P. M. RAINEY.

ACOUSTIC DEVICE.

APPLICATION FILED DEC. 27, 1918.

1,373,019.

Patented Mar. 29, 1921.

2 SHEETS—SHEET 1.

Fig. 1.

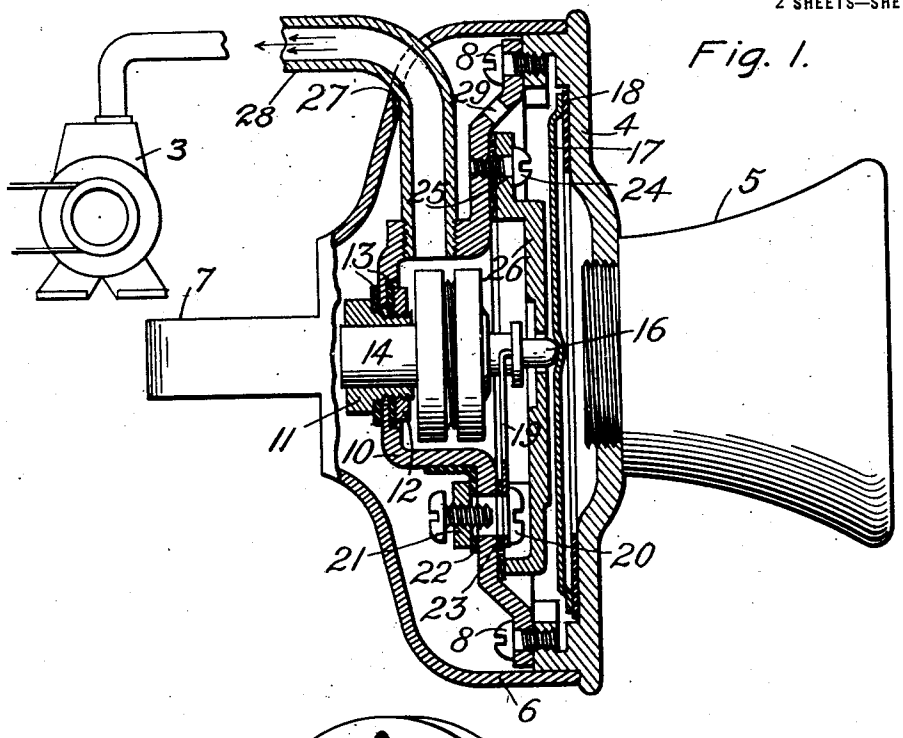
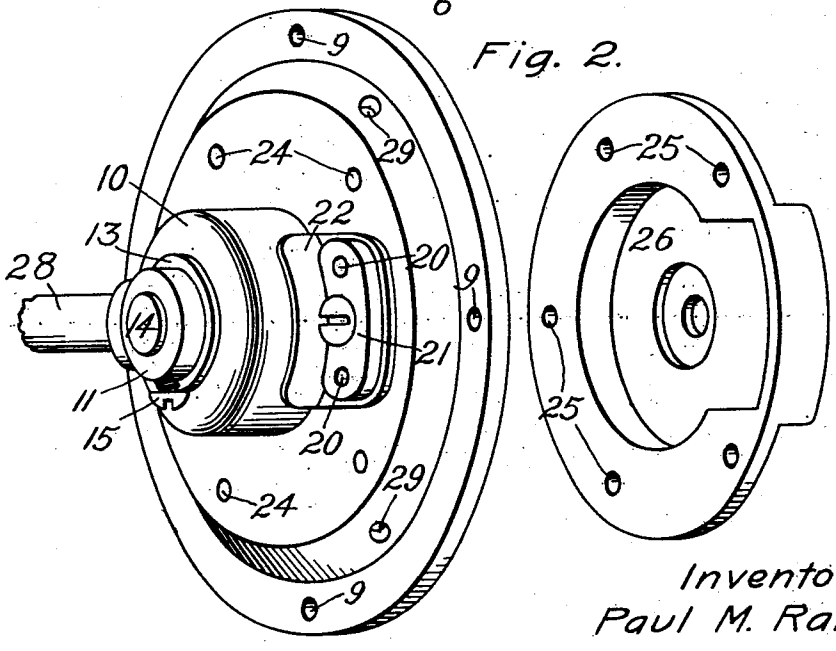


Fig. 2.



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2 SHEETS—SHEET 2.

Fig. 3.

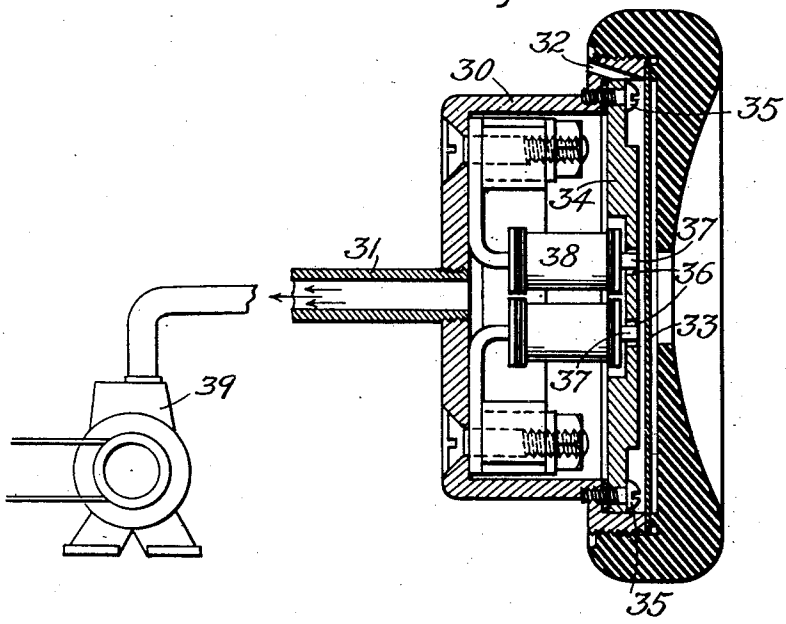
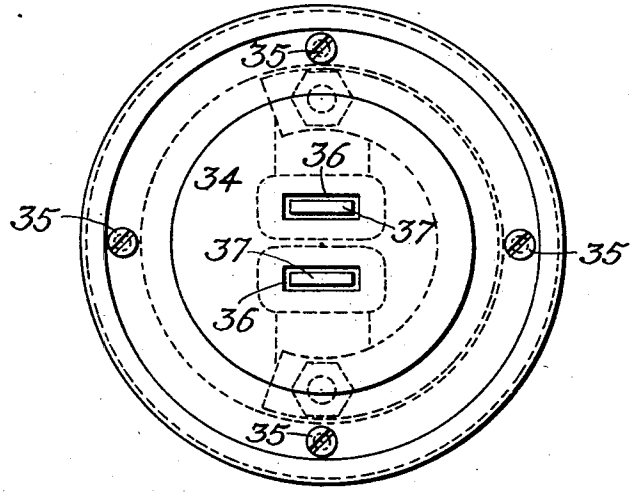


Fig. 4.



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UNITED STATES PATENT OFFICE.

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ACOUSTIC DEVICE.

1,373,019. Specification of Letters Patent. Patented Mar. 29, 1921.

Application filed December 27, 1918. Serial No. 268,505.

To all whom it may concern:

Be it known that I, PAUL M. RAINEY, a citizen of the United States, residing at Glen Ridge, in the county of Essex, State of New Jersey, have invented certain new and useful Improvements in Acoustic Devices, of which the following is a full, clear, concise, and exact description.

This invention relates to acoustic devices, and more particularly to a means for increasing the sensitiveness on the vibrating system of an acoustic device such as a telephone transmitter or receiver.

In general, the forces acting upon the vibrating system of an acoustic device are extremely small, and it is accordingly desirable to make the moving system as sensitive as possible in order to obtain the maximum amplitude of vibration in response to these small forces.

It is, therefore, the object of the present invention to provide an acoustic device in which the vibrating system is so arranged that a maximum movement of the diaphragm results from the small forces acting upon it. A further object is to provide an acoustic device in which a very sensitive diaphragm is employed, and damping means are also included to overcome the disturbing effect due to the diaphragm vibrating in accordance with its own natural frequency.

To attain these objects and in accordance with a feature of this invention, there is provided an acoustic device in which a chamber is located on one side of the diaphragm, and a vacuum or exhaust pump is applied to this chamber in such a manner as to cause a flow of air through an orifice into this chamber, this flow of air being restricted by the movement of the diaphragm. This and other features of the invention may be more clearly understood by reference to the accompanying drawing, in which Figure 1 is a sectional view of a telephone transmitter embodying this invention, and Fig. 2 shows, in perspective, the cup-shaped members shown in assembly on Fig. 1, but rotated 90° in a counter-clockwise direction from their former positions. Fig. 3 is a sectional view of a telephone receiver embodying this invention, and Fig. 4 is a side view of the receiver of Fig. 3 with the cup and diaphragm removed.

Referring now more particularly to Figs. 1 and 2, there is disclosed a telephone transmitter of the well-known type modified to include the features of the present invention. The front plate 4 equipped with a mouthpiece 5 is secured to the common type of casing 6, this casing being provided with a mounting lug 7. Secured to the front plate 4 by means of the screws 8—8, passing through the holes 9—9, is the cup-shaped bridge member 10, the central portion of which is provided with an opening to receive the thimble 11. This thimble is held in place by means of the nut 12 and is insulated from the bridge member 10 by means of the insulating washers 13—13. The stem 14 of the transmitter button passes through the opening in the thimble 13 and is held in place, after being suitably adjusted, by means of the screw 15. The front stem 16 of the transmitter button rests against the diaphragm 17 which bears against the back portion of plate 4, but is insulated therefrom by means of the washer 18 of oiled linen or other suitable material. The front stem 16 is held against the diaphragm with the proper tension by means of the damping spring 19 which is secured to the bridge member by means of the screws 20—20 and the plate 21. These parts, however, are insulated from the bridge by means of the insulators 22 and 23 which are preferably of mica. Secured to the bridge member 10 by means of screws 24, which pass through openings 25—25, is a second cup-shaped member 26 equipped with a central opening through which the stem 16 of the transmitter button extends. The casing 6 is provided with an opening 27 somewhat larger than the diameter of a tube 28 which extends therethrough and is threaded into the bridge member 10. A number of perforations 29 are provided in the bridge member 10 to permit free access of air. The tube 28 is connected to a vacuum chamber or a suction pump 3.

In the operation of this device, as sound waves impinge upon the diaphragm 17, causing it to move inwardly, the space between the member 26 and the diaphragm 17 is decreased, the current of air flowing through this space is further restricted, and the suction force acting upon the diaphragm correspondingly increased. This current of air flows through the openings 27 and 29, and thence through the restricted space be-

tween the diaphragm 17 and the member 26, through the central opening in the member 26 and out through the tube 28 in the direction indicated by the arrows. The amplitude of vibration is therefore considerably increased by the resulting suction acting upon the diaphragm. In the return movement as the diaphragm moves outwardly, the area of the restricted space is increased, thereby facilitating the movement. Moreover, the thin layer of air existing between the diaphragm and the member 26 also acts in conjunction with spring member 19 to provide suitable damping for the moving system.

In the construction shown in Figs. 3 and 4, the same principle of operation is employed. The cup shaped casing 30 is provided with a tube 31 threaded therein and connected to a suitable vacuum chamber or suction pump 39. A vent 32 is provided in the casing 30 to allow the entrance of air back of the diaphragm 33. In close face to face relation with the diaphragm 33 is the plate member 34 which is secured to the casing by means of the screws 35—35. This member is provided with openings 36—36 of sufficient size to allow the entrance therethrough of the core members 37—37 and with sufficient clearness to allow the free movement of air thereabout. As a result of the suction on tube 31, a current of air normally flows through the vent 32, thence through the restricted portion between the diaphragm 33 and the plate 34, through the openings 36 about the cores 37—37, and thence out through the tube 31 as indicated by the small arrows. Upon current flowing through the electromagnet 38, the diaphragm 33 approaches the cores 37, thereby restricting the flow of air between the diaphragm and the plate 34, and as a result of the suction, the movement of the diaphragm is still further increased. As this current ceases to flow in electromagnet 38, the diaphragm 33 is free to return to its normal position, but the return movement is damped to a certain extent by the retarding effect which results from the suction of air through the restricted section. However, as the diaphragm moves outwardly, this restricted space becomes larger and the retarding effect becomes less and less, permitting the diaphragm to return to its normal position.

What is claimed is:

1. An acoustic device comprising a diaphragm to be set in vibration, and means cooperating with a current of air for increasing the amplitude of vibration of said diaphragm.

2. An acoustic device comprising a diaphragm to be set in vibration, and a damping plate in close face to face relation thereto, said diaphragm and plate coöperating to increase the amplitude of vibration of the diaphragm by controlling the flow of a current of air between the diaphragm and the damping plate.

3. An acoustic device comprising a diaphragm to be set in vibration, a damping plate in close face to face relation thereto, a chamber at the rear of said damping plate, and means for causing a current of air at less than atmospheric pressure to flow between the diaphragm and said damping plate into said chamber.

4. An acoustic device comprising a diaphragm to be set in vibration, and a damping plate in close face to face relation thereto, said diaphragm and plate coöperating with a current of air controlled by the movement of the diaphragm to increase its amplitude of vibration.

5. An acoustic device comprising a casing, a diaphragm forming an end-wall for said casing, a damping plate mounted in close face to face relation to said diaphragm and having a central opening therein, and means for causing a current of air at less than atmospheric pressure to flow radially between said diaphragm and damping plate.

In witness whereof, I hereunto subscribe my name this 24th day of December, A. D., 1918.

PAUL M. RAINEY.