

Feb. 17, 1925.

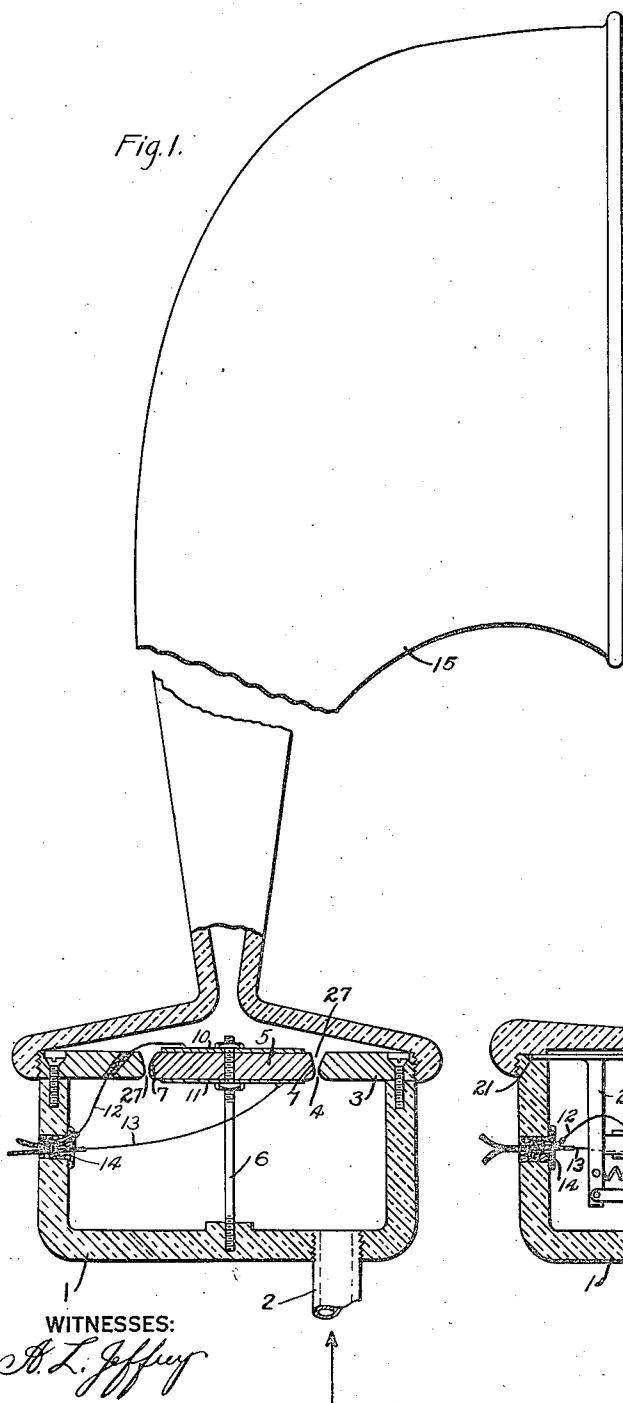
1,526,319

L. W. CHUBB

PIEZO ELECTRIC LOUD SPEAKER

Filed Jan. 8, 1924

Fig. 1.

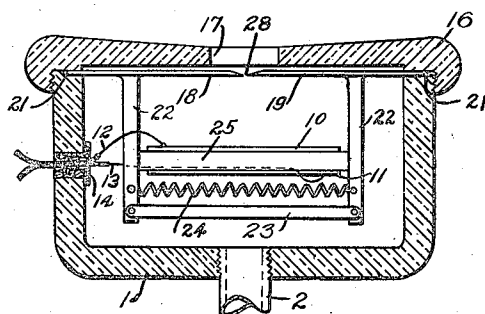


WITNESSES:

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Fig. 2.



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PIEZO-ELECTRIC LOUD SPEAKER.

Application filed January 8, 1924. Serial No. 685,013.

To all whom it may concern:

Be it known that I, LEWIS W. CHUBB, a citizen of the United States, and a resident of Edgewood, Pittsburgh, in the county of Allegheny and State of Pennsylvania, have invented a new and useful Improvement in Piezo-Electric Loud Speakers, of which the following is a specification.

This invention relates to telephones, particularly to loud-speaking telephones such as are frequently used in connection with wireless receiving systems.

It is an object of this invention to make use of the properties of a piezo-electric crystal for controlling energy in accordance with telephonic currents.

Another object of this invention is to control the flow of a stream of air by altering the size of the orifice through which the stream emerges. This alteration is made to accord with the telephonic currents to be translated, by causing the elongations or changes in volume in a piezo-electric crystal to control the size of the orifice.

It is a further object of this invention to provide an arrangement in which the control of the orifice by means of a piezo-electric crystal shall be simple and readily effected without employing any parts likely to get out of order.

A very small amount of energy is needed to cause a piezo-electric crystal to change its length. Moreover, if the change in length be made to control the exit of air from a chamber in which pressure is maintained, the small energy delivered by the crystal can be made to control the very considerable energy present in the air under pressure. In this way, sound vibration of any desired amplitude may be produced from very feeble telephonic currents.

Other objects of my invention and details of the construction employed will be apparent from the following description and accompanying drawings in which:

Figure 1 is a view, partially in section and partially in elevation, of a loud-speaking device, and

Fig. 2 is a sectional view of a modification.

The telephone instrument includes a cas-

ing 1 which provides a chamber into which air under pressure may be introduced by any suitable means, indicated by the tube 2. In Fig. 1, the chamber is shown as covered by a plate 3, in the center of which there is an opening 4 which is nearly filled by a properly cut piece of piezo-electric material 5, such as quartz, tourmaline, or Rochelle salts.

The crystal is supported by means of a standard 6 mounted in the bottom of the chamber 1. This standard extends through the central part of the crystal, leaving both ends of the crystal free to move. The end surfaces 7 of the crystal and the opposing surfaces of the opening 4 in the plate 3 are shaped to correspond to the stream lines of the air so that minimum friction occurs between the air and these surfaces. Moreover, this shape of the sides of the orifices assists in avoiding undesirable overtones which otherwise might be caused by eddies or other disturbances as the air passes through the small orifices.

The distance between the surfaces 7 and the adjacent surfaces of the opening 4 is much smaller than can be illustrated on the drawing. Preferably, these distances are so small that at the maximum elongations of the crystal, the ends of it will almost contact with the ends of the opening 4.

The crystal is provided with two metallic plates 10 and 11, conductors 12 and 13 respectively go from these plates to the source of telephone current. This source may be a wireless receiving system, a telephone line or any other source of periodic electrical potential of audio-frequency.

Preferably, an insulating bushing 14 is provided in the side wall of the casing 1 for the passage of the conductors 12 and 13. The cover plate 3 is threaded on its edge to afford means for securing a horn 15 in place.

In Fig. 2, instead of the cover plate being threaded, there are threads on the outside of the top of the casing 1 and an ear piece 16 is screwed on to these threads. The ear piece contains the usual central opening 17 for the emission of sound.

Two movable plates 18 and 19 have their

opposing edges immediately beneath the opening 17. These plates are mounted to slide upon the edge of the housing 1 and are guided in their motion by the ear-piece 16 as is indicated at 21. Each plate has a lever 22 secured thereto by brazing or in any other desired way. The lower ends of the levers 22 are held at a fixed distance apart by a connecting link 23, pivoted to each lever. A spring 24, also connected to each lever 22, tends to move these levers and the plates 18 and 19 toward each other.

The levers are kept apart by a properly cut piece 25 of piezo-electric crystal. The force of the spring 24 holds the levers in firm contact with each end of this crystal. Electrodes 10 and 11 are supplied for this crystal and connected to the telephone source by wires 12 and 13 as explained in connection with Fig. 1.

In the operation of the form of the device shown in Fig. 1, the source of telephone current supplies alternating electromotive force to the electrodes 10 and 11. When this electromotive force is in one direction it causes the crystal to elongate. When it is in the opposite direction, it causes the crystal to shorten. The width of the orifices 27, between the surfaces 7 and the opposing surfaces at the ends of the opening 4 changes, because of the alterations in the length of the crystal. When these orifices are narrow, the air supplied by the pipe 2 emerges but slowly with the result that pressure builds up in the chamber. When the orifices widen, the flow out through them is increased, but the pressure in the chamber remains substantially constant because the orifices, even at their widest, are not large enough to cause the flow to be great enough to diminish the pressure materially. Also, the widening of the orifices is both brief and slight.

The crystal, during the reception of the telephone current, is in continual vibration at a frequency corresponding to the pitch of the sound. The streams of air through the orifices, therefore, are in the nature of intermittent pulses whose frequency corresponds to that of the sound. These pulses create intermittent pressures in the conical space at the lower end of the horn and thus set the air within the horn into vibration. This produces a loud sound which corresponds accurately to the character of the telephone current.

In the operation of the form of the device shown in Fig. 2, when the crystal 25 elongates, the levers 22 are moved away from each other against the force of the spring 24, and the space 28 between the opposing edges of the plates 18 and 19 is widened. When the crystal contracts, this space is narrowed. Thus a succession of puffs of air are delivered through the space 28 and cause sound to pass through the opening 17. Since the

space 28, even at its widest portion is small, no very great flow of air takes place at any time and the air current is so slight that no discomfort will be produced in the operator's ear.

Many other forms in which this invention may be embodied will occur to those skilled in the art and the fact that I have specifically illustrated and described but two of them is not intended as a limitation.

I claim as my invention:

1. In a telephone instrument, a chamber having an orifice, means for maintaining fluid pressure in said chamber, and piezo-electric means for controlling the size of said orifice.
2. In a sound-reproducing device, a piezo-electric crystal, means for controlling said crystal by a telephonic current, means for creating a stream of air and means including said crystal for controlling said stream.
3. In a telephone instrument, a chamber, means for supplying fluid under pressure to said chamber, said chamber having an outlet and piezo-electric means for varying the size of said outlet.
4. In a sound-reproducing device, means for creating a stream of air, a piezo-electric crystal and means associated with each end of said crystal for controlling said stream of air by the vibration of said crystal.
5. In a loud-speaking telephone, a horn, an air chamber connected to said horn, means for supplying air under pressure to said chamber and means for admitting the air from said chamber to said horn in intermittent puffs, said means including a piezo-electric device.
6. In a sound-reproducing device, a chamber, a cover plate therefor having an opening therein, piezo-electric device supported in said opening, opposing end surfaces of said piezo-electric device and said opening being of stream-line form, and means for supplying air under pressure to said chamber.
7. In a telephone device, a chamber, a standard therein and a piezo-electric device centrally supported by said standard.
8. In a telephone device, a chamber, means for supplying air under pressure thereto, a cover plate for said chamber, said cover plate having a central opening, a piezo-electric crystal within said opening, and a standard within said chamber centrally supporting said piezo-electric crystal.
9. In a telephone device, a chamber, means for supplying air under pressure thereto, a cover plate for said chamber, said cover plate having a central opening, a piezo-electric crystal within said opening, and a standard within said chamber centrally supporting said piezo-electric crystal, the ends of said crystal and opposing ends of said opening being of stream-line form.

10. In a telephone device, means for creating a stream of air and means for controlling said stream, said means including a piezo-electric crystal supported with both ends free to move. 5
11. In a telephone loud speaker, means for creating a stream of air, a piezo-electric device supported with both ends free to move and means operated by the motion of either end for controlling said air stream. 10
- In testimony whereof, I have hereunto subscribed my name this 4th day of January, 1924.

LEWIS W. CHUBB.