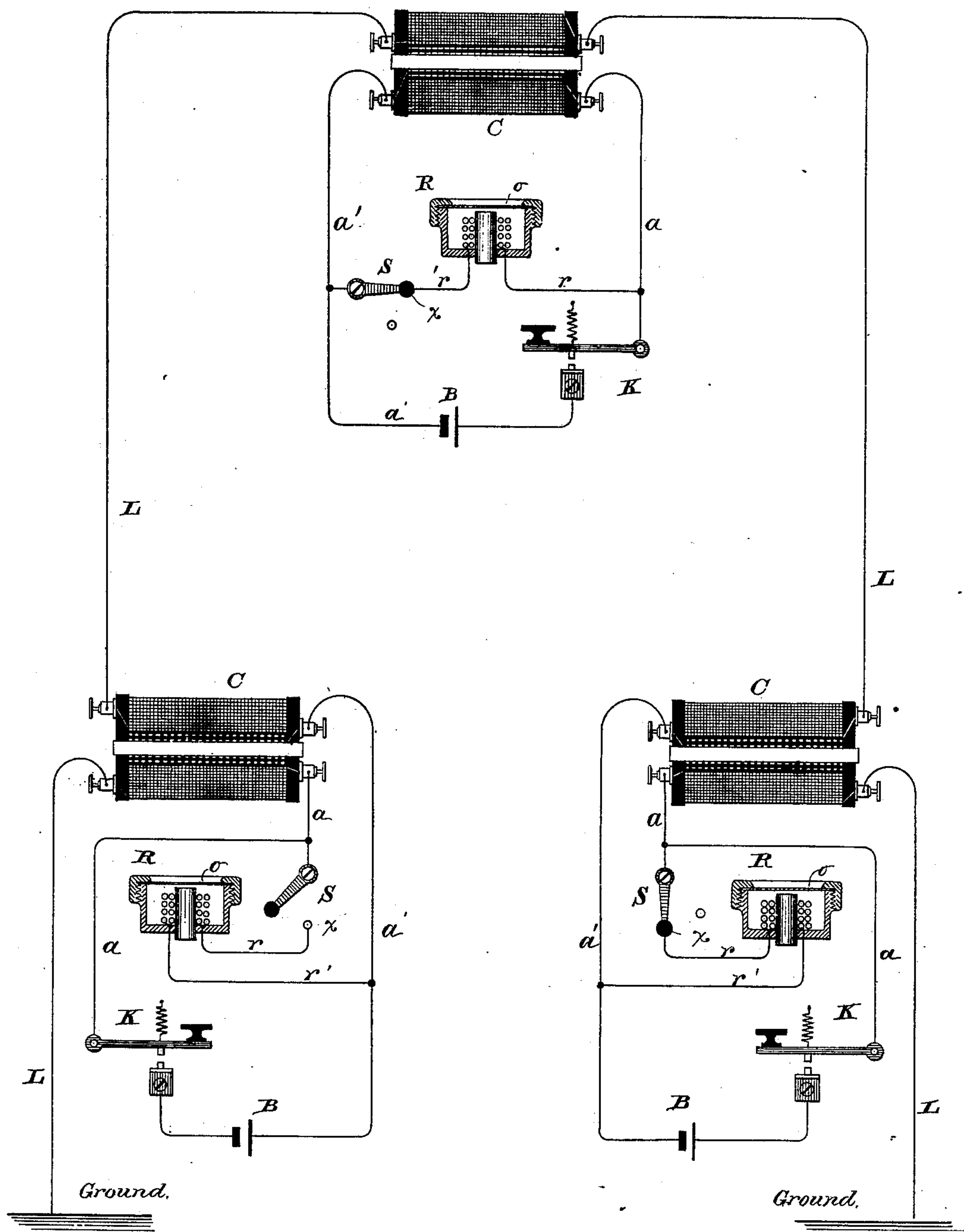


(No Model.)

O. LUGO.  
Electric Telegraphs.

No. 235,161.

Patented Dec. 7, 1880.



WITNESSES

*Wm A. Skinkley.*  
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# UNITED STATES PATENT OFFICE.

ORAZIO LUGO, OF NEW YORK, N. Y., ASSIGNOR TO SAMUEL L. M. BARLOW,  
OF SAME PLACE.

## ELECTRIC TELEGRAPH.

SPECIFICATION forming part of Letters Patent No. 235,161, dated December 7, 1880.

Application filed May 10, 1880. (No model.)

*To all whom it may concern:*

Be it known that I, ORAZIO LUGO, a citizen of the United States, residing in the city, county, and State of New York, have made  
5 an invention of certain new and useful improvements in the art of communicating intelligence by electricity, and in apparatus therefor, of which improvements the following is a specification.

10 The object of my invention, speaking generally, is to produce intelligible signals in a long telegraphic circuit with great distinctness while employing a comparatively small battery-power. This object I attain by a novel  
15 organization of old instrumentalities, the essential features of which organization are at the transmitting-station the primary metallic circuit of an induction-coil, including a battery, provided with means for making signals  
20 by making and breaking said circuit, said primary coil being of very low resistance, a secondary coil included in the line-wire, and at the receiving-station; a secondary coil also included in the line-wire, both secondary coils  
25 being of comparatively very high resistance, and a primary coil of very low resistance included in metallic circuit with a helix of low resistance actuating a diaphragm or plate-sounder.

30 The above-described organization is adapted for transmission in one direction only; but the apparatus can readily be adapted for reciprocal transmission by including a battery, a key, a switch, and a sounder in each of said primary circuits.  
35

My invention, broadly stated, consists in a novel art, method, or system of producing intelligible signals at a distant station in an electric circuit by making and breaking at the  
40 transmitting-station an electric current in the primary wire of an induction-coil constituting a transmitting or generating circuit of very low resistance, thus producing corresponding electric currents of very high tension in the  
45 secondary wire of said induction-coil, which constitutes part of the line-wire, and transmitting said currents through the secondary wire of a corresponding receiving induction-coil, also of very high resistance, and included

in the line-wire, which operation induces corresponding currents of low intensity in the  
50 primary circuit of said receiving induction-coil, in which primary circuit a helix of low resistance actuating a diaphragm or plate-sounder is included, and which primary circuit is again of very low resistance. The  
55 interrupted currents thus produced in the primary wire of the receiving induction-coil correspond exactly with those produced in the primary wire of the transmitter, and, being  
60 rendered audible by the sounder, are converted into intelligible signals.

The subject-matter of my invention is set forth in the claims at the end of this specification.  
65

I deem it unnecessary here to describe the details of the apparatus employed by me, as such details constitute no part of my invention. Their construction is well known, and may obviously be varied in various well-known  
70 ways.

In the accompanying drawing I have shown a convenient organization of apparatus for carrying out the object of my invention, an intermediate and two terminal stations being  
75 shown.

The arrangement of apparatus at each station being substantially alike, a description of one will be sufficient for the proper understanding of the whole.  
80

Under the organization shown in the drawing a battery, B, a key, K, and a sounder, R, consisting of a diaphragm or plate actuated by a helix surrounding a core, are shown as included in the primary metallic circuit *a a'*  
85 of an induction-coil, C, the sounder being provided with a switch, S, for throwing it in or out of circuit, its wires *r r'* being connected with the primary circuit in such manner as to cause the current to pass through them when  
90 the switch S is closed. When signals are being received the switch S should be at X—that is to say, the helix of the sounder is then in the metallic circuit of the primary wire of the induction-coil. This switch, although convenient for shunting the sounder out of the  
95 circuit, is not essential, as the apparatus would work effectively without it.



The secondary wire of the induction-coil C constitutes part of the line-wire L, which is an earth-circuit.

I have found the best results to be produced by having a very wide working margin between the primary and secondary coils—that is to say, having a primary circuit of very low resistance and a secondary coil of comparatively very high resistance. For instance—as an example—I have used with great advantage a line-wire having a resistance of sixteen thousand ohms, primary coils with a resistance varying from two-tenths of an ohm to one ohm, and secondary coils with resistances varying from twelve thousand to four thousand ohms.

An ordinary Morse key may be used to make and break the primary circuit. When contact is made the circuit is closed from the battery through the primary coil.

The sounder shown, although resembling an ordinary magneto-telephone in appearance, differs essentially from it in the fact that it is not necessarily a reproducer of sound—that is, a silent electric signal at the transmitting-station will produce sound at the receiving-station. The induced current of electricity of very high tension coming from the secondary wire of the induction-coil at the transmitting-station is conveyed to the secondary wire of the induction-coil at the receiving-station, and there induced inversely through such secondary wire into the primary wire of said induction-coil, (which primary wire or circuit is of very low resistance,) and passing through the helix of the sounder, which is in circuit with said primary wire, causes a metal dial or plate, *c*, in the receiving-instrument to vibrate, and thus give an audible sound. This plate constitutes a sounder, and may be greatly varied in thickness and tension. I prefer to use a diaphragm or plate, as it can be thrown into vibration with very small expenditure of electro-motive force.

In order to obtain the best results the helix of the sounder should have a very low resistance—equal to that of the primary wire of the receiving induction-coil.

The operation of an apparatus organized as above described is as follows: The closing of the transmitting-key forms a closed circuit from one pole of the battery to the other pole through the primary wire of the transmitting induction-coil, thereby inducing a current in the secondary wire of the transmitting induction-coil, the line-wire, and the secondary wire of the receiving induction-coil. When the circuit is broken, by opening the key a reverse current of high intensity is induced in the secondary wire of the transmitting induction-coil and in the line-wire. The secondary wire of the receiving induction-coil, being included in the main line, is correspondingly affected and acts inductively and inversely on the primary wire of said induction-coil, and as the key of the primary circuit at that station is open and the

switch closed the interruptions of the current at the transmitting-station are audibly produced as intelligible signals on the sounder, as is well understood.

Under the organization shown it will be observed that the primary circuit is made and broken by the key when transmitting, thus throwing the battery into and out of circuit, while at the receiving-station the key is open and both the battery and key are short-circuited or cut out, and the battery is again thrown in by closing the key.

Any number of intermediate stations may be employed, the line being continuously connected at each of such stations with the secondary wire of the induction-coil, and by an arrangement of apparatus similar to that shown and described at the terminal station messages may be sent to and taken from the primary wires of the induction-coils at any or all of such intermediate stations.

I have found by practical tests that with the above-described apparatus electric signals made at a transmitting-station may be made to produce audible sounds at a receiving-station so distant that the resistance of the line-wire is equal to about four thousand miles.

I claim as of my own invention—

1. The hereinbefore-described improvement in the art of producing intelligible signals at a distance in an electric circuit, which improvement consists in causing signals to be made by makes and breaks of the electric current in the primary wire of an induction-coil at the transmitting-station, (which primary wire or circuit is of very low resistance and constitutes a metallic circuit,) thereby inducing corresponding currents, but of very high tension, in the secondary wire of said induction-coil, in the line-wire, and in the secondary wire of a corresponding induction-coil of high resistance at the receiving-station, the currents of which wire act inversely by induction upon the primary wire of the receiving induction-coil, (which primary wire is of very low resistance,) and the helix, also of low resistance, actuating a diaphragm or plate sounder, included in said primary wire, which constitutes a metallic circuit.

2. The combination, substantially as herein set forth, of the primary wire of an induction-coil constituting a metallic circuit of very low resistance, the battery, the key, and the helix, (actuating the diaphragm or plate sounder,) included in a branch of said primary circuit, whereby the key and battery are both cut out of circuit by opening the key.

3. The combination, substantially as herein set forth, of the battery and the key in the primary wire of an induction-coil at the transmitting-station, (said primary wire constituting a circuit of very low resistance,) the secondary wire of said induction-coil, the secondary wire of the receiving induction-coil, (both secondary coils being of very high resistance,)



the line-wire connecting said secondary wires, and the helix, actuating the diaphragm or plate sounder, included in a branch of the primary wire of the receiving induction-coil, constituting a metallic circuit of very low resistance, whereby the key and battery are both cut out of circuit by opening the key.

4. The combination, substantially as herein set forth, at each station, of the primary and secondary wires of an induction-coil, a battery and a key in one branch of the primary circuit or wire, and a helix of low resistance, actuating a diaphragm or plate sounder included

in another branch of said primary circuit, with a line-wire connecting the secondary wires of the respective induction-coils, each primary circuit being of very low resistance and having the capacity of cutting out its battery and key, and each secondary of comparatively very high resistance.

In testimony whereof I have hereunto subscribed my name.

ORAZIO LUGO.

Witnesses:

WM. A. SKINKLE,  
CHAS. H. BAKER.