

July 13, 1926.

1,592,243

E. C. WENTE
TELEPHONE APPARATUS
Filed Oct. 9, 1922

Fig. 1.

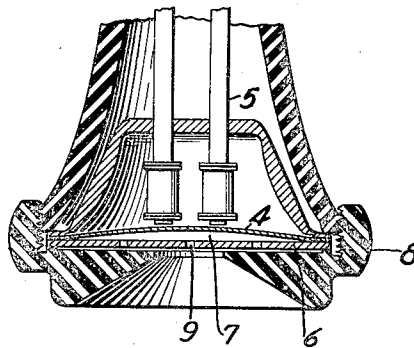


Fig. 3.

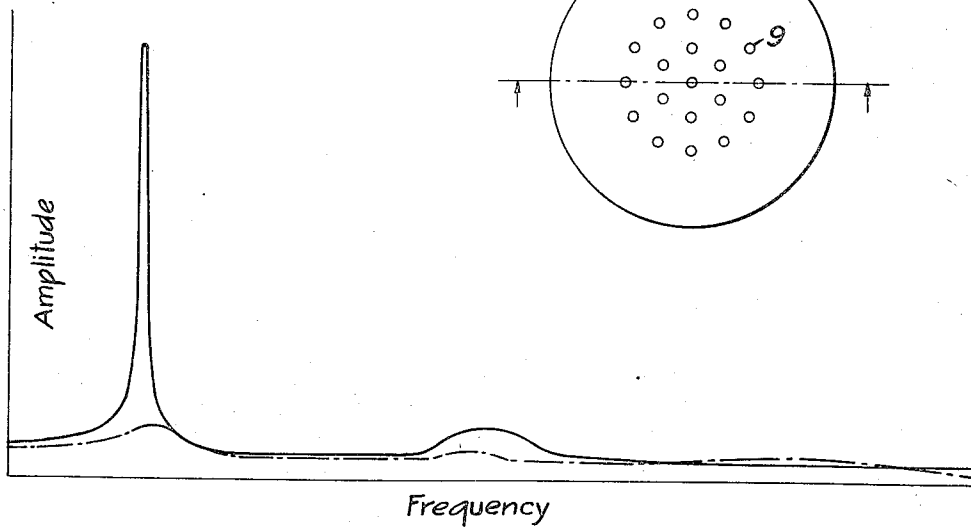
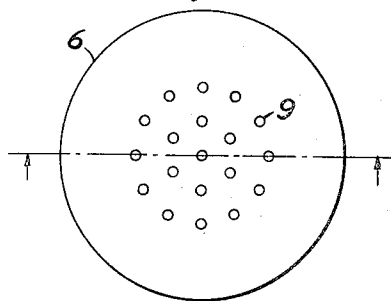


Fig. 2.



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UNITED STATES PATENT OFFICE.

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TELEPHONE APPARATUS.

Application filed October 9, 1922. Serial No. 593,203.

This invention relates to means for damping acoustic diaphragms and particularly to air damping means for controlling their free vibrations at resonance.

5 An object of the invention is to provide an efficient and inexpensive air-damping means which may be readily applied to standard types of receivers.

10 In accordance with the general features of this invention use is made of a perforated plate of suitable material and thickness located adjacent to the receiver diaphragm for the purpose of damping the resonance effect of the receiver diaphragm. Although 15 shown in the drawing as located upon the outer face of the diaphragm, the invention contemplates the use of this damping plate upon either side of the diaphragm.

20 When a diaphragm is separated a short distance from a plane parallel plate, both its damping and elastic constants are effectively increased. The magnitude of these effects for plates having various perforations and grooves are well known. However, 25 previous arrangements providing air-damping for receivers and transmitters, require special and expensive structures, whereas the present invention provides means which may be easily applied to any standard type of receiver, and by its use, the response frequency characteristic is greatly improved without 30 appreciable sacrifice in efficiency.

35 Fig. 1 is a sectional view showing an application of the invention to a standard type receiver.

Fig. 2 is a plan view of the damping plate.

Fig. 3 shows characteristic damping curves of receivers with and without damping means.

40 The ordinary type of magnetic receiver diaphragm 4 has an initial displacement owing to the magnetic pull of the magnet 5. For the sake of clearness, this displacement is shown somewhat exaggerated. A plate 45 6, preferably of non-magnetic material, is superimposed upon the concave side of diaphragm 4, and is held in relation therewith by means of the usual receiver cap 8 to provide a chamber 7 between the plate 6 and 50 the diaphragm 4 for a film of air. Plate 6 is preferably of a thickness such that its resonance frequency is considerably higher than that of the diaphragm 4, and is perforated with one or more holes 9 through

55 which air passes back and forth as the diaphragm 4 vibrates. On account of its viscosity the air will flow less freely through the holes 9 as the frequency of the vibration of the diaphragm is increased. It is, therefore, evident that a perfectly rigid plate 60 would reduce the efficiency of the receiver at the high frequencies. If, however, plate 6 has a resonance frequency somewhat higher than that of the diaphragm, it will vibrate with the diaphragm at the higher frequencies, while at the lower frequencies air 65 will flow freely through the openings. At the higher frequencies, the stiffness factor of the vibrating system is thus greater than that of the diaphragm alone, and consequently within a certain region the amplitude of motion of the diaphragm and plate 70 combined will be greater than that of the diaphragm without the damping plate, the plate and the diaphragm forming a coupled system, the coupling being very loose at low 75 frequencies, but becoming closer and closer as the frequency is increased. The effect of the plate on the efficiency of the receiver is, therefore, to alter the response below the 80 natural frequency but little, dampen out the free vibrations, cut down the response within the regions of resonance, and increase the response within a certain region at the higher 85 frequencies.

In Fig. 3, the curve 10 represents the frequency characteristic of a non-damped diaphragm in a commercial type of telephone receiver, and the curve 11, represents the frequency characteristic of the same receiver 90 after applying the plate 6 to the diaphragm. The thickness of the damping plate for the size and the number of the holes will depend upon the characteristics of the receiver to which it is applied and the character of 95 the damping desired.

The invention claimed is:

1. In a telephone receiver, a diaphragm having a predetermined frequency of vibration and a perforated plate having a substantially different frequency of vibration superimposed thereon and coupled thereto by a film of air such that the coupling greatly increases at the higher speech and music frequencies. 100 105

2. In a telephone receiver, a diaphragm, and a perforated plate of non-magnetic material superimposed upon said diaphragm,

said diaphragm and plate being in contact at their peripheries and separated at their centers by a film of air sufficiently thin to produce appreciable air damping of the diaphragm at speech and music frequencies.

3. In a telephone receiver, a diaphragm, a perforated plate secured in superimposed relation thereon to form between the diaphragm and plate a chamber for an air film which with the diaphragm and perforated plate constitutes a coupled vibrating system which is very loose at low frequencies in the speech and music frequency range but becomes closer and closer as the frequency is increased within the limits of the speech and music frequency range.

4. In a telephone receiver, a diaphragm, a perforated plate of non-magnetic material superimposed upon one side of said diaphragm, magnetic means on the other side of said diaphragm to give it an initial displacement whereby a chamber for an air film is formed between the center portions of said diaphragm and plate, the dimensions of the said film and the relative size of the perforations in the said plate being such as to produce appreciable air damping within the speech and music frequency range.

5. A method of controlling resonance effects in a telephone receiver diaphragm which consists in providing a perforated diaphragm juxtaposed in such a relation with the receiver diaphragm as to be loosely coupled therewith at low frequencies and more closely coupled as the frequency increases within the speech and music frequency range.

6. In a telephone receiver, a vibratory diaphragm, means to apply a magnetic force on one side of said diaphragm, and an air film

and a perforated plate superposed on the other side of said diaphragm and having a higher resonant frequency than that of the said diaphragm alone, said diaphragm and said perforated plate being coupled by the said film of air, the relative dimensions of the parts being such that the coupling greatly increases at the higher speech and music frequency.

7. In a telephone receiver a diaphragm having a predetermined frequency of vibration, damping means comprising a perforated plate of substantially different frequency placed over the diaphragm so that when the diaphragm is in its unconstrained condition, said diaphragm and plate are in contact over their entire surface, and magnetic means for holding said diaphragm and plate in spaced relation at their centers.

8. A method of controlling the acoustics of a telephone receiver which consists of superimposing upon the receiver diaphragm plate a perforated plate of non-magnetic material and of a different frequency from that of the receiver diaphragm, and applying magnetic force to one plate to produce an air chamber between said plates.

9. A method of controlling the acoustics of a telephone receiver which consists in positioning in front of said receiver diaphragm plate a secondary perforated diaphragm plate of a non-magnetic material having a frequency substantially different from that of the receiver diaphragm, and applying magnetic force to one plate to produce an air chamber between said plates.

In witness whereof, I hereunto subscribe my name this 3rd day of October A. D., 1922.

EDWARD C. WENTE.