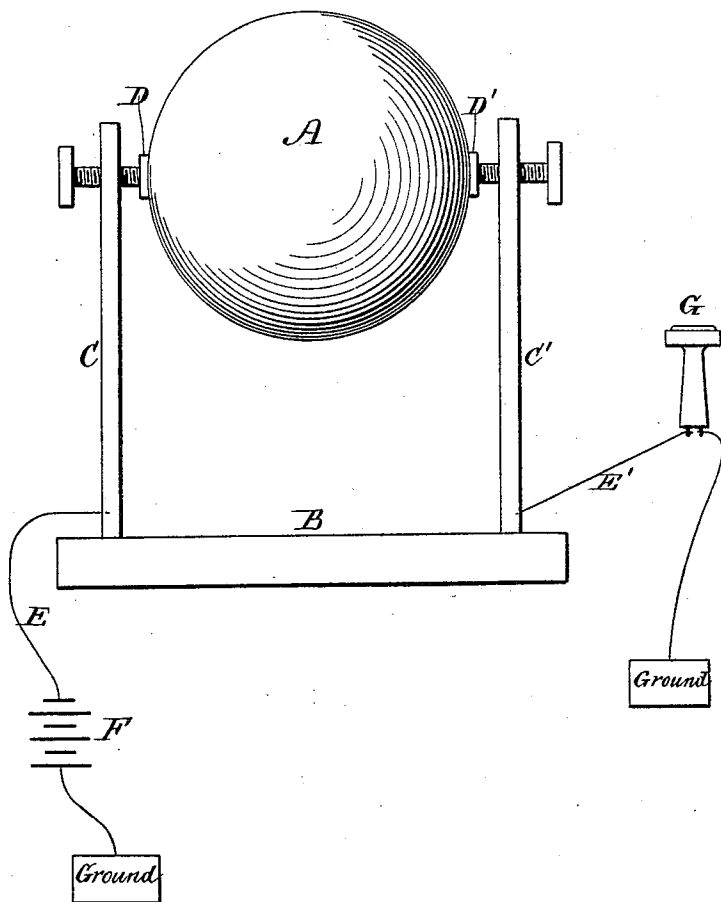


A. G. BELL.
Electric Telephone Transmitter.

No. 228,507.

Patented June 8, 1880.



Witnesses:
E. E. Masson
Philip Maura.

Inventor:
Alexander Graham Bell
by A. Pollok
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UNITED STATES PATENT OFFICE.

ALEXANDER G. BELL, OF WASHINGTON, D. C., ASSIGNOR TO NATIONAL BELL TELEPHONE COMPANY, OF BOSTON, MASS.

ELECTRIC TELEPHONE TRANSMITTER.

SPECIFICATION forming part of Letters Patent No. 228,507, dated June 8, 1880.

Application filed January 2, 1880.

To all whom it may concern:

Be it known that I, ALEXANDER GRAHAM BELL, of Washington city, in the District of Columbia, have invented a new and useful
5 Telephonic Transmitter, which invention is fully set forth in the following specification.

This invention relates more particularly to instruments known as telephonic transmitters, which convert, so to speak, the sound waves
10 or vibrations in the atmosphere into undulatory currents of electricity, the sound-waves being reproduced from such currents by suitable telephonic receivers. These transmitting-instruments operate, in general, to throw into
15 undulations the current from a battery by varying the resistance in the circuit in accordance with vibrations in the atmosphere, and do not themselves generate the electric currents.

20 In transmitting-instruments heretofore known the impact of the sound-waves has been received by a vibratory plate, ordinarily of sheet metal, which, by pressure against a carbon button, or by other suitable means, effects the changes in the resistance of the circuit.

By this invention a more delicate and sensitive instrument is produced, so that the reproduction by the receiver of speech and
30 other sounds is clearer, more distinct, and louder than heretofore, and is accompanied by the peculiar metallic quality characteristic of transmitters operated by vibratory metallic plates.

35 Heretofore the medium for effecting the change of resistance has been a metallic plate or stretched membrane operated by the voice of the speaker.

In my present invention the medium is a
40 body of confined air reacting, under the influence of the voice of the speaker, upon the envelope confining it, which envelope is rendered conducting by coating its surface with a conducting-film, such as plumbago, or by incorporating such material into the substance of
45 the envelope.

Under the influence of the voice of the speaker the body of confined air alternately expands and contracts, expanding when the
50 external air is rarefied and contracting when

it is condensed. The particles of conducting material tend to be separated from one another during the expansion, and are brought nearer together during the contraction, and thus the conducting-envelope changes its resistance to the electrical current in a manner
55 corresponding to the changes in the density of the atmosphere produced by the voice of the speaker.

The form of apparatus that I prefer to use
60 for this purpose is an india-rubber ball the surface of which is coated with plumbago. The sensitiveness of the instrument is increased with the size of the ball and with the readiness of the ball to collapse and expand.
65 This is true, however, only within certain limits. If the ball be too large one portion of it may be in a medium of rarefaction, while the other portion is in a condensed medium, and the distinctness of articulation may thus be
70 impaired. The best effect will be produced upon a ball of such size as will at any particular moment be surrounded by air of the same density, and the larger the ball consistent with this condition the better the result.

75 I have obtained excellent results by using an ordinary child's toy balloon, about six inches in diameter, coated with plumbago and held between two contact-plates in the manner described. Turning my back to this instrument and talking, I found the articulation came
80 out on an ordinary Bell hand-telephone receiver with good loudness and with distinctness of articulation.

An instrument for transmitting sound conveyed to it from a short distance may be made of comparatively small diameter, the reason
85 being that the variations of the density of the surrounding air produced by the voice at a short distance are very much greater than those produced by a voice at a great distance.

The india-rubber envelope confining the air is preferably of the most elastic kind and as thin as may be consistent with durability; but
90 for certain purposes it may be advisable to reduce the sensitiveness of the instrument by increasing the thickness of the walls or material.

The conducting material or plumbago is applied by rubbing it over the surface of the ball.
100

The depth of the film which is thus produced is, of course, very small.

In order to connect the ball in the circuit it is held between two buttons or contact-pieces placed on opposite sides of the ball, and these may be forced against it by springs, the pressure of which is regulated by suitable means. The ends of the wires composing the circuit are connected with these springs.

The arrangement indicated may, it is obvious, be varied. For example, the ends of the springs may bear against the sides of the ball, and thus themselves be the contact-pieces.

The surface of the conductors in contact with the plumbago film may be increased or diminished within wide limits. In general, the larger the surface the less the resistance to the current. The surface may be so large as to flatten the ball when pressed against it; but this, as well as the pressure of the contact-pieces against the sides of the ball, is a matter of adjustment.

In order that the invention and the manner of carrying the same into effect may be more readily understood, reference is made to the accompanying drawing, which forms a part of this specification, and which is a diagrammatic representation of a transmitting-instrument constructed in accordance with my invention connected in a circuit.

A is the rubber ball, whose surface is coated with plumbago; B, the base or supporting piece. C C' are standards or supports connected with the base. D D' are adjustable contact-pieces. E E' are wires forming the circuit, and grounded; F, a battery, and G a receiving-telephone at the other end of the line.

The supports C C' (which may be springs) are metallic, and are connected with a metal wire or strip, so as to form electrical conductors.

The contact-pieces D D' are of metal. They are screw-threaded, and rest in the ends of the supports C C', which are screw-threaded, or are so formed as to engage with the screw-thread in the contact-pieces. By turning the contact-pieces they are advanced or withdrawn, and the force with which the ball is compressed thus regulated.

The wires E E' are connected with the supports or with conductors united thereto at their fixed ends. The wire E and support C are insulated from the wire E' and support C' at the bottom, which is readily effected by making the base-piece B of insulating material.

When a person speaks in the vicinity of the instrument the sound-waves in the air cause the ball to contract and expand, as already stated, so that the particles of plumbago on its surface are separated or crowded together, thereby increasing and diminishing the resistance of the circuit, and throwing the currents from the battery F into undulations, from which the receiver G reproduces the sounds transmitted.

In order to employ the new transmitter in

telephone-systems it may be connected in any ordinary or suitable way, as other instruments for the same purpose are. The transmitters usually employed in telephonic-exchange systems are of such low resistance that they cannot be practically used upon the main circuit. On this account it is customary to place each transmitter in the primary circuit of a local induction-coil with a local battery, the secondary circuit of the coil being connected to the line-wire. Upon the usual system, therefore, there are as many distinct batteries and induction-coils as there are transmitters, and the batteries, being located in different and distant places, occasion a great deal of trouble in their repair. One great advantage, therefore, that I propose to derive from the use of these instruments is to employ for their operation a battery located in the central office of the telephonic exchange, and to do away with the necessity of employing induction-coils.

Of course it is obvious that the transmitter may be used with an induction-coil in the ordinary manner; but on account of the high resistance of the conducting-envelope it is more advantageous to place the instrument directly in the main circuit, or to place it in circuit with the fine wire of the induction-coil with a battery and connect the primary wires to the line.

The instrument, although described as a transmitter, for which it is best adapted, may also be used as a receiver, but not to the same advantage. It is well known that a current of electricity tends to cause the particles of a conductor to repel one another, and when an undulatory current is passed through an instrument of the above construction the particles of the conducting-material are repelled most forcibly when the current is strongest and least forcibly when it is weakest. Thus a mechanical vibration is produced, reproducing the original sound. Of this, however, I can speak only from theory, as I have not as yet had opportunity of testing this instrument as a receiver under favorable circumstances.

It is obvious that the details may be varied without departing from the spirit of my invention. I do not, therefore, intend to limit myself thereto.

Having thus fully described my said invention, and the manner in which the same is carried into effect, what I claim, and desire to secure by Letters Patent, is—

1. As an improvement in electric telephony, the method described of causing electrical undulations corresponding to sound-waves in a galvanic circuit, by varying the resistance of said circuit by the expansion and contraction of a body of confined air operating through an elastic envelope to separate and bring together the particles of conducting material upon or within the substance of the envelope through which the electric current is passed, substantially as described.

2. A telephonic transmitter in which the medium for transforming waves of sound into

electrical undulations is formed by an elastic ball and a conducting material, as specified, acting in connection therewith, substantially as described.

5 3. In a telephonic transmitter, the elastic hollow ball having on its surface a film of pulverized conducting material, such as plumbago, substantially as described.

10 4. The combination of the elastic ball, coated as specified, and contact-pieces, for completing an electro-telephonic circuit by means of said coating, substantially as described.

5. The combination, in a telephonic transmitter, of the elastic ball, supports, or springs, and adjustable contact-pieces, substantially as 15 described.

In testimony whereof I have signed this specification in the presence of two subscribing witnesses.

ALEXANDER GRAHAM BELL.

Witnesses:

A. POLLOK,
BARTRAM ZEVELY.