

(No Model.)

4 Sheets—Sheet 1.

S. D. FIELD.
TELEPHONE.

No. 433,120.

Patented July 29, 1890.

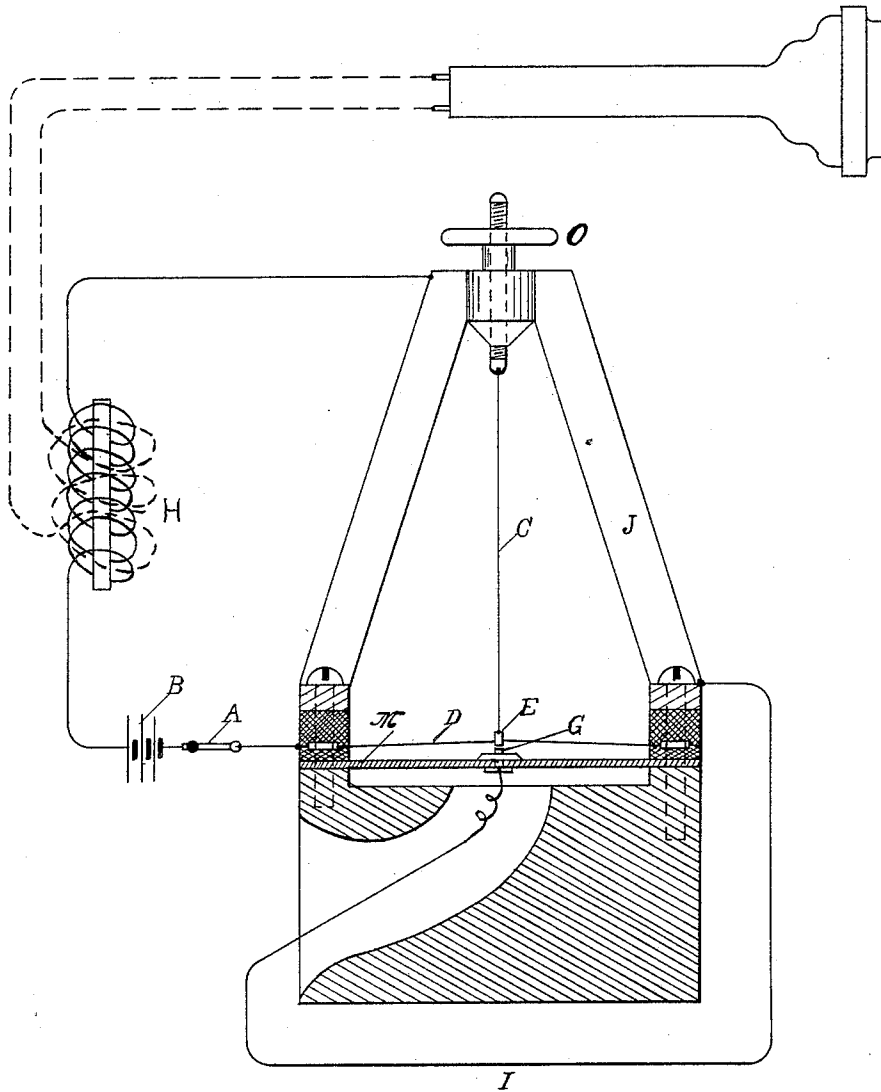


Fig. 1.

WITNESSES

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INVENTOR

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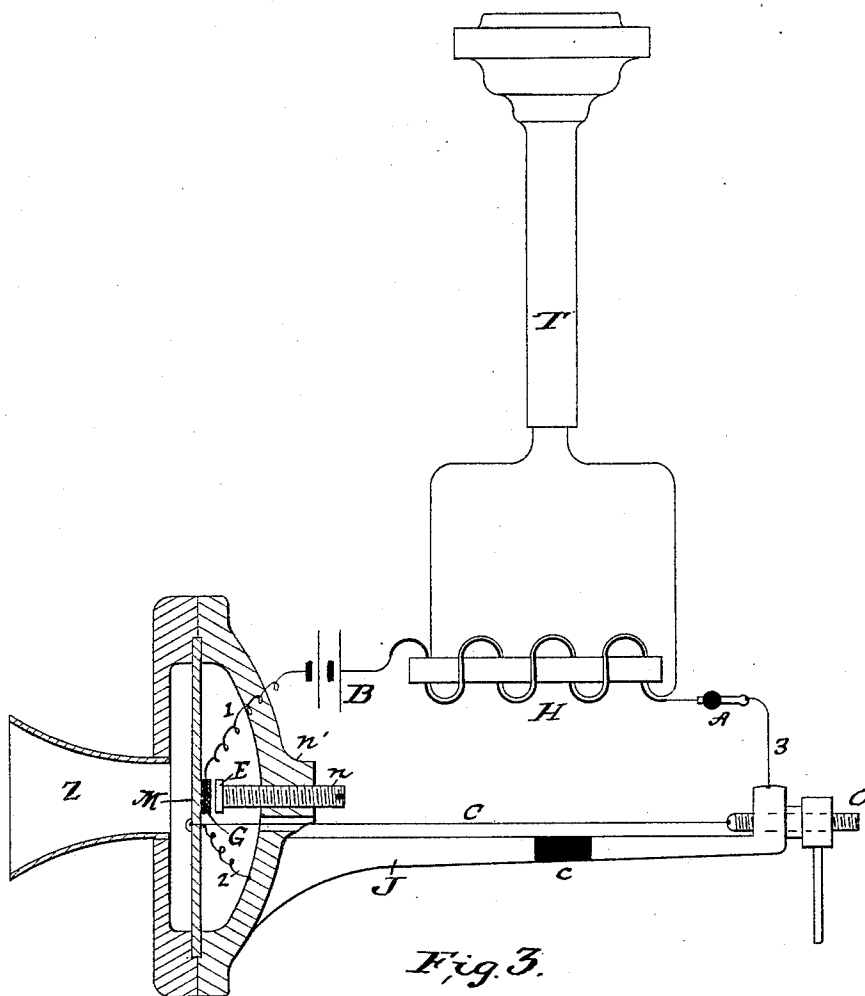
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S. D. FIELD.
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WITNESSES
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David E. Lain.

INVENTOR
Stephen Field

(No Model.)

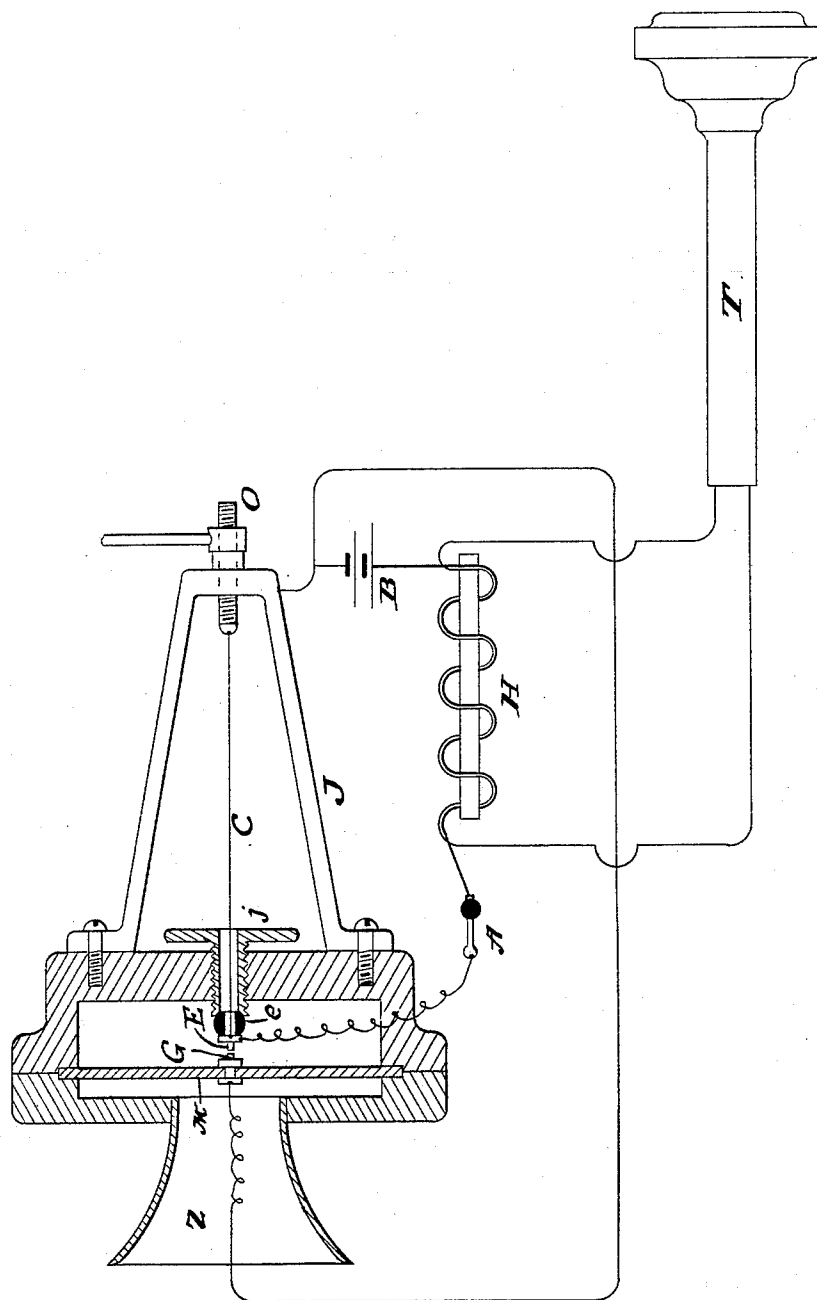
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Fig. 4.



WITNESSES

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UNITED STATES PATENT OFFICE.

STEPHEN DUDLEY FIELD, OF YONKERS, NEW YORK.

TELEPHONE.

SPECIFICATION forming part of Letters Patent No. 433,120, dated July 29, 1890.

Application filed June 21, 1887. Serial No. 242,001. (No model.)

To all whom it may concern:

Be it known that I, STEPHEN DUDLEY FIELD, a citizen of the United States, residing in Yonkers, in the county of Westchester and State of New York, have invented certain new and useful Improvements in Telephone-Transmitters; and I do hereby declare that the following is a full, clear, and exact description of my invention, such as will enable others skilled in the art to which it appertains to make and use the same.

My invention consists in constructing an apparatus which automatically makes and breaks an electric circuit with a rapidity too great for its effects to be appreciated by the ear, and in so combining the apparatus with a diaphragm that sound-waves projected against the same are caused to bridge over more or less of said makes and breaks of the circuit in proportion to the rapidity with which the sound-waves succeed each other.

My invention may be embodied in a variety of constructions, several of which are illustrated in the drawings accompanying this specification, in which—

Figures 1, 2, 3, and 4 represent, diagrammatically, four different embodiments of my invention.

In Fig. 1 I show two diaphragms D and M, supporting, respectively, two platinum contact-points E and G. One of the diaphragms is supported above the other, and is maintained in a state of tension by means of a fine wire C of considerable electrical resistance. The drawings show, besides the parts above described, the usual battery B, an induction-coil II, together with a switch A and the electrical circuits. They also show an adjusting-screw O for regulating the tension of the upper diaphragm through the wire C. It will be seen that the circuit of battery B passes normally through the insulated metallic frame J of the telephone and the wire C to the diaphragm D. It will also be observed that there is a short circuit by way of wire I between the contact-point G and the frame J. The tension of the wire C is normally sufficient to separate the points E and G. When, however, the switch A is closed and the current from battery B passes over wire C, the latter will be caused to elongate and will allow said points to come into contact. The current will thus be shunted around the wire C through a path

of approximately no resistance, and as a result the fine wire, becoming cool, will contract and separate the contact-points. The apparatus thus becomes a circuit-breaker, working with almost inconceivable rapidity so long as the current from battery B continues to circulate. The makes and breaks are so rapid as to pass beyond the limit of receptivity of the ear. Now it is evident that sound-waves striking upon the diaphragm F will alter the relative positions of the points E and G, tending to prolong their respective contacts. These prolonged contacts will produce effects which are audible, and if they follow each other in the proper sequence articulate speech may be transmitted and reproduced in suitable attached receiving instruments. In short, the drawings, Fig. 1, represent an apparatus constructed to send vibrations or pulsations over an electric circuit at a rate too great for recognition by the sense of hearing, such apparatus being combined with means for prolonging at will the vibrations or pulsations by bridging over several of them into one. The means for prolonging the vibrations are attached, in this instance, to a diaphragm which is capable of being acted upon by the voice, so as to cause the prolongations to take place in proper sequence for reproducing articulate speech. This is the principle which underlies the construction illustrated in all the drawings.

In Fig. 2 the points E and G are supported, respectively, upon levers S and F, the former being pivoted at h and the latter at d. The relations of the two levers can be adjusted by means of the screws W and X, the former of which bears against the lever S at one end and the latter against the rubber spring K, which is located between the other end of the lever and the screw W. The circuit of battery B in this apparatus, when the key A is closed, passes, by way of wire 1, key A, wire 2, adjusting-screw O, and fine wire C, to the lever S, and back to the battery by way of the screw X and the wire 3. The closing of the key will therefore cause the current of battery B to pass through the wire C, thus heating and causing it to expand. The wire will accordingly be lengthened and the tension upon the lever S will be relaxed, allowing it to move toward the lever F by reason of the pressure exercised upon it by the rub-

ber spring K. If this lever movement continues far enough, the points E G are brought into contact, closing a short circuit around the wire C by way of wire 3, screw X, lever S, contacts E G, lever F, and wire L, wire 2, key A, and wire 1, the wire L being a copper wire joined to the wire 2 and the lever D. The short-circuiting of the wire C will cause it to cool and contract, and thereby break the contact between the points E and G, whereupon the above operation will be repeated automatically as long as the key A is kept closed.

The lever F is connected by a link N with a diaphragm M, so that it will partake of all the movements of the said diaphragm. The said lever being centrally pivoted, it is obvious that its outer end will have a reverse motion to that given the inner end by the diaphragm. A sound-wave striking upon the diaphragm M will therefore tend to cause a separation of the contacts E G and to prolong the expansion of the wire C. Now the lever S carries besides the contact-point E a point P, which is located exactly opposite a similar point Q on the lever F. The action just referred to, by which the movements of the diaphragm tend to prolong the expansion of the wire C, will accordingly tend also to prolong the contact of the points P and Q when the latter is moved toward it by a movement of the diaphragm due to the effects of a sound-wave or to any other cause—that is to say, the apparatus here illustrated produces effects similar to those produced by the construction illustrated in Fig. 1, except that the automatic circuit-breaker is included in a distinct circuit from that which constitutes the primary circuit of the telephone, the latter being made and broken by the approach and recession of the levers, in the manner described. The contact of P and Q closes the circuit of a battery R through the primary of an induction-coil H, the secondary of which is connected with the telephone T in a manner that is well understood in the art.

O' is a condenser, and R' a rheostat included in the circuit of battery R, to prevent sparking. Any other of the well-known devices for that purpose may be employed in its place.

The key A has connected with it an arm U, which, in the extreme positions of the key, rests against one or the other of two contact-points for connecting up with the line either the bell V or the telephone T. This arrangement is also well understood and requires no special explanation.

The adjusting post or screw O is employed for regulating the tension upon the wire C. The lever F is cut and insulated at the point Y to guard against any interference between the batteries B and R in their operation.

A mouth-piece Z is employed to concentrate the sound-waves upon the diaphragm M.

I do not wish to confine myself to any par-

ticular arrangement of circuits and batteries, as the same results may be obtained by many combinations of the above apparatus. Thus the battery for affecting the fine wire may be located at a central station, or one battery may be arranged to serve for several transmitters. The contacts effected by the key in Fig. 2 may be effected automatically by a self-acting switch. Again, the fine wire and contact-points may be placed in series with the induction-coil, in which case the wire must be attached to the lower diaphragm in Fig. 1 and its cooling produced by breaking the circuit.

In Fig. 3 I have illustrated an arrangement for applying my invention to a carbon transmitter for the purpose of increasing its sensitiveness. In this construction I keep the carbon, which is mounted on the diaphragm, in contact with a corresponding platinum contact-piece by means of a fine wire under tension attached to the diaphragm. The circuit in this instance, when the contact-points are together, is by way of wire 1, carbon button G, contact-point E, screw n, and metallic head n', wires 2 and C, adjusting-screw O, wire 3, and primary of induction-coil. The contact expands the wire C, thereby tending to break the circuit; but the consequent cooling of the wire contracts the same and closes the described circuit. It will be observed that the frame J is cut and insulation inserted at c for obvious reasons. With the construction here illustrated an equilibrium is set up between the elongation of the wire C and the resistance at the carbon contact, the result being that the pressure of the carbon is kept automatically at the most delicate point and a self-adjusting carbon transmitter is obtained. The changed thermostatic condition of the primary circuit is brought about in this construction by a rupture of the circuit, due to the elongation of the resistance-wire, or, rather, by an increase in the resistance of the circuit, and not, as in the other described forms, by the introduction of a shunt around the resistance-wire.

Fig. 4 illustrates an apparatus embodying the same principles as have already been set forth, but in a slightly-different construction. The contact-point E is here cushioned against a soft-rubber cushion e, which is of general spherical shape, and is provided with a perforation through which the wire C passes for attachment to the contact-piece. The wire also passes through a hollow screw j, which is set into the head of the telephone. The object of the cushion e is to render the apparatus more sensitive as regards the action of the wire C in response to successive heating and cooling. The cushion forms a sufficiently rigid home for the contact E, and is at the same time sufficiently yielding to respond quickly to the expansion and contraction of C. The diaphragm M is an insulating-diaphragm, preferably of wood.

In the invention set forth in the foregoing

the fine wire C, with its connected contact-point, forms an automatic circuit-breaker whose makes and breaks produce no audible effects upon the circuit by reason of the great
 5 rapidity with which they follow each other—that is to say, the normal vibrations of the circuit-breaker considered with respect to their capacity to reproduce sounds are neutral or inharmonious. That which reduces
 10 them to harmony and enables them to reproduce sounds in suitable receiving-instruments is the combination, with the apparatus which produces them, of devices which bridge over or throw together more or fewer of the inhar-
 15 monious vibrations and thus alter their natural sequence. By employing a thin diaphragm and sealing up all the works in a heavy cast-iron box to cut off outside vibrations, my apparatus may easily be made to serve as a telephone-
 20 repeater. The diaphragm should then be arranged with an electro-magnet in proximity to it, the said magnet being included in the line over which impulses are being sent.

The diaphragm of my apparatus may be
 25 provided with a multiplicity of contacts connected either in series or in multiple arc.

In this specification the word "diaphragm" is used to signify any device, of whatever shape, which may be caused to vibrate by impulses
 30 communicated to it from any source. It is not necessary that both contacts should be movable. For example, the contact G may be attached to a rigid support, and the proper effects may be produced for sending speech
 35 by talking directly against the wire C or against a suitable covering or a shield attached to the said wire.

What I claim, therefore, is—

1. An automatic circuit-breaker one of
 40 whose terminals is operatively connected with a diaphragm.

2. In a telephone-transmitter, a self-acting thermostatic circuit-breaker one of whose
 45 terminals is operatively connected with a diaphragm.

3. In a telephone-transmitter, a self-acting thermostatic circuit-breaker the expanding
 50 element of which is a conductor included in the primary circuit of the telephone and actuated by the current therein, in combination with a diaphragm carrying one of the terminals of the said circuit-breaker, and a short circuit connected to the said terminal and also
 55 to the primary circuit beyond the said expanding element.

4. The combination, with a diaphragm and a platinum contact-point attached thereto, of a corresponding platinum contact-point forming part of a self-acting vibrator.

5. In a telephone-transmitter, a thermostatic circuit-breaker consisting of a fine wire under tension in the primary circuit of the
 60 telephone, and a short circuit around the said wire, the said short circuit and the fine wire being attached to corresponding contact-points, substantially as set forth.

6. In a telephone-transmitter, two contact-points, one of which is operatively connected with a diaphragm and the other with a resistance-wire under tension, in combination
 70 with a primary telephone-circuit normally passing through the said wire, and a short circuit connected to the first-named contact-point and also to the said primary circuit beyond the said resistance-wire, the tension of
 75 the said wire upon the said second contact-point being relieved by a spring or cushion, as and for the purpose set forth.

7. An automatic circuit-breaker, in combination with a telephone-diaphragm and
 80 mouth-piece, one of the terminals of the said circuit-breaker being supported upon the said diaphragm.

8. In a telephone-transmitter, a self-acting thermostatic circuit-breaker the expanding
 85 element of which is a conductor of considerable resistance included in the primary circuit of the telephone and actuated by the current therein, in combination with the diaphragm carrying one of the terminals of the
 90 said circuit-breaker, and a short circuit connected to the said terminal and also to the primary circuit beyond the said expanding element, the normal primary circuit including a switch for disconnecting the said circuit
 95 at will.

9. In a telephone-transmitter, a self-acting thermostatic circuit-breaker the expanding
 100 element of which is a conductor included in the primary circuit of the telephone and actuated by the current therein, in combination with a diaphragm carrying one of the terminals of the said circuit-breaker.

10. A self-adjusting thermostatic transmitter consisting of an expansible conducting
 105 element forming part of the primary circuit of the telephone, in combination with a diaphragm to which the expansible element is attached, and a pair of electrodes, one of which is connected with the diaphragm,
 110 whereby the strength of the current will determine by its heating effect the degree of contact between the electrodes, substantially as described.

11. A self-adjusting thermostatic carbon
 115 transmitter consisting of an expansible conducting element forming part of the primary circuit of the telephone, in combination with a diaphragm to which the expansible element is attached, and a pair of electrodes,
 120 one of which is carbon and connected with the diaphragm, whereby the strength of the current will determine by its heating effect the degree of contact between the electrodes, substantially as described.

In witness whereof I have hereunto signed
 125 my name in the presence of two subscribing witnesses.

STEPHEN DUDLEY FIELD.

Witnesses:

DAVID E. LAIN,

WM. A. ROSENBAUM.