(No Model.)

J. E. DANN & J. LAPP.

TELEPHONE TRANSMITTER.

No. 338,660. Patented Mar. 23, 1886.

Fig. 1.

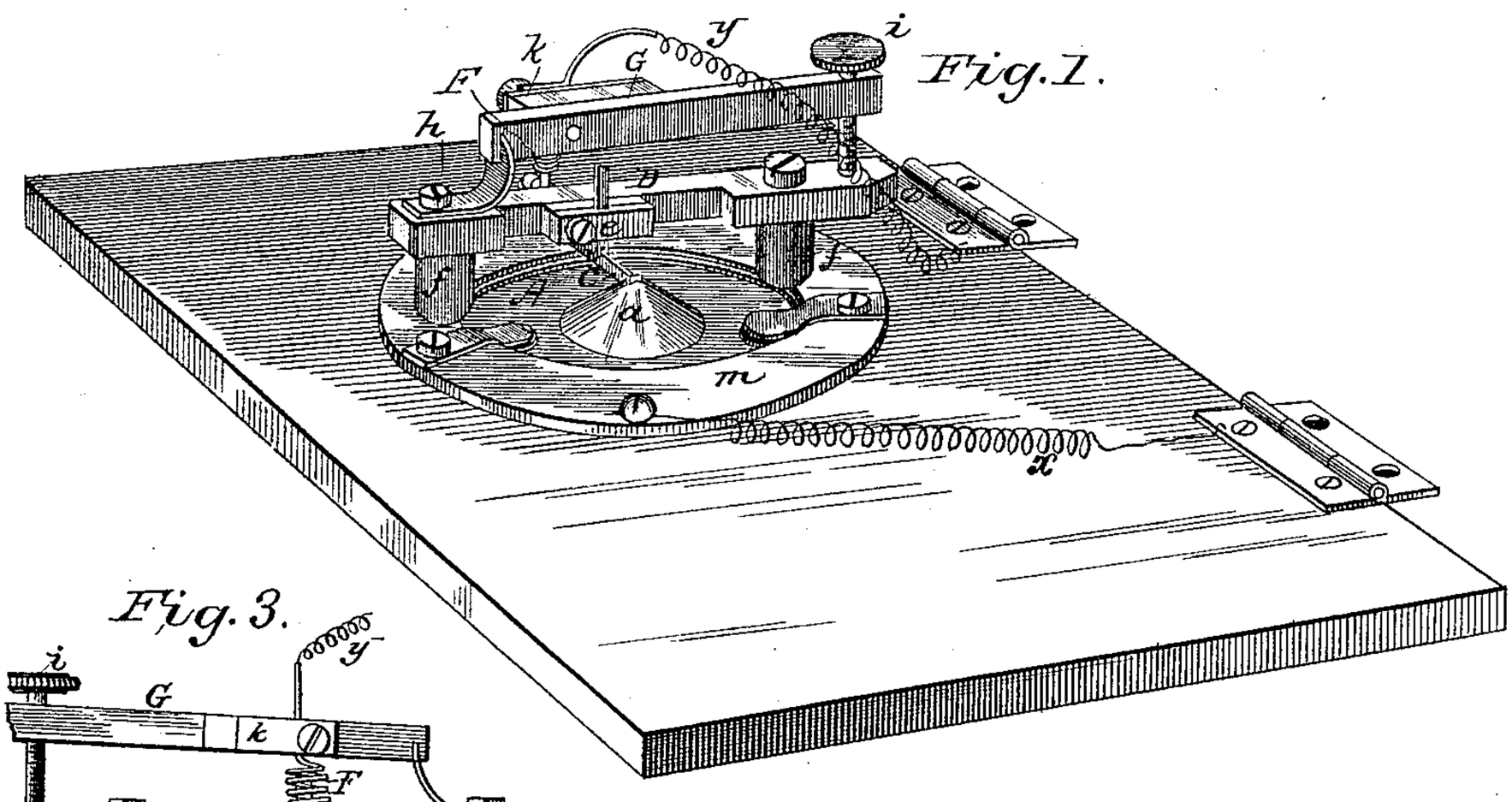


Fig. 3.

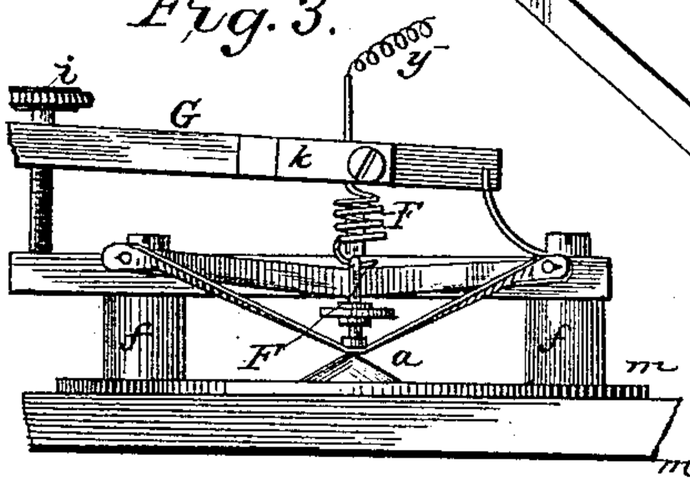


Fig. 2.

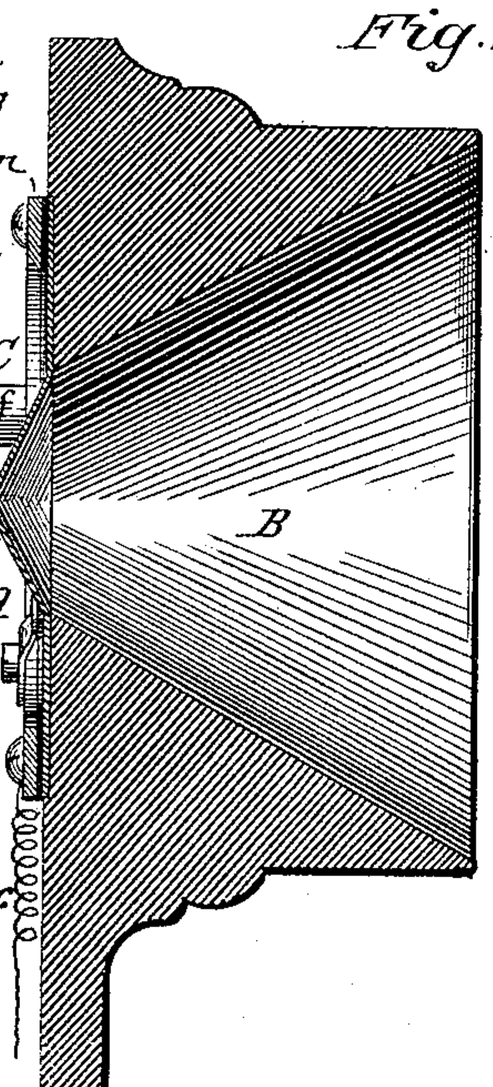


Fig. 4.

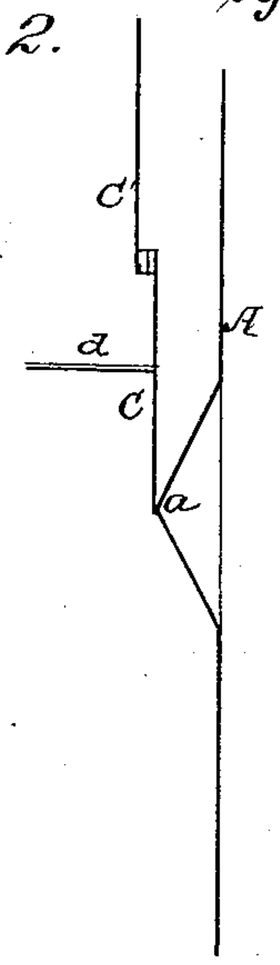


Fig. 5.

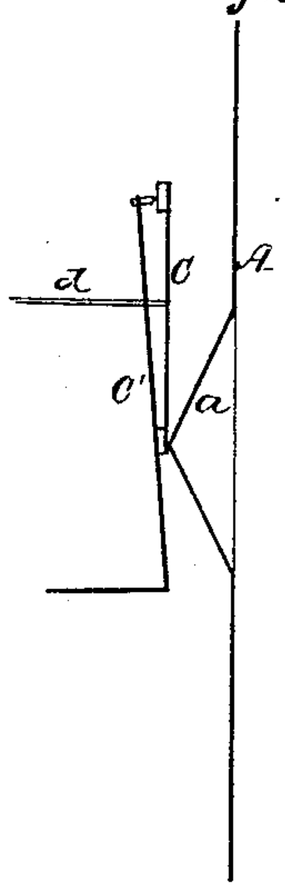
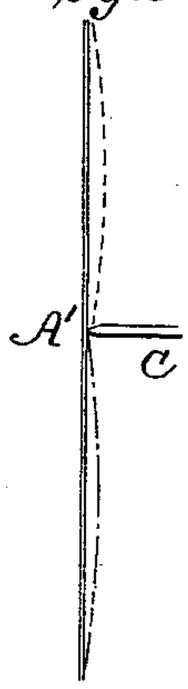


Fig. 6



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JOHN E. DANN AND JOHN LAPP, OF HONEOYE FALLS, NEW YORK.

TELEPHONE-TRANSMITTER.

SPECIFICATION forming part of Letters Patent No. 338,660, dated March 23, 1886.

Application filed December 24, 1885. Serial No. 186,644. (No model.)

To all whom it may concern:

Be it known that we, JOHN E. DANN and JOHN LAPP, citizens of the United States, residing at Honeoye Falls, in the county of Monroe and State of New York, have invented a new and useful Improvement in Telephone-Transmitters, of which the following is a full, clear, and exact description.

Our invention is an improvement in the class of transmitters having vibrating electrodes arranged adjacent to and one of them normally pressing upon the diaphragm, and in some cases attached to it.

The object we aim at and have attained is the production of a loud-speaking instrument capable of operating with a minimum expenditure of battery-power or electro-motive force.

To this end we have devised a new and simple construction of the diaphragm, and also provided a new and improved mechanism for co-operating therewith, as hereinafter fully described.

In the accompanying drawings, Figure 1 is a perspective view of our invention applied to the door of a transmitter-box. Fig. 2 is a central cross-section of the same. Fig. 3 is a side view of a portion of the mechanism. Figs. 4 and 5 illustrate modifications. Fig. 6 illustrates a defective operation of the ordinary diaphragm employed in telephones.

The sheet-metal diaphragm A is constructed with a central conical portion, *a*, which may be formed integral therewith or made separately and attached by solder, brazing, or in any other suitable manner. The diameter of the base of the hollow cone may be varied considerably; but we prefer it shall equal and even slightly exceed that of the contiguous inner end of the mouth-piece B, of which it forms practically a conical extension. By this construction and combination of parts the whole force of the air-current or sound-waves from the mouth of the person speaking into the instrument is concentrated on the cone—that is to say, on the central portion of the diaphragm—thereby producing the maximum effect in respect to the required vibration of the latter, and the transmission of sound with corresponding loudness, force, and precision.

A lever, C, which constitutes one of the electrodes, is permanently attached to the apex of the cone *a* through the intermediary of a spring or other device which will allow the lever to vibrate within certain narrow limits. The lever may, however, be rigidly attached to the cone, and in that case of course the diaphragm must yield enough to permit due vibration of the lever. The fulcrum of the latter is a spring or flexible plate, *d*, which is held adjustably by a clamp, *e*, to a fixed bar, D, supported by posts *f*. A shorter lever, C′, is arranged parallel to and in front of the former, C, and also attached to its middle portion by a short spring, *g*, which constitutes a yielding fulcrum that permits slight movement of such shorter lever toward and from the other. The outer or free end of this lever C′ has an eye or socket that holds the other electrode—to wit, a short metallic pin, E. The latter is suitably insulated in the socket by rubber or equivalent means. The inner end of the pin E rests normally in light contact with the free end of lever C, and it is the vibration of these two parts C and E, corresponding exactly to the vibration of the diaphragm, that effects the transmission of speech.

It is obvious that the contact-points or electrodes proper may be multiple instead of single, although we prefer and intend to use the latter.

When a current is sent through a freely-suspended carbon electrode, it is repelled somewhat from an opposite electrode. We utilize this principle of repulsion as an aid in avoiding the "stick," which two metallic electrodes exhibit, by inserting a piece of carbon in the outer or free end of the lever C, so that the metallic electrode rests in contact therewith, instead of with the lever proper. By this means rapidity of vibration of the electrodes is efficiently promoted, and the instrument thereby adapted to transmit speech with greater fidelity and speed.

As a means of support and adjustment for the pin-electrode C, we connect it by means of a spiral spring, F, with a lever, G, which is arranged parallel with the fixed bar D, and attached to it by a flexible fulcrum-piece, *h*. Said lever is provided with a screw, *i*, at its opposite or free end, for adjusting it closer to or farther from the bar D. A screw-clamp, *k*, secures the spring E to the lever, and it is suitably insulated by a rubber block, *l*.

In practice the diaphragm A and spring F are connected by wires *x y* with the primary of an induction-coil and with a battery, neither of which is shown in the drawings; or the instrument may be set in a battery-circuit with an intensity-coil properly connected with the line-wire. When a sound-wave strikes upon the diaphragm, its main force is concentrated at the center, which is capable of the greatest amplitude of vibration, and the consequent movement of the diaphragm is transmitted to the electrode-lever C, so that the free end of the latter vibrates with a greater amplitude than the diaphragm, owing to the fulcrum *d* being nearer the end attached to the cone *a*. This vibration of the lever-electrode C effects the transmission of sound through the receiving-instrument at the other end of the line.

In addition to the function of the cone *a* in concentrating the sound-waves, as above stated, it has a still more important one, which we will explain as follows: When a sound-wave strikes upon a diaphragm of the usual form with whose center an electrode rests in contact, the latter resists more or less the tendency of such central portion to yield and assume a concavo-convex form, and consequently the portion surrounding the center yields first, as illustrated in an exaggerated way in Fig. 6, in which A′ indicates the diaphragm and C‴ an electrode. The result is a failure to transmit and reproduce sound with the desired loudness and accuracy; but by use of the cone *a* this defect is avoided, since the air-wave pressure forces back the cone or central portion of the diaphragm before or else simultaneously with the portion that surrounds it. In other words, the diaphragm vibrates with the freedom and in the manner required to produce, in connection with the other mechanism employed the desired perfection of result.

A still further advantage attends the use of the cone, since it is capable of withstanding the pressure and thrust to which it is subject in acting on the attached lever, and hence the diaphragm is made correspondingly more durable than if constructed in the usual form.

In further relation to the cone *a* we desire it to be understood that while it is desirable and even necessary that its inner side shall be open, as shown, in order to produce the best result, yet we do not propose to here limit ourselves to such construction, since a good degree of success may be attained by closing the base of the cone—that is to say, by employing a diaphragm of the ordinary form and attaching a hollow cone to its center.

Our improved diaphragm is applicable to other telephonic instruments beside transmitters.

In respect to adjustments it may be stated that the spring-fulcrum *d* of the inner lever-electrode, C, is properly adjusted when the apparatus is prepared or "set up" for use. The lever G is adjusted by screw *i* to increase or lessen the tension of the spring F, and thereby regulate the contact-pressure between the electrodes E C, as required for the desired perfection of operation.

In practical operation of the instrument a metallic sound arises from the molecular or mechanical vibration of movable parts, particularly the electrode-levers and the spring F. To quickly destroy such vibration we employ elastic bands, Fig. 3, which are stretched between suitable points of attachment and press lightly on the spring and pin-electrode E and both levers C and C′, as shown. It is also expedient to employ dampers or elastic pressure-plates, as shown in the drawings, to limit the vibration of the diaphragm, and thus choke out the metallic clang.

We do not propose to limit our invention to the described and preferred arrangement of levers shown, since various others are practicable. As an example, the outer electrode might be attached to the lower end of a metal strip or bar, C′, as shown in Fig. 4, and said bar may be a spring, or it may be inelastic, and in the latter case the action of gravity would be depended on to hold it in light contact with the other electrode, C.

Fig. 5 illustrates still another arrangement, wherein both levers C C′ are attached to the cone, which thus acts directly on both when vibrated.

We are aware that a diaphragm having a conical portion with a surrounding annular part which is curved transversely (or in cross-section) has been suggested or employed, and we therefore restrict our claim to the precise construction of our diaphragm, which experiment has demonstrated to be advantageous.

We propose to file another application in which the function and advantages of a carbon electrode in transmitters of this particular class shall be fully described, and in which it shall be claimed more broadly than in this application.

What we claim is—

1. The diaphragm having a central hollow cone and a surrounding annular part, all portions of which are flat or lie normally in the same plane, said diaphragm being free to vibrate, as shown and described.

2. The combination, with the diaphragm and its central hollow cone, of electrode-levers having yielding fulcra, and one of them attached to said cone, substantially as shown and described, to operate as specified.

3. The combination of the spring F with the connected electrode-levers, the spring or elastic fulcra therefor, the diaphragm having a hollow cone to which one of said levers is attached by a yielding connection, all as shown and described.

4. The combination of the spring F with the pin-electrode, the lever C, and the cone-diaphragm, substantially as shown and described.

5. In a telephone of the character herein-

before specified, the combination, with the diaphragm and an electrode, E, of the lever C, connected with the diaphragm and carrying a carbon contact-point.

6. The combination, with the diaphragm and the lever-electrode C, attached thereto, and the spring-fulcrum *d* therefor, of the electrode C′ and its spring-fulcrum *g*, substantially as shown and described.

7. The combination, with the diaphragm and the vibrating lever-electrode C, attached thereto and having a spring-fulcrum, of the second electrode-lever, C′, and a spring-fulcrum therefor, which connects it with the other, C, at a point between the fulcrum and free end of the latter, as shown and described.

8. The combination, with the diaphragm, the electrode-levers, the spring F, and a fixed bar, D, of the adjusting-lever G and the screw *i*, all arranged as shown and described to operate as specified.

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