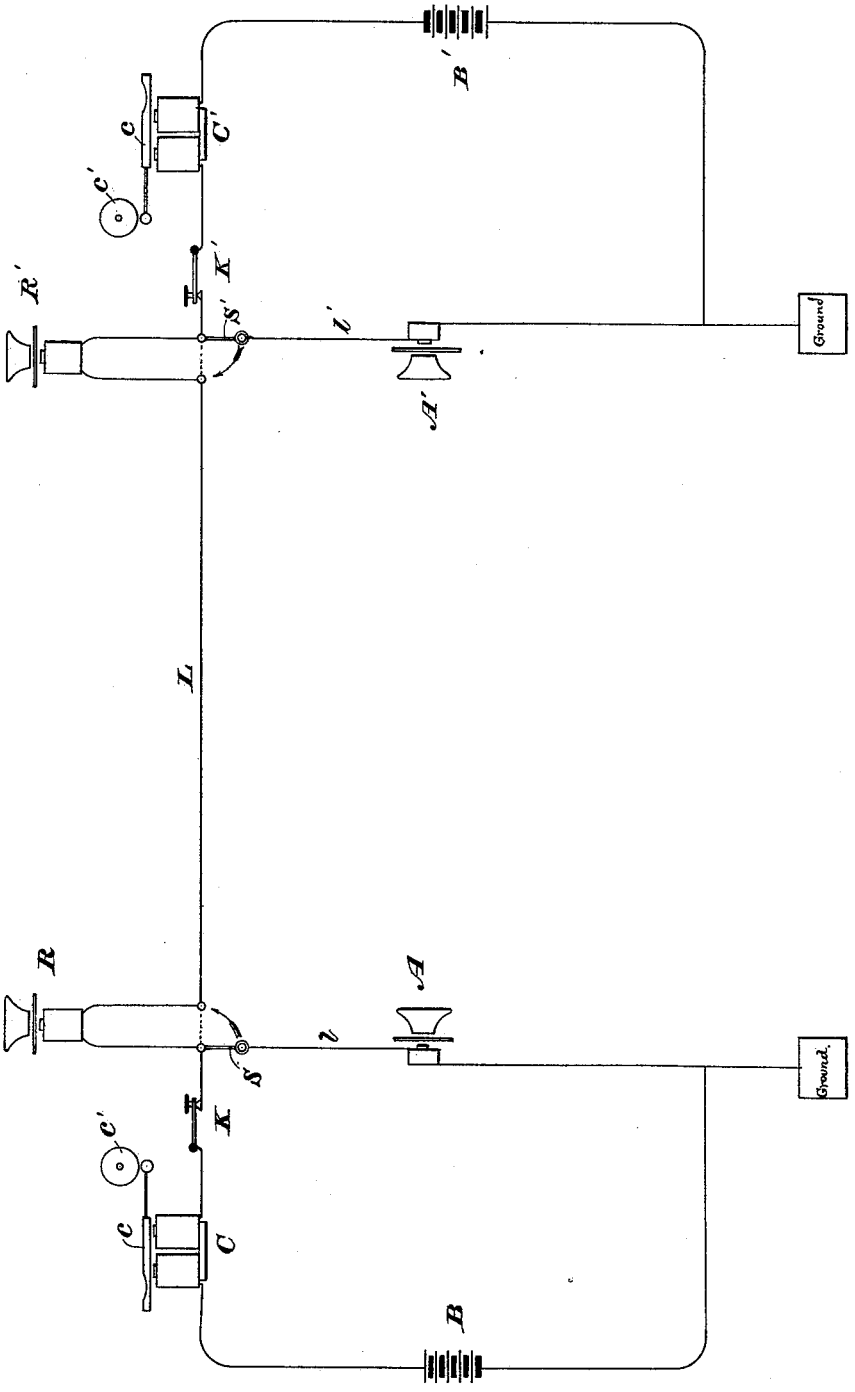
E. GRAY.

Apparatus for Operating Speaking-Telephones.

No. 221,406. Patented Nov. 11. 1879.



WITNESSES

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ELISHA GRAY, OF CHICAGO, ILLINOIS.

IMPROVEMENT IN APPARATUS FOR OPERATING SPEAKING-TELEPHONES.

Specification forming part of Letters Patent No. **221,406**, dated November 11, 1879; application filed May 14, 1879.

To all whom it may concern:

Be it known that I, ELISHA GRAY, of Chicago, in the county of Cook and State of Illinois, have invented certain new and useful Improvements in the Method of and Apparatus for Operating Electric Speaking-Telephones, of which improvements the following is a specification.

My invention more especially relates to speaking-telephones of that class in which a battery and an induction-coil are employed, as in the apparatus shown in my patent, No. 210,776, of December 10, 1878.

The objects of my invention are to simplify the construction, increase the efficiency, and diminish the cost of the apparatus heretofore employed to transmit articulate speech. These ends I attain, first, by employing the induced or extra current of a primary coil instead of the induced current of the secondary coil, heretofore generally used, by which means I am enabled to dispense with the ordinary induction-coil heretofore employed in apparatus of this kind, and to utilize as an induction-coil the electro-magnet ordinarily employed in connection with the call-bell; secondly, by combining with the line-wire a transmitting-telephone arranged in a short circuit, shunting the battery and magnet, and a switch which simultaneously and by a single movement disconnects the transmitter, short-circuits the receiver when not in use, and closes the main line, thus leaving the full force of the battery upon the line to actuate the call-bells.

The subject-matter claimed will hereinafter specifically be designated.

The accompanying diagram shows the arrangement upon circuit of my improved apparatus in the best way now known to me.

The details of construction of the apparatus need no description here, as such details constitute no part of the subject-matter herein claimed, as many of the speaking-telephones in common use will operate efficiently under my improved system.

A A′ represent transmitting-telephones of well-known construction, such, for instance, as the Edison carbon telephone now in general use, or the telephone patented to F. K. Fitch, No. 214,767, April 28, 1879, or that shown in my patent, No. 210,776, of December 10, 1878, above mentioned.

B B′ represent the batteries. C C′ represent ordinary electro-magnets, each provided with a vibrating reed or armature, *c*, constituting the hammer of an ordinary call-bell, *c′*.

R R′ represent ordinary telephone-receivers arranged in loop-circuits. K K′ represent keys for opening or closing the circuit to sound the call-bells; and S S′ represent switches, which short-circuit the receiver and disconnect the transmitting-telephones when required, at the same time and by the same movement closing the main line, as will readily be understood from the diagram. L represents the line-wire.

The transmitter, it will be observed, is arranged in a branch circuit, which, when closed, shunts the battery and magnet. When open the transmitter is out of circuit.

The operation of the apparatus will readily be understood from the diagram and from the foregoing description.

It will of course be understood in practice that the receiving and transmitting apparatus, keys, and switches are to be arranged in convenient proximity to each other for ready manipulation in the usual way.

Two stations only are shown in the diagram; but obviously as many more may be inserted in the circuit as are required.

When in its normal position for calling, the circuit is closed, the magnets are kept constantly charged, and the current flows continuously through the line-wire and magnets, the receiving-telephones R R′ being short-circuited, and the transmitting-telephones A A′ being disconnected or thrown out of circuit by arranging the switches as shown in dotted lines in the drawings. If, now, any person makes and breaks the circuit with his key, signals will be transmitted in the ordinary way, and responded to by the receiver in a similar manner, as all the bells in the circuit would be actuated as in the ordinary Morse circuit. Each person closes his key, so as to leave the circuit continuous, and then changes his switch to the position shown by the full lines in the diagram, so as to throw the telephones into circuit. The transmitting-operator then speaks into his instrument, thus causing electrical undulations or vibrations in the current, which produce corresponding variations in the magnet of the call-bell, which vibrations are not sufficiently strong to operate the bell.

Each vibration of the diaphragm changes the resistance of the short or shunt circuit *l*, and thus produces a corresponding change in the strength of the current, and consequently the magnetic effect produced in the core of the electro-magnet.

When the diaphragm by its vibrations compresses the button, thus lessening the resistance of the circuit, its magnetism is increased by an amount directly proportionate to the amount of the decrease of resistance; but when the diaphragm retracts, the resistance of the circuit is increased and the magnetism is suddenly diminished, which variation sets up in the coils surrounding the core an induced or extra current, which flows through the line at each vibration.

The strength of any given electrical impulse depends upon the amplitude of vibration of the diaphragm. Thus it will be seen that the electrical impulses will correspond accurately in rate, amplitude, and complexity to the motions of the diaphragm, thus perfectly fulfilling all the conditions necessary to the accurate generation, transmission, and reproduction of the rhythmical vibrations or undulations of the diaphragm representing the vocal sound or speech uttered in its vicinity.

I do not broadly claim simultaneously switching the transmitting and receiving telephones into or out of circuit, as this is old.

I claim as of my own invention—

1. The method hereinbefore described of generating and transmitting telegraphically in an electric circuit rhythmical electrical undulations or vibrations representing articulate sounds or speech by means of the extra or induced current produced in a primary circuit, including an electro-magnet, by the vibrations of the transmitter, whereby a special induction-coil is dispensed with.

2. The combination, substantially as hereinbefore set forth, of the battery, the line-wire, the transmitting-telephone, and the call-bell electro-magnet in the primary circuit, the extra current of which electro-magnet is employed to transmit the vibrations produced in the circuit by the transmitting-telephone.

3. The combination, substantially as hereinbefore set forth, of the battery and electro-magnet in the main line with the transmitting-telephone arranged in a short circuit, shunting the battery and magnet from the main line.

4. The combination, substantially as hereinbefore set forth, of the battery and electro-magnet in the main line, the transmitting-telephone arranged in a short circuit, shunting the battery and magnet from the main line, the receiving-telephone in a loop-circuit, and the switch which simultaneously and by a single movement disconnects the transmitting-telephone, short-circuits the receiving-telephone, and closes the main-line circuit, thus leaving the line free for calls.

In testimony whereof I have hereunto subscribed my name.

ELISHA GRAY.

Witnesses:
WM. D. BALDWIN,
E. C. DAVIDSON.