No. 732,284. PATENTED JUNE 30, 1903.

E. B. FAHNESTOCK.

TELEPHONE TRANSMITTER.

APPLICATION FILED MAY 7, 1900.

NO MODEL.

Fig. 1.

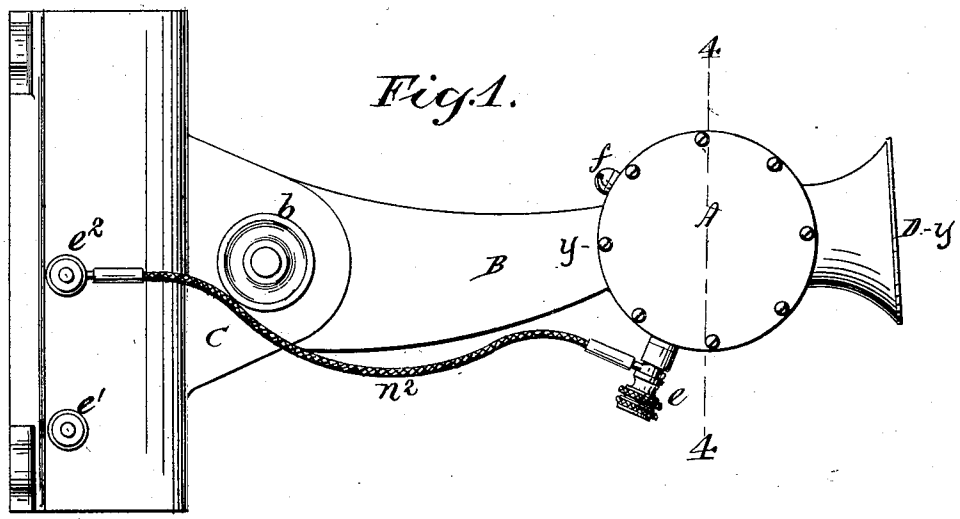


Fig. 2.

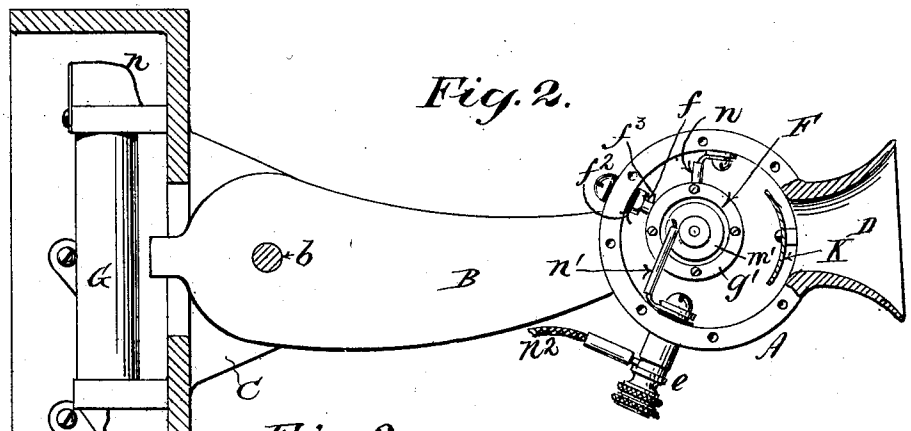


Fig. 3.

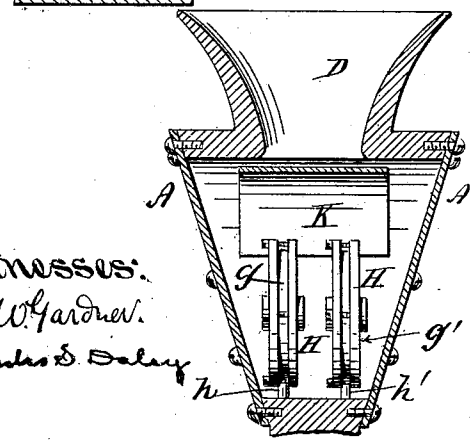
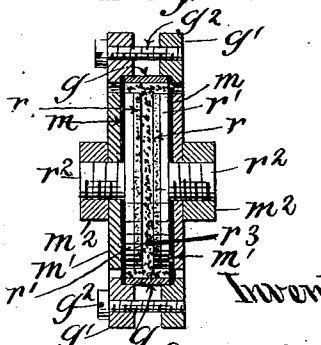


Fig. 4.



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No. 732,284. Patented June 30, 1903.

UNITED STATES PATENT OFFICE.

ERNEST B. FAHNESTOCK, OF NEW YORK, N. Y.

TELEPHONE-TRANSMITTER.

SPECIFICATION forming part of Letters Patent No. 732,284, dated June 30, 1903.

Application filed May 7, 1900. Serial No. 15,688. (No model.)

To all whom it may concern:

Be it known that I, ERNEST B. FAHNESTOCK, a citizen of the United States, residing at No. 119 West Forty-third street, in the borough of Manhattan, city of New York, State of New York, have invented certain new and useful Improvements in Telephone-Transmitters; and I 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, reference being had to the accompanying drawings.

My invention relates in general to electric telephones, and more specifically consists of an improved form of microphone-transmitter for use therein.

In microphones employing a quantity of granular conducting material, such as loose carbon particles, it is desirable for obvious reasons not to have the electrodes of too great diameter. On the other hand, it has usually been considered necessary that the diaphragm upon which the sound-waves impinge be of considerable diameter, in order to keep down the pitch of its characteristic note or natural period of vibration of the apparatus. This tendency of the diaphragm to vibrate as a whole at a given rate, determined by its diameter, weight, and flexibility, exerts a selective action on the vibrations impressed upon it by the air sound-waves, reproducing most strongly the tones the pitch of which most nearly approximate its characteristic note. If the diaphragm be made smaller, other things being equal, its characteristic note becomes higher and the reproduced or transmitted sounds will be rendered shrill and metallic in character. The result of these conflicting conditions has been to compel the use in nearly all cases of a large diaphragm separate from the smaller microphone disk, but mechanically connected thereto. This has increased the bulk and complication of the structure and interfered to a certain extent with the faithfulness of the sound transmission. I have overcome these difficulties and secured the advantages of the construction employing the large diaphragm by employing a microphone composed of small diaphragms, clamping the electrodes directly to the diaphragms and weighting the same. Thus by varying the degree of rigidity of the clamping and the weight of the parts the characteristic note or natural period of vibration of the device may be reduced to the extent desired. At the same time the air-waves of sound impinge directly on the microphone instead of being transmitted to it through intervening mechanism.

An apparatus embodying the preferred form of my invention is illustrated in the accompanying sheet of drawings, in which—

Figure 1 is a side elevation of a transmitter containing my invention. Fig. 2 is a similar view with certain parts shown in section and one cap or side plate removed. Fig. 3 is a sectional view of a modification in which two microphones are employed; and Fig. 4 is an enlarged cross-section of the microphone, taken on line 4 4 of Fig. 1.

Throughout the drawings like reference letters refer to like parts.

The microphone F is inclosed in a casing A, forming a sound-receiving chamber and mounted therein in any suitable way, as by a screw f, which coacts with the threaded opening f^3 in the side of the microphone F, and which screw f may be insulated from the casing by means of a non-conducting washer f^2. The mouthpiece D conveys the air sound-waves to the sound-receiving chamber within the casing A.

The casing A is preferably attached to or formed integral with an arm B, which is hinged to the base C by the screw b in the well-known way. This allows the arm B and transmitter carried thereby to be raised or lowered to accommodate the speaker.

e, e', and e^2 represent binding-posts.

n, n', and n^2 represent wires which constitute a portion of the electric circuit extending through the microphone, the induction-coil G, and an electric battery. (Not shown.)

As shown in Figs. 2 and 4, my improved microphone consists of a two-part casing composed of the interior ring g, the two exterior rings g' g', having annular shoulders which coöperate with and engage the interior ring g, and diaphragms m m, held in place between said interior and exterior rings, the whole forming a microphone-chamber in which is held granular carbon r^3. The parts described are held together by screws g^2 or equivalent

means. Electrodes of the microphone consist of the carbon disks r r, which are supported by the disks or metal plates r', and oppositely disposed one to the other with a quantity of carbon filling the space between. From these disk electrodes extend bosses r^2 r^2 through perforations in the diaphragms m m. These bosses are preferably screw-threaded, as shown, and coöperate with exterior annular disks m' m', which are held in position by the nuts m^2 m^2, screwed upon the bosses r^2 r^2.

K is a guard which may be used to protect the microphones.

In the construction shown in Fig. 3 two microphones similar in construction to those described are located side by side in a sound-receiving chamber H, being held in position by the supports h h'.

The method of operating my invention is as follows: The diaphragms m m, being preferably of some insulating material, such as mica, serve to insulate the electrodes of the microphone from the supporting structure, and the current is consequently compelled to pass through the granular carbon r^3. The vibrations of the electrodes toward and from one another produces varying degrees of contact between the particles of the granular carbon, and thereby vary the conductivity of the circuit in the well-known way. The said diaphragms are grasped with a greater or less degree of rigidity between the disks r r and the exterior disks r' r', according to how firmly the nuts m^2 m^2 are screwed down upon the screw-threaded bosses r^2. In this way and by properly adjusting the weight of the screw-nuts m^2 and of the other parts the natural period of vibration of the diaphragm so loaded may be reduced to the proper degree and the pitch of the characteristic note of the structure thereby lowered. By varying the degree of rigidity of clamping and employing nuts m^2 of different weights I can vary the result and properly adjust the microphone. The microphone being adjusted and placed in position, a person speaking into the mouthpiece D produces sound-waves in the atmosphere, which enter the sound-chamber and striking on the exterior of both diaphragms and electrodes set up sound-vibrations therein, which produce corresponding undulations in the electric current passing through the wires and binding-posts described and shown. The disk electrodes being of only slightly-less diameter than the diaphragms themselves, the same are held rigidly, so that the central portion of the diaphragm is exempt from vibration within itself as a whole.

The advantages of my invention comprise a compactness resulting from the use of small diaphragms, a perfection of sound-transmission resulting from the sound-waves acting directly upon the microphone-electrodes and the diaphragms clamped thereto, and the capability of adjusting the microphone to a low characteristic note.

It is evident, of course, that various changes may be made in the form and proportion of the parts of the structure illustrated and described without departing from the spirit and scope of my invention so long as the principle of operation and relative arrangement of parts above set forth are substantially preserved. Different clamping means for the diaphragm and electrodes might be employed, other materials might be substituted for the mica used as diaphragms, the microphone-chamber might be of different shape, and the inclosing casing therefor differently constructed. The electric connection might be differently arranged and the manner of mounting the microphone in the sound-receiving chamber might be varied, &c.; but all changes such as these I consider are matters of construction of details and the various modifications so rendered possible would still be within the scope of my invention.

Having therefore described my invention, what I claim as new, and desire to protect by Letters Patent, is—

1. A telephone-transmitter consisting of a substantially non-vibratable sound-receiving chamber, having an opening through which to speak, and a microphone inclosed within, said microphone having two sensitive sides consisting of vibratable diaphragms weighted at the central portion thereof, and carrying electrodes between which is powdered carbon, these parts being held in position by means of an interior ring and two exterior rings having annular shoulders engaging the interior ring, said microphone being supported in the sound-receiving chamber by means of a set-screw and having suitable electric connections so as to transmit the sound-waves to an exterior circuit.

2. A telephone-transmitter consisting of a substantially non-vibratable sound-receiving chamber having an opening through which to speak, said sound-receiving chamber containing a microphone, said microphone having two sensitive sides consisting of vibratable diaphragms weighted and clamped at the central portion thereof and carrying electrodes, between and around which is powdered carbon, these parts being held in position by means of an interior ring and two exterior rings having annular shoulders engaging the interior ring; and suitable electric connections with said microphones.

3. A microphone consisting of a chamber containing granular carbon, said chamber being cylindrical in shape and inclosed by means of a ring and flexible, vibratable diaphragms coöperating therewith, said diaphragms being weighted at the center and carrying disk electrodes, the central portion of each diaphragm being clamped between an electrode and an exterior plate, so that the central portion of said diaphragm cannot vibrate within itself, the parts being held firmly together by means of a two-part inclosing casing having annular shoulders coöperating with the before-mentioned ring and wires for

connecting said microphone with an electric circuit.

4. A microphone, consisting of a chamber containing granular carbon, oppositely-disposed electrodes in said chamber, flexible diaphragms against which the air-waves are adapted to impact, connected at their outer peripheries to said chamber, and means for decreasing the normal rate of vibration of said diaphragms.

5. A microphone, consisting of a chamber containing granular carbon, oppositely-disposed electrodes in said chamber, flexible diaphragms against which the air-waves are adapted to impact, and means relatively large as regards the diameter of the diaphragms for decreasing the normal rate of vibration of said diaphragms.

6. A microphone, consisting of a small carbon-chamber, granular carbon in said chamber, oppositely-disposed electrodes in said chamber, flexible diaphragms upon which the air-waves impact, approximately of the size of the chamber and relatively smaller in diameter than is necessary to produce the required pitch of the vocal notes to be transmitted, and means for decreasing the normal rate of vibration of such small diaphragms.

7. A microphone, embodying in its construction, a diaphragm of small size against which the air-waves are adapted to impact and whose characteristic note in pitch and rate of vibration is higher than that desired for use, together with a plate relatively large as regards the size of the diaphragm fixed to the center of the diaphragm and adapted to decrease the pitch of said note and rate of vibration of the diaphragm.

8. A microphone embodying in its construction, a chamber containing granular carbon, a pair of electrodes in said chamber, a diaphragm of approximately the size of the carbon-chamber, and means for decreasing the normal rate of vibration of the diaphragm, supported solely by the diaphragm, and said diaphragm free to vibrate at its normal rate except as modified by such means.

9. A microphone embodying in its construction, a chamber containing granular carbon, a pair of oppositely-disposed electrodes in said chamber, a flexible diaphragm on each side of said chamber and approximately of the size of the chamber, and means relatively large as regards the diameter of the diaphragms mounted on said diaphragms, and adapted to normally decrease the rate of vibration of said diaphragms.

In witness whereof I have hereunto set my hand this 5th day of May, 1900.

ERNEST B. FAHNESTOCK.

Witnesses:
MYRA B. MARTIN,
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