Aug. 18, 1931. F. CONRAD 1,819,499

TELEPHONE RECEIVER

Filed July 13, 1925

Fig. 4.

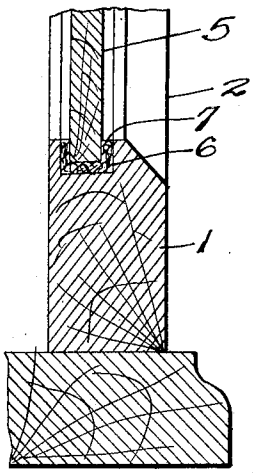


Fig. 1.

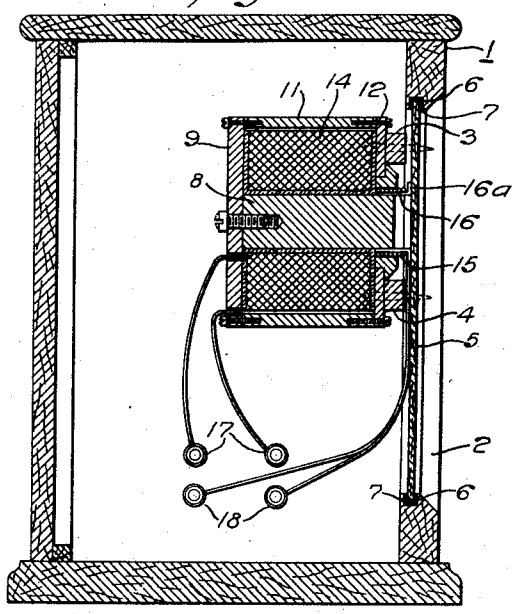


Fig. 2.

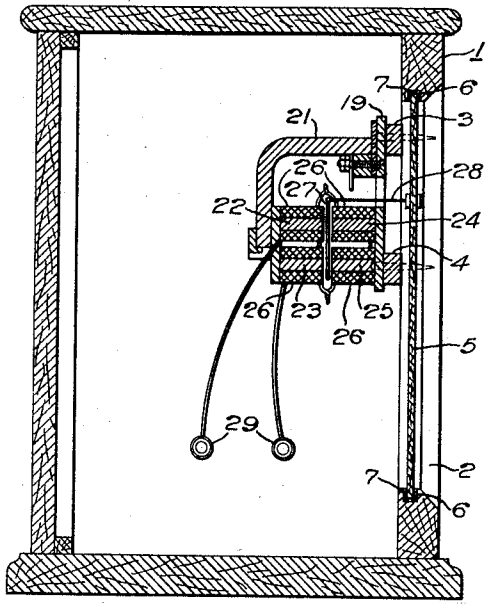
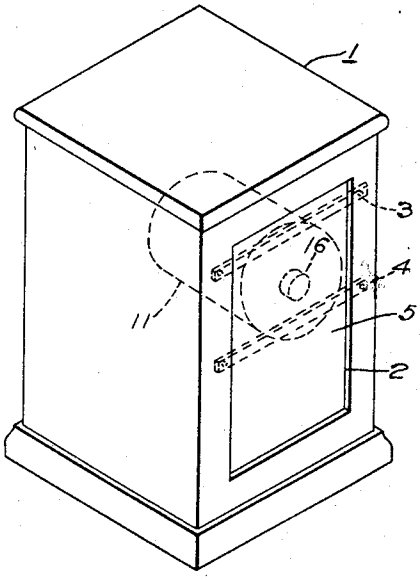


Fig. 3.



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UNITED STATES PATENT OFFICE

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TELEPHONE RECEIVER

Application filed July 13, 1925. Serial No. 43,096.

My invention relates to telephone devices and particularly to telephone receiver devices of the "loud speaker type".

An object of my invention is to provide a telephone receiver device having a plane sound-radiating member.

Another object of my invention is to provide a telephone receiver device having a cabinet and a wooden panel, adapted to radiate sound vibrations.

Another object of my invention is to provide a telephone receiver device having a "balsa" wood diaphragm.

Another object of my invention is to provide a telephone receiver device having a thick, stiff, light, wooden diaphragm member.

Another object of my invention is to provide a telephone receiver device having a plane diaphragm with a dimension greater than ¼ the wave length of sound of normal musical frequency.

Another object is to provide a telephone receiver device having a plane diaphragm adapted to radiate sound vibrations without a horn member.

In the construction of telephone receiver devices, two types are commonly made, one in which a small plane diaphragm is vibrated, and loaded accoustically by a horn member; in the other a large, light, cone member is adapted to be vibrated and has sufficient area to radiate sound directly. In these constructions, the small plane diaphragm is much too small to radiate sound directly, and the cone type, while large enough, is extremely delicate and easily injured.

My invention provides a telephone receiver device having a large plane diaphragm of sufficient size to radiate sound vibrations directly, and of sufficient thickness and strength to be resistant to injury, and to vibrate readily as a whole, rather than in sections and to be much more compact than a cone.

Other objects and structural details of my invention will be apparent from the following description when read in connection with the accompanying drawings wherein

Fig. 1 is a view in vertical section of an embodiment of my invention;

Fig. 2 is a view in vertical section of an alternative embodiment of my invention; and

Fig. 3 is a perspective view of my invention; and

Fig. 4 is an enlarged view in cross-section showing the manner in which the diaphragm of Fig. 1 is mounted in its support.

In the construction of my invention, I provide a cabinet 1 as shown in the figures which may be of a hard wood, such as oak or mahogany or, if desired, it may be of metal. One of the sides of the cabinet 1 is cut away to provide a panel opening 2. Cross members 3 and 4 are provided across the opening 2. These members are adapted to support a device which converts the electrical vibrations into mechanical vibration.

In front of the cross members 4 and 3, and within the openings 2 is provided a panel 5 of light, stiff material. This is preferably the material called "balsa wood" which is a little known tropical product. It is a very light fibrous wood of moderate strength and extremely low density. Other materials such as that known as "ceba wood" may be substituted. Suitable specimens may weigh as litle as seven pounds per cubic foot or have a density as low as 0.12 of the density of water. The desired material is formed into a panel having a thickness preferably about ⅛ of an inch and is supported in the opening in the case 1. Preferably the panel is a plane rectangular sheet of sufficient thickness to give the required stiffness. The opening 2 in the cabinet 1 has grooves 6 within which the edges of the panel 5 have a "floating" support in a soft material such as a felt packing 7.

For suitable reproduction of the customary range of musical sounds, I have found the panel should be not less than six or eight inches wide and eight or ten inches long. It has been found that a panel will radiate satisfactory sound vibrations of a frequency corresponding to a wave length of about four times the longest dimension of the plane surface. Experiment has shown that for satisfactory transmission of speech the lowest essential sound has a wave length of 2½ to 3 feet corresponding to the notes

known to musicians as tenor C to tenor G.

By reason of the fact that applicant provides a speaker cabinet presenting no openings to the outside, a substantially confined air column will exist therein, which, due to resonance phenomenon, will function to modify the characteristics of the tone frequencies reproduced by the diaphragm. This resonance condition may be changed by altering the dimensions of the cabinet, thereby changing the dimensions of the confined air column. The resonance condition, at whatever frequencies it may be caused to exist, will function to amplify the output of the speaker at those frequencies. Thus, if the resonant condition is caused to occur at frequencies to which the speaker would normally have poor response characteristics, then the output and tone quality would be improved.

In one embodiment of my invention, the vibration producing means may comprise an electro-dynamic receiver. This may consist of an electromagnet having a central core member 8, a base member 9, a shell 11 and a pole piece 12. A coil 14 is wound upon the core member 8. Surrounding the end of the core member 8 is a coil 15 which is wound upon a light rigid tubular support 16 having a flange 16*a* which is adapted to be secured as by cement to the balsa-wood panel 5. After the coil has been wound on the support 16 I prefer to dip or provide it with a coat of binder material so that the coil and its support vibrate as a unit with the panels.

The electromagnet structure is supported upon the cross members 3 and 4 in alinement with the coil 15. The coil 14 is provided with flexible connections to binding posts 17 which may be connected to a storage battery, or other source of current (not shown). The terminal wires of the coil 15 are attached to the panel 5 along its length to a position near the bottom and are connected to binding posts 18 which are connected to the source of vibratory electro-current.

The modified form, illustrated in Fig. 2 comprises a permanent magnet translating device attached to the bridge pieces 3 and 4 in a manner similar to the first described embodiment. The structure may comprise a base plate 19, a permanent magnet 21 and pole pieces 22, 23, 24 and 25 upon which are wound coils 26, connected in series. Between the pole pieces 22, 23, 24 and 25 is positioned an armature 27 which is connected by a rod 28 to the balsa-wood panel 5. The terminals of the coils 26 are connected to binding posts 29 which are connected to the source of vibratory electric currents in the same way as the binding posts of the first described embodiment.

In the operation of my device, the electromagnet vibration-producing means of either embodiment impresses vibratory energy upon the balsa-wood panel 5. This panel is thereby caused to vibrate as a unit and by virtue of its very small mass, it vibrates readily in accordance with the impressed energy without interference from the presence of troublesome resonant frequencies. While in a condition of vibration, it displaces a substantial amount of air for the production of air vibrations which are perceived by a listener as sound.

The small mass of the panel and the presence of only the negligible restoring effect produced by the felt 7 causes the panel to have practically no resonant frequency or only a minor resonant frequency below the audio range. Likewise the large area of the panel gives excellent acoustic damping and therefore the device has a high efficiency of translation from mechanical vibrations into air vibrations and a uniform response to vibration over a wide range of frequencies.

While I have shown but two embodiments of my invention, it is capable of other modifications therefrom and it is desired that only such limitations shall be imposed thereon as are required by the prior art or indicated by the appended claims.

I claim as my invention:

1. In a sound-producing device a plane diaphragm, means for vibrating it as a whole and means surrounding the diaphragm for preventing acoustic communication between the faces thereof.

2. In a sound-producing device a rigid plane diaphragm, a non-biasing support permitting substantially free movement of the diaphragm and attached to the edges thereof, and means for vibrating the diaphragm as a whole.

3. In a sound-producing device, a closed chamber, vibration producing means therein, a plane diaphragm forming one wall of said closed chamber and means associating the diaphragm and said vibration producing means whereby the diaphragm is vibrated as a whole.

4. In a sound-producing device, a plane diaphragm having a rectangular face and mounted for rigid movement in the direction of its thickness, and means for vibrating the diaphragm as a whole in said direction.

5. In a sound-producing device, a plane diaphragm having a rectangular face mounted for rigid movement in the direction of its thickness, and means for vibrating the diaphragm as a whole in said direction, and a chamber of dimensions of the same order of magnitude as the face of said diaphragm, one wall of said chamber comprising said diaphragm.

6. In a loud speaker, a cabinet, one wall of which is constituted by a floating panel, and means in the interior of said cabinet for emparting vibratory movements to said panel.

7. In a loud speaker, a cabinet the major portion of one wall of which is constituted by a floating panel, and means in the interior of said cabinet for imparting vibratory movements to said panel.

8. In a loud speaker, a cabinet having a rectangular opening in one wall thereof, a panel floated in said opening by means of yieldable material disposed peripherally thereof, and means in the interior of said cabinet for imparting vibratory movements to said panel.

9. In a loud speaker, a cabinet having a rectangular opening in one wall thereof, a panel floated in said opening by means of yieldable material disposed peripherally thereof and carried by said wall, and means in the interior of said cabinet for imparting vibratory movements to said panel.

10. In a loud speaker, a cabinet having an opening in one wall thereof, a panel floated in said opening by means of yieldable material disposed peripherally thereof, and means in the interior of said cabinet for vibrating said panel, the remaining walls of said cabinet being devoid of openings of substantial size whereby acoustic communication between the two faces of said panel is prevented.

11. In a loud spaker, a cabinet having a rectangular opening in one wall thereof, a panel floated in said opening by means of yieldable material disposed peripherally thereof, and means in the interior of said cabinet for vibrating said panel, the panel being at least six inches wide and eight inches high.

12. In a loud speaker, a cabinet having an opening in one wall thereof, and a vibratile panel of material having a specific gravity of the order of .12 floated in said opening by means of yieldable material disposed peripherally thereof.

13. A loud speaker comprising a cabinet having an opening in one wall thereof, a diaphragm supported in said opening, and means in the interior of said cabinet for vibrating said diaphragm, the remaining walls of said cabinet being substantially devoid of openings, whereby air vibrations emanating from the rearward face of said diaphragm are prevented in large measure from mingling with air vibrations emanating from the forward face of said diaphragm.

14. Apparatus of the loud speaker type comprising driving means, a diaphragm actuable thereby and a substantially confined air column associated with said diaphragm and operating to modify the characteristics of the tone frequencies toward the lower end of the audio frequency range, reproduced by said diaphragm.

In testimony whereof, I have hereunto subscribed my name this 8th day of July, 1925.

FRANK CONRAD.