

No. 744,001.

PATENTED NOV. 10, 1903.

J. T. ARMSTRONG & A. ORLING.  
SYSTEM OF TELEPHONIC COMMUNICATION.

APPLICATION FILED JULY 23, 1903.

NO MODEL.

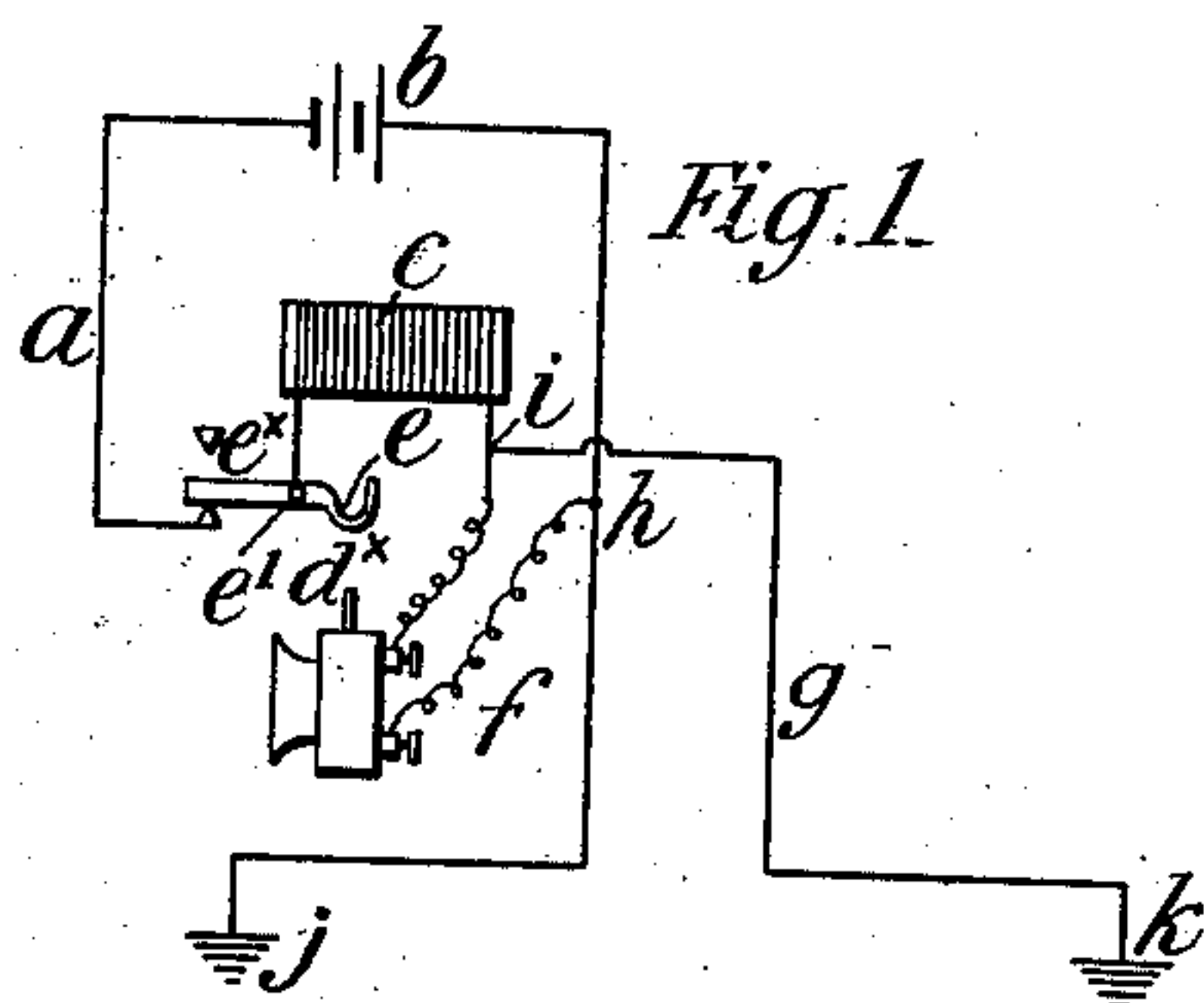


Fig. 1.

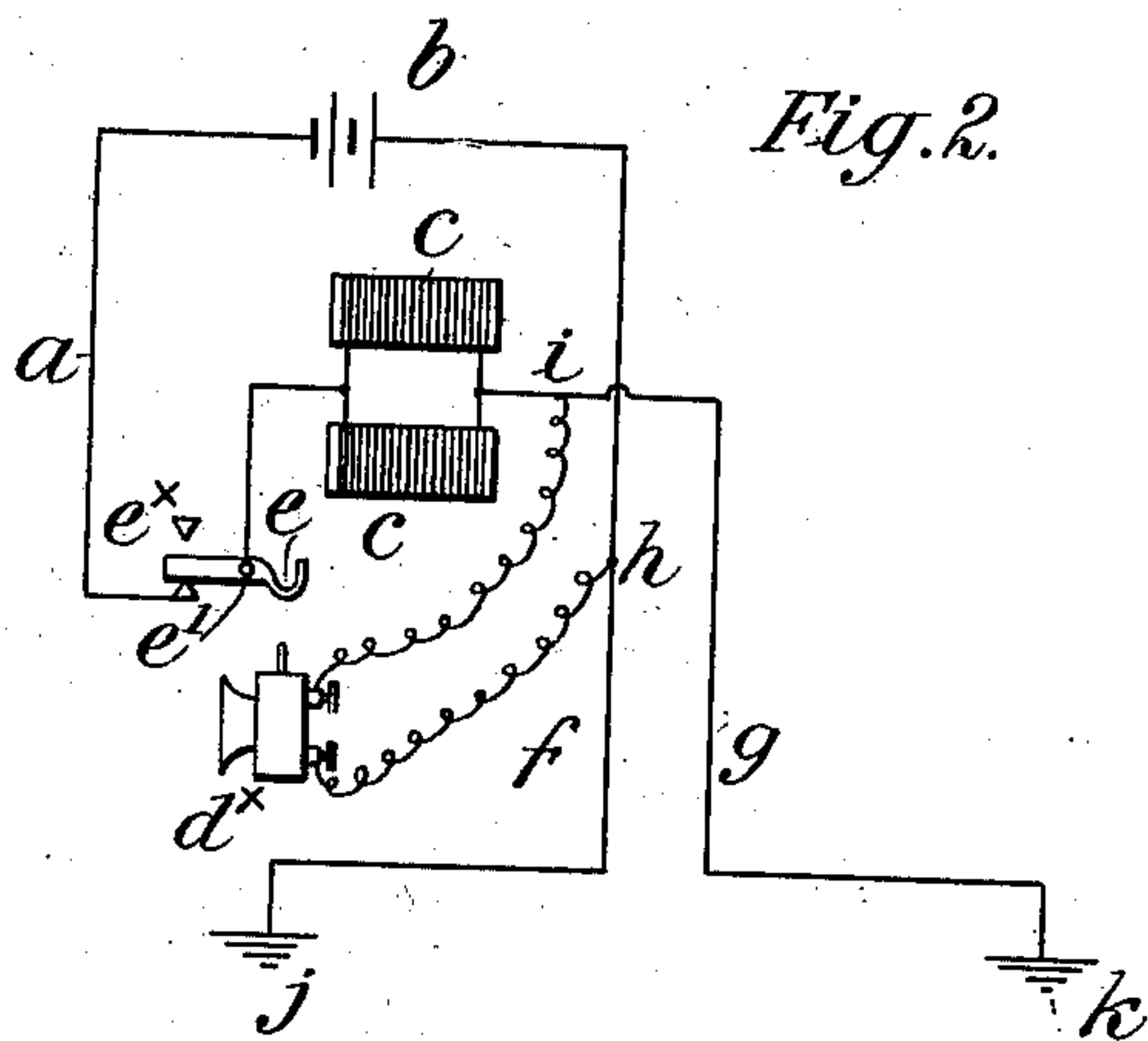


Fig. 2.

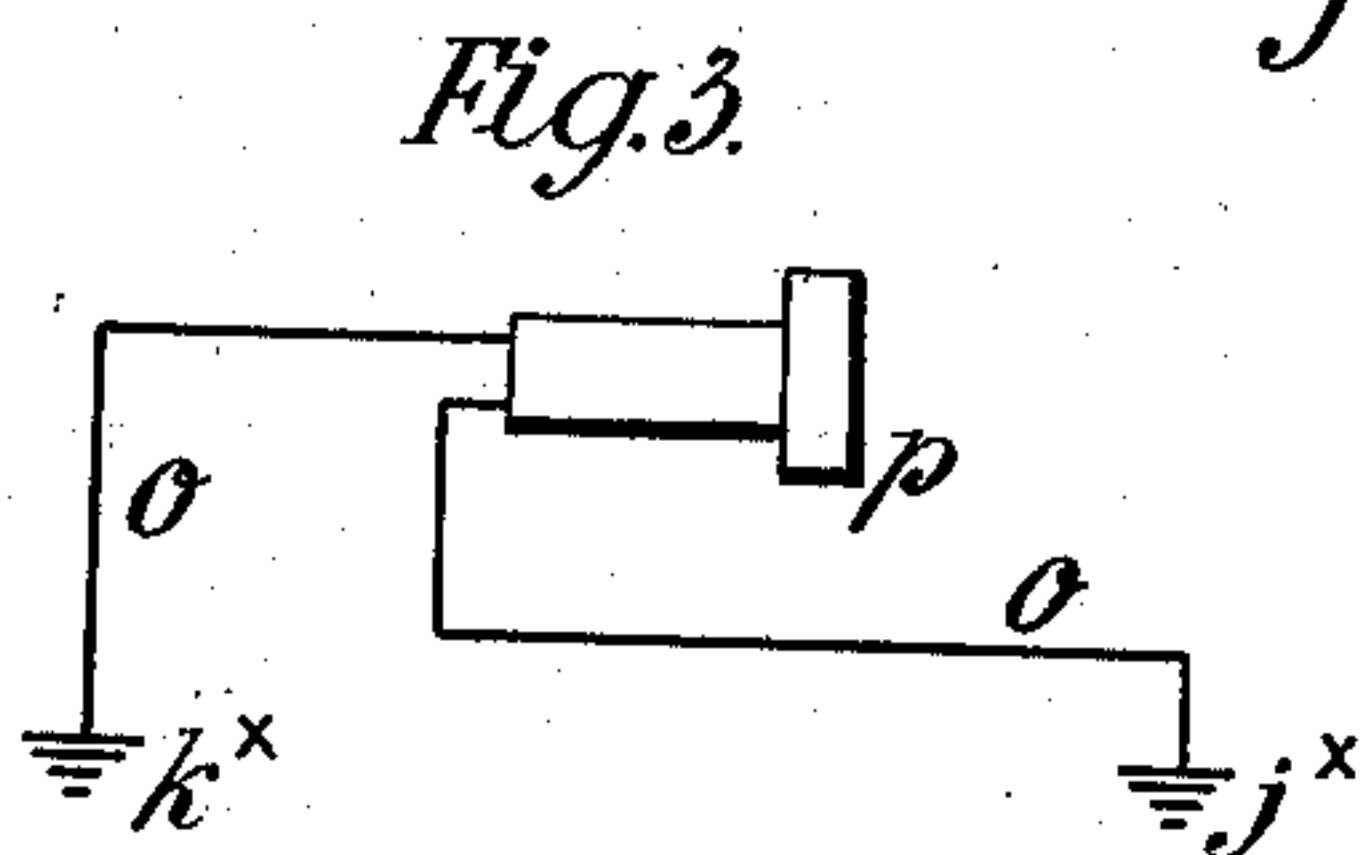


Fig. 3.

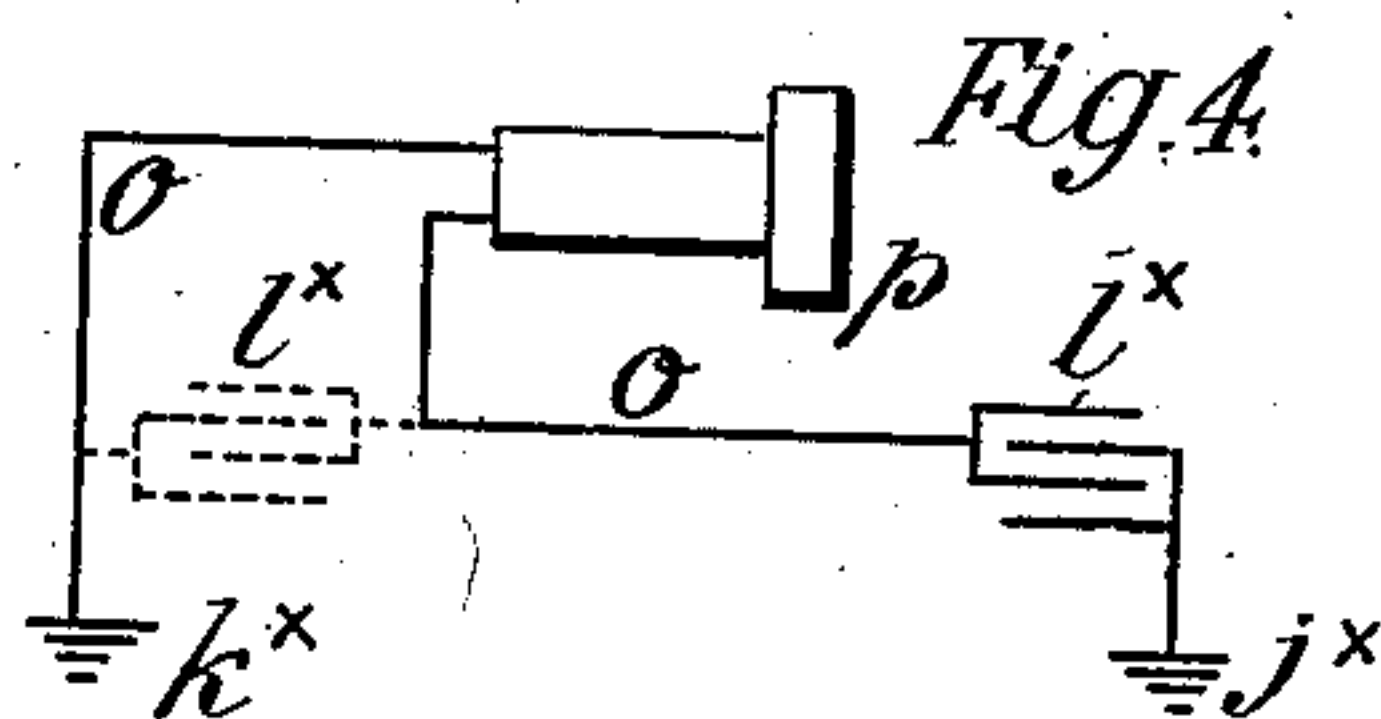


Fig. 4.

WITNESSES.

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# UNITED STATES PATENT OFFICE.

JAMES TARBOTTON ARMSTRONG AND AXEL ORLING, OF LONDON,  
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## SYSTEM OF TELEPHONIC COMMUNICATION.

SPECIFICATION forming part of Letters Patent No. 744,001, dated November 10, 1903.

Original application filed February 5, 1902, Serial No. 92,683. Divided and this application filed July 23, 1903. Serial No. 166,734. (No model.)

*To all whom it may concern:*

Be it known that we, JAMES TARBOTTON ARMSTRONG, a subject of the King of England, and AXEL ORLING, a subject of the King of Sweden and Norway, both residing at London, England, have invented certain new and useful Improvements in Systems of Telephonic Communication; and we do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

Our invention relates to means and apparatus for the transmission of speech and other articulate sounds to a distant receiver or receivers without the employment of wire or other like connection between the transmitter and the receiver, and has for its object the improvements hereinafter set forth.

In carrying out our invention we provide the transmitting apparatus (hereinafter described) with two or more earth connections, through which are conducted a combination of high-potential discharges and low-tension currents whose circuit or circuits are completed through numerous lines of current-flow which traverse the earth. The transmitted impulses enter the earth by one of the said earth connections and after traversing the same return to complete the circuit through the other. The receiving apparatus (hereinafter described) is also provided with two or more earth connections which are adapted to cut the said lines of current-flow (in the neighborhood of the distant receiver) at points of different potential, causing some of the transmitted energy to pass through them and to actuate the receiver.

We will now more particularly describe our invention, reference being made to the accompanying diagrammatic drawings, in which—

Figure 1 shows one form of transmitter constructed according to our invention. Fig. 2 shows a modified form thereof, and Figs. 3 and 4 are respectively different forms of receiving apparatus adapted for use with our improved transmitter.

According to the arrangement shown in Fig. 1 we employ an electric circuit  $a$ , which is provided with a battery  $b$  or other convenient

source of energy, a self-inductance coil  $c$ , a microphonic or any other suitable telephone-transmitter  $d^x$ , and a switch  $e^x$ , which is pivoted at  $e'$  and provided with a hook  $e^2$ , upon which the transmitter  $d^x$  is adapted to hang when not in use, so that its weight may cause the said switch to open the circuit. Suitable connections  $f$  and  $g$  are made with the circuit  $a$  at  $h$  and at  $i$  on opposite sides of the transmitter  $d^x$  and are respectively led to earth at  $j$  and  $k$  in such a manner that the earth is in shunt-circuit.

According to the construction shown in Fig. 2 a plurality of self-inductance coils  $c$  is employed.

In operation the varying resistance of the transmitter  $d^x$  causes a fluctuating current to pass through the coil or coils  $c$ , with the result that "extra" currents are induced, the circuit of which is completed through the transmitter  $d^x$  and the earth, which is in shunt thereto. At each increase in the resistance of the transmitter  $d^x$  a larger proportion of the low-tension-battery current will pass through the earth with a large proportion of the induced direct high-potential extra current. At each decrease in the resistance of the transmitter  $d^x$  a larger proportion of the battery-current will pass through the coil or coils  $c$  and a large proportion of the induced inverse high-potential extra current will pass through the earth, owing to the resistance of the transmitter  $d^x$  and the opposing electromotive force of the battery-current. The electrical effects that are thus led to earth at  $j$  and  $k$  (which connections are preferably as far apart as practicable when communication is carried on over great distances) set up lines of current-flow which extend to very considerable distances and are intercepted in the neighborhood of the receiver (see Figs. 3 and 4) by its earth connections  $j^x$  and  $k^x$ . These connections, with the receiving part  $o$  of the circuit, constitute a species of shunt through which some of the transmitted energy flows.

The receiving apparatus consists of a telephone  $p$ , by means of which the passage of the transmitted energy through the receiving shunt  $o$  may be detected.

In some cases we employ a condenser  $l^x$ , as



shown either in full or dotted lines in Fig. 4, to obviate the effect of earth-currents.

We are aware that it was known prior to our invention that when a battery-circuit is grounded at two points at a considerable distance apart some of the current may be picked up by "tapping" the earth at two points at a comparatively short distance, and we are also aware that results similar in some respects have been obtained when the secondary circuit of an ordinary induction-coil was similarly completed through the earth; but in none of these cases was it possible to communicate between widely-separated stations except when the earth connections at each station were at prohibitive distances apart. These difficulties we have overcome by the employment of a combination of high-potential discharges and low-tension current, as hereinbefore described, by means of which lines of current-flow which extend great distances are propagated through the earth between the connections of the transmitter. In this way sufficient of the electric energy to actuate a suitable receiver may be transmitted through very considerable distances, while the earth connections are comparatively near to their respective transmitter and receiver. We therefore wish it to be understood that we do not restrict ourselves to the forms of transmitter described, as it is obvious that other forms of apparatus may be employed to produce the desired combination of electrical effects. We also wish it to be understood that the words "earth" and "ground" are used in the general sense and may refer either to land or sea.

What we claim as our invention, and desire to secure by Letters Patent, is—

40 1. In apparatus for transmitting telephonic impulses, an electric circuit provided with two or more earth connections through which a combination of low-tension currents and high-

potential discharges are completed through the earth, substantially as described. 45

2. An apparatus for transmitting telephonic impulses consisting of an electric circuit having a battery or other source of energy, and a self-inductance coil, the said circuit being completed through the earth at two or more points and a shunt containing a telephonic transmitter, by the operation of which extra currents are induced and discharged into the earth periodically with the battery-current whereby lines of current-flow are propagated whose presence may be detected at the distant station by a receiving-shunt provided with a suitable receiver and two earth connections adapted to cut the said lines of current-flow at points of different potential substantially as described. 50 55 60

3. An apparatus for transmitting telephonic impulses consisting of an electric circuit having a battery or other source of energy and a plurality of self-induction coils arranged in parallel circuit, the said circuit being completed through the earth at two or more points and a shunt containing a telephonic transmitter, by the operation of which extra currents are induced and discharged into the earth periodically with the battery-current whereby lines of current-flow are propagated whose presence may be detected at the distant station by a receiving-shunt provided with a suitable receiver and two earth connections adapted to cut the said lines of current-flow at points of different potential substantially as described. 65 70 75

In testimony whereof we have signed our names to this specification in the presence of two subscribing witnesses. 80

JAMES TARBOTTON ARMSTRONG.  
AXEL ORLING.

Witnesses:

ALFRED NUTTING,  
FREDK. L. RAND.