F. D. CLARKE & M. G. FOSTER.

Device for Aiding the Deaf to Hear.

No. 226,902. Patented April 27, 1880.

Fig. 1.

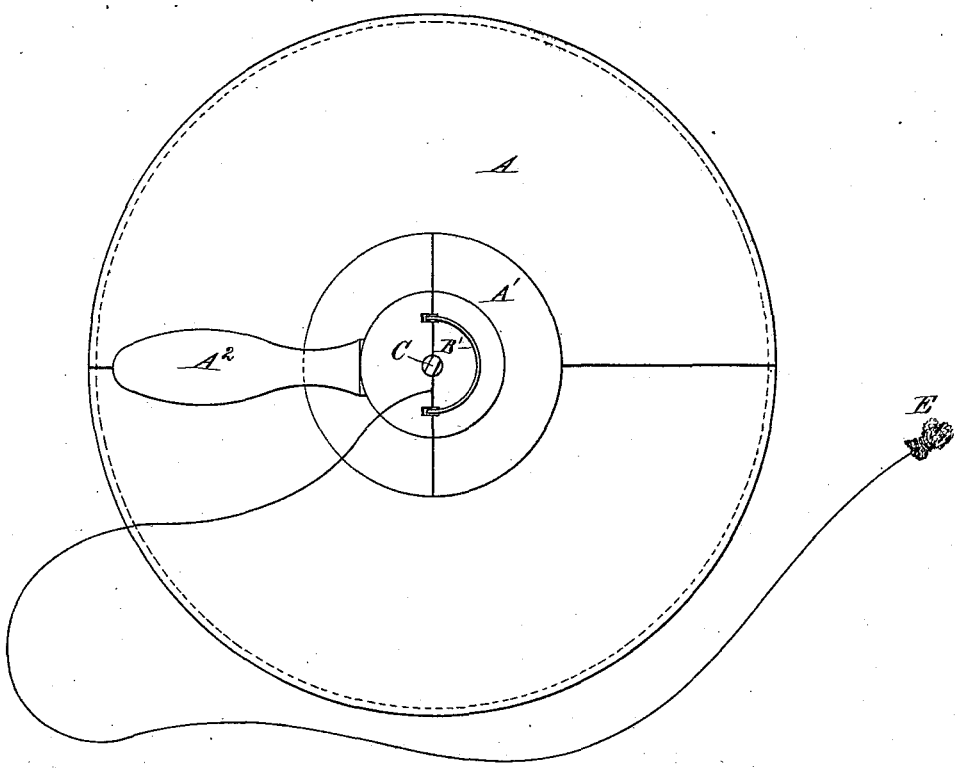
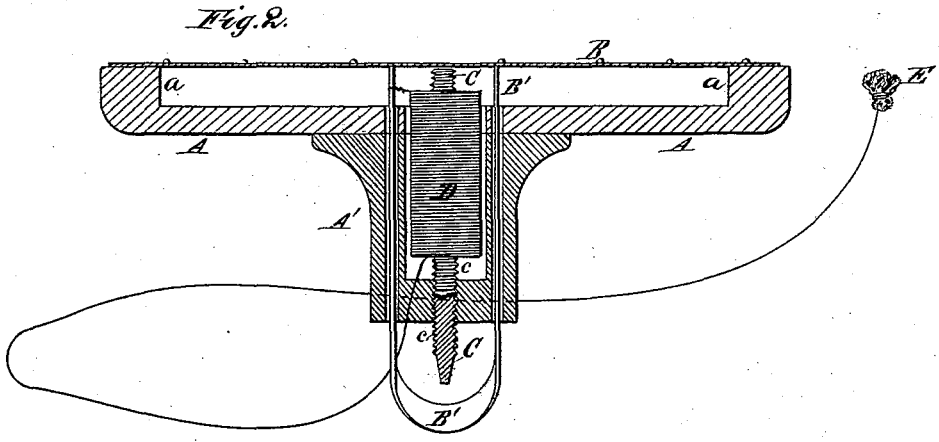


Fig. 2.



WITNESSES:

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UNITED STATES PATENT OFFICE.

FRANCIS D. CLARKE AND MACOMB G. FOSTER, OF NEW YORK, N. Y.

DEVICE FOR AIDING THE DEAF TO HEAR.

SPECIFICATION forming part of Letters Patent No. 226,902, dated April 27, 1880.

Application filed January 20, 1880.

To all whom it may concern:

Be it known that we, FRANCIS D. CLARKE, of New York city, in the county and State of New York, at present connected with the New York Institution for the Deaf and Dumb, and MACOMB G. FOSTER, of New York city aforesaid, have invented certain new and useful Improvements in Apparatus or Devices for Aiding the Deaf to Hear; and we do hereby declare that the following is a full and exact description thereof.

It is well known that a succession of gentle galvanic currents, in the proper rapidity and order, imitating the undulations of the air in spoken words, may, by a proper connection to a sonorous diaphragm, produce faint sounds closely resembling the said words. This is the ordinary receiving-instrument of the device known as the "telephone." We have discovered that the corresponding succession of currents may be made to induce a closely similar effect in deaf persons, or those nearly deaf, by being conducted directly through the inner ear or very near it. In our experiments we applied one conductor to the upper teeth and the other to a small piece of damp sponge inserted in the ear; but in case of objection, for any reason, to meddling so intimately with the inner ear, we have reason to believe pretty nearly the same effect can be obtained by a conductor applied to the head just behind the ear, or in any other convenient place adjacent to the ear.

It is well known that a properly-mounted sheet of thin metal of any sonorous kind, especially iron, will receive from the air undulations corresponding to the sounds in the adjacent air. Such is the principle involved in the ordinary sending-instrument of the telephone.

It is also well known that a sheet of iron undulating very near but not quite in contact with one end of a permanent magnet will induce a corresponding succession of intermittent gentle currents through an insulated helix of iron wire surrounding such magnet. These laws are made available in our instrument. We provide a permanent magnet with a sufficiently large iron diaphragm close to one end and a quantity of fine wire properly insulated around the magnet, connected at each end to different points near the inner ear of the deaf person. It communicates to the brain of such person a consciousness of the words spoken in the vicinity of the said diaphragm.

We have not tested the capacity of the invention for thus communicating to distant points, but believe it may be useful for that purpose also. We have in our efforts been mainly anxious to aid very deaf persons to understand words distinctly spoken near them. We have devised a portable apparatus which involves all this in a convenient and eminently practicable form, and which also makes available, in combination therewith, another principle or law long known and used in somewhat analogous conditions—the actual conduction of sound from a sonorous body to the consciousness of the hearer through a solid rod or the like in contact with the teeth.

The following is a description of what we consider the best means of carrying out the invention.

The accompanying drawings form a part of this specification.

Figure 1 is a plan view of that side of our improved device to which the handle is attached, and Fig. 2 is a view at right angles to that shown in Fig. 1, partly in section.

Similar letters of reference indicate corresponding parts in all the figures.

A is an extended disk of suitable wood, having a rim, *a*, to which is attached an iron diaphragm, B, so that the middle is free to vibrate like a drum-head.

A′ is a stout extension of wood from the back of A, and A^2 is a convenient-shaped handle fixed in A′. These parts A A′ A^2 may be all formed in one piece, or may be in separate pieces suitably joined.

B′ is an extension-piece of stout sheet metal bent as shown, and united to the back of the iron diaphragm B by soldering. We have in our experiments used thick sheet-brass for the part B′. We make sufficient mortises through the wood body A′ to allow this piece B′ to extend through without touching, or with only slight touching, not enough to kill the conduction of sound through it.

Now, by exposing the diaphragm B to the reception of the voice of the speaker to be heard, and letting the extension-piece B′ rest

against the teeth of the nearly deaf person listening, the conduction of sound from the sonorous diaphragm to the teeth aids the natural hearing through the ears, and the sound is heard more plainly. This is a long-recognized mode of hearing faint sounds, as the working of valves or the rush of water in a pump by a stick resting firmly on the outside of the pump-barrel and bitten or otherwise pressed firmly by the teeth.

The electrical action to be made available, in addition, is obtained as follows: C is a permanent magnet, straight, with plane ends, and provided with screw-threads *c*, engaging in corresponding female threads in its bearing in the body A′, so that by turning it may be adjusted with delicacy, with one end close to but not touching the sonorously-vibrating iron B. It stands at right angles to the plane of B, so that each undulation or movement of B carries it alternately to and from the end of C in the line of the axis thereof, this being, as we understand, the most favorable condition for exciting electrical currents in a helix surrounding the magnet.

D is such helix. We have used successfully copper wire wound with silk and varnished or prepared in the ordinary manner for reliable insulation. One long fine helix was employed, with one end extended a little and united to the piece B′, communicating, when in use, with the teeth of the user, and with the other end extended longer and terminating in a small piece of sponge, E, which, when not in use, may be wound around the body A′ out of the way, and when in use may be thrust partially or entirely in one ear of the person using the apparatus.

This constitutes the whole apparatus, as we have mainly tried it and have elected to represent it. We believe it to be the preferable form of the device, all things considered. We have made the parts A B with a diameter of about ten inches; but we believe it may serve successfully much smaller.

We can introduce various modifications of the forms and proportions without departing from the principle or sacrificing the advantages of the invention. We propose, for example, to employ, in some instances, two separate and distinct helical wires, D, both connected to the piece B′ at one end, and at the other end connected to the two ears of the user.

We propose, as another obvious modification, to employ a single helix with both ends extended and equipped with damp sponge, or otherwise adapted to form a good electrical connection with the two ears of the user. In such case the succession of gentle currents induced by the action of the excited magnet will play directly through the head from one ear to the other, and may, in some cases, be found very effective. We can in some extreme cases provide a device analogous to an ear-trumpet to aid in concentrating the sound upon the diaphragm.

In ordinary use we have not found it necessary to speak with the mouth close to the diaphragm. We have simply exposed the diaphragm to the ordinary air of the room and spoken.

We claim as our invention—

An instrument having in combination a diaphragm, B, and extension-piece B′, for transmission of sound, and a magnet, C, and coil D, excited by the movements of such diaphragm, and provided with conductors or extensions from the coil D, adapted to induce pulsating electrical currents through or near the ear, as herein specified.

In testimony whereof we have hereunto set our hands this 17th day of January, 1880, in the presence of two subscribing witnesses.

F. D. CLARKE.
MACOMB G. FOSTER.

Witnesses:
HENRY HESSE,
CHAS. I. CORNELL.