circuit. Thus one-half of the coils c and c^2 is on each side of the battery. By this arrangement of circuits current from the common battery B will circulate in each organized circuit in the direction of the arrows from the positive to the negative pole thereof and supply current for each transmitter T. When the current in each circuit is varied by voice-vibrations and variations of current representing sound-waves are produced therein, the combined repeating and impedance coils act in a well-known manner to repeat each into its own circuit and to prevent the passage through their helices of current variations or disturbances between the said circuit and any other circuit receiving current from or connected with the common battery. The coils c and the common battery B may be located between the plugs in the cord-circuit, as represented in Fig. 5.

P and P^2 are the plugs whose tips and sleeves are connected with the terminals of the circuit-conductors a and a^2 and b b^2, respectively.

In Fig. 2 four substation-circuits are shown organized into two metallic circuits. L and L^2 are associated with each other, as are also L^3 and L^4. The combined repeating and impedance coils c c^2 are connected in each substation-circuit L and L^2 in each plug-cord circuit, the conductors a and a^2 connect one helix of each coil in series, and the conductors b and b^2 connect the second helix of each coil and the common generator in series. The operation is the same as in Fig. 1. The circuit is non-inductive to currents of one direction from the battery B going in the direction of the arrows, but is inductive to currents passing from the battery in parallel through the coil-windings, and the helices of each coil repeat into each other.

In Fig. 3 four substation-circuits are organized into two conversation-circuits, as in the previous figures. One conductor of each substation-circuit includes an impedance-coil c in series with the common battery. In the upper circuit a loop or shunt 10, having a condenser C or its equivalent as an electrolytic cell or Planté battery therein, connects conductor b with conductor b^2 around the coils c and c^2. Current from the battery B circulates in the circuit in the direction of the arrows, and the conversation-circuit is from A to Z and through the loop or shunt 10 and condenser C. In the lower circuit a loop is formed around the impedances c^3 and c^4, consisting of the wires 11 and 12, connected, respectively, to the conductors e and e^2 and the conductor f, and include in parallel the helices of the repeating-coil c^5. Current circulates from battery B, as indicated, and the current variations produced at one substation are repeated through the coil c^5. As in the other figures, conversation in one circuit does not disturb or vary the current circulating in any other circuit in series with the common battery.

Fig. 4 shows two conversation-circuits arranged with four substation-circuits. The lower circuit, extending from D to X, is the same as the upper circuit, connecting A and Z in Fig. 3, and needs no description. The upper circuit from A to Z has an impedance-coil c in the cord-circuit with each conductor b and b^2 in series with the common battery. A loop or shunt 13 is connected to the conductors b and b^2 around the coils and battery, having in series therewith one helix of the impedance-coil c^6, the other helix being in series with the conductors a and a^2. Current from the common battery B flows in the circuit as indicated by the arrows, while the conversation-circuit is from station A by the conductor a, one helix of coil c^6, conductor a^2 to station Z, returning by conductor b^2, loop or shunt 13, and the second helix of the coil c^6 and conductor b. The operation of impedances c, c^2, c^3, and c^4 is the same as previously described in the other figures.

The impedances, repeating-coils, and condensers referred to in Figs. 2, 3, and 4 may be all located in the operator's cord-circuit, as shown in Fig. 5, and with this understanding it is not necessary to illustrate each cord-circuit.

It will be apparent that all of the described circuits can be associated with a common current supply and be reciprocally protected from disturbance.

Having thus described my invention, I claim—

1. The combination in a telephone system of two telephone-circuits; a source of transmitter-current supply common to and in series with both; a telephone-transmitter for each circuit, adapted to mold the said supplied current into voice-currents or variations; a telephone-receiver in each circuit responsive to the said variations; and an electromagnetic device or association of devices interposed in the circuit and placed in such relation to the said transmitter and receiver, and to the terminals of the other telephone-circuit, as to constitute a repeating induction-coil between the said instruments, and thereby promote the passage of the said variations from the transmitter to the receiver, and to constitute choking or impedance coils between the conductors of the said two circuits, adapted to prevent or oppose the passage of the said variations from either circuit to the other.

2. The combination in a system of telephonic circuits with a common transmitter-current battery and two telephone-circuits connected in series therewith, each including a telephone-receiver and a telephone-transmitter supplied with current thereby; of a device having a relatively high apparent resistance or impedance, in series in each of said circuits, and with the said battery, which device also operates as a repeating-coil.

3. The combination in a system of telephonic circuits, of a common current-supply battery, two telephone-circuits connected in series therewith, each including a telephone-receiver and a telephone-transmitter supplied with current thereby; with a device having a high apparent resistance or impedance to voice-currents or variations placed in series in each of said circuits, and with the said battery, and located in one conductor thereof, like portions of its winding being placed on both sides of the said battery, and adapted to act upon each other as the two windings of a repeating-coil.

4. The combination in a system of telephonic circuits, of a common battery, two compound telephone-circuits each formed of two subscribers' lines, and a plug-and-cord-switch connection in series therewith, and each including a telephone-receiver and a telephone-transmitter supplied with current from said battery, and adapted to transform the same into voice-currents, with devices offering to said voice-currents a high apparent resistance or impedance, in series in each of said circuits; the said impedance devices of each circuit being respectively connected in the said plug-and-cord connection in series with the said battery and in inductive relation to one another and adapted thereby to operate as repeating-coils.

5. The combination in a system of telephonic circuits with a common transmitter-current battery, two telephone-circuits, and two impedances connected in series therewith, each circuit including a telephone-receiver and a telephone-transmitter supplied with current by said battery; of a repeating-coil, each helix of which is in a separate bridge between the circuit-conductors, which bridges constitute a loop or shunt around the said impedances and the common battery.

6. The combination in a system of telephonic circuits with a common transmitter-current battery, two telephone-circuits and two impedances connected in series therewith each circuit including a telephone-receiver and a telephone-transmitter supplied with current by said battery; of a repeating-coil for one or both of the said circuits having one helix in series with one circuit-conductor, and the second helix in a loop or shunt from the other circuit-conductor around the said impedances and common battery.

7. The combination in a system of telephonic circuits of a common current-battery, a plurality of pairs of telephone-circuits connected in series therewith, each including a telephone-receiver and a telephone-transmitter supplied with current thereby; of combined impedance and repeating coils in series in each of said pairs of circuits and in series with the said battery, as set forth.

8. The combination in a system of telephonic circuits of a common current-battery, a plurality of organized conversation-circuits connected in series therewith and each including a telephone-receiver and a telephone-transmitter supplied with current thereby; of a combined impedance and repeating coil in series in one of said circuits and in series with the said battery; of impedance-coils in series in another of said circuits and in series with said battery and a loop or shunt around the said impedances and battery including a condenser, as set forth.

In testimony whereof I have signed my name to this specification, in the presence of two subscribing witnesses, this 26th day of March, 1896.

JOHN S. STONE.

Witnesses:
GEO. WILLIS PIERCE,
FRANK C. LOCKWOOD.