April 4, 1939. N. P. R. JARNAK 2,153,044

EARCAP FOR TELEPHONE RECEIVERS

Filed Oct. 5, 1937

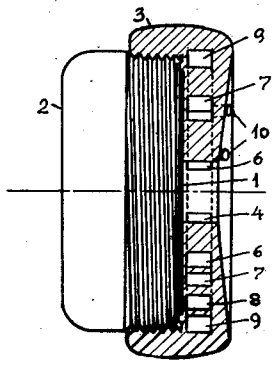


Fig. 1.

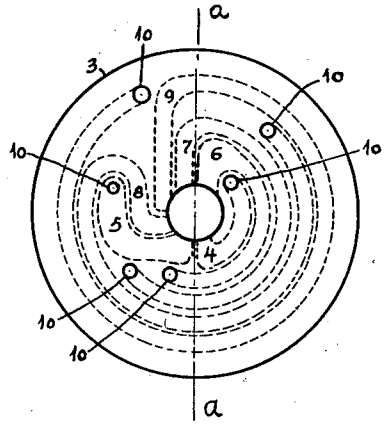


Fig. 2.

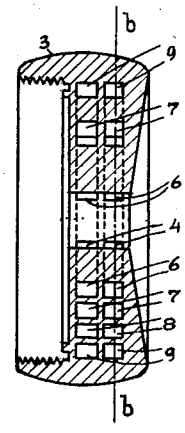


Fig. 3.

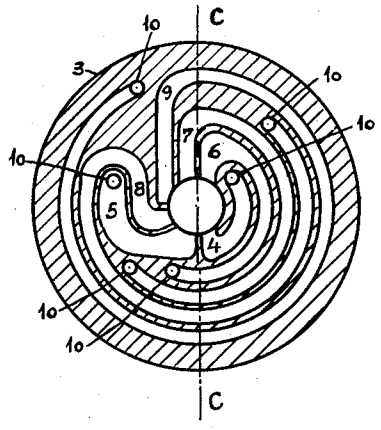


Fig. 4.

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Patented Apr. 4, 1939 2,153,044

# UNITED STATES PATENT OFFICE

2,153,044

## EARCAP FOR TELEPHONE RECEIVERS

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Application October 5, 1937, Serial No. 167,335
In Denmark October 5, 1936

3 Claims. (Cl. 179—82)

The present invention refers to the design or construction of an earcap for a telephone receiver or similar apparatus, also such a device as the mouth-piece of a microphone, and it consists in the application of a multi-cavity resonator comprising a plurality of channels open at both ends and incorporated in the earcap in such a way that said resonator has access both to the chamber of which the vibrating diaphragm of the apparatus makes a part and to the chamber outside, which chamber may be formed between the earcap and the cavity of the ear; altogether this means that the multi-cavity resonator has access to the free air outside the apparatus.

In apparatus of a similar kind used in connection with the reproduction or transmission of sounds from an elastic vibrating diaphragm various methods have been used attempting to decrease the coupling between the diaphragm and the timpany membrane of the ear, or means for damping the vibrations of the diaphragm also have been used; but little or nothing has been gained for avoiding or eliminating the distortions caused by the effect from resonance of the diaphragm itself, the aural impression of which is a masking of the speech caused by "singing" of the diaphragm.

This distortion is decreased to a great extent whereby the quality of sound reproduction is improved, if in accordance with the invention, the above mentioned multi-cavity resonator is added to the conventional construction of an earcap in such a way that the standing air waves oscillated within the channels of the resonator by the vibrations of the diaphragm enact to suppress the resonance vibrations of the diaphragm itself.

Furthermore this invention is related to my former invention "Acoustical apparatus," British Patent No. 456,414, and U. S. application Ser. No. 83,013, filed June 2, 1936, according to which a new method of loading the vibrating diaphragm acoustically makes it possible to oscillate standing interfering air waves which show an optimum effect in counteracting the resonance vibrations of the diaphragm, if the resonance frequencies of these standing waves form a series of numbers the terms of which have the proportion 2:3.

The invention has primarily significance for telephone receivers or similar apparatus of which the accompanying drawing indicates an example of its application to a telephone receiver equipped with two slightly different earcaps made in accordance with the invention.

Fig. 1 indicates a section through the earcap which is fixed to a telephone receiver casing including the diaphragm and viewed from the one side.

Fig. 2 shows the same earcap viewed outside from that side which is turned to the ear.

Fig. 3 indicates a section through a slightly changed construction viewed from the one side, of which Fig. 4 is a section through the same showing the design of the multi-cavity resonator.

In Fig. 1, 1 is an elastic diaphragm clamped between the receiver casing 2 and the earcap 3, and said diaphragm may be oscillated for a desired vibration by means of the electro-magnetic device placed within the receiver casing. Inside the earcap 3, which may be made of any kind of a plastic suitable for moulding parts which can be cemented together making a complete unit, are moulded six channels which in Fig. 2 are indicated by the numbers 4, 5, 6, 7, 8, and 9. All these channels extend from the centre aperture of the earcap and they end as indicated by the apertures 10 respectively at different places on the surface of the earcap which is generally turned against the ear lap.

In order to obtain a suitable form of the channels, they are arranged as indicated on the drawing whereby their length, as mentioned before, conditions the proportion of 3:2 between their frequencies of resonance respectively. Therefore the length of the channel 6 in proportion to the channel 9 must be approximately 2:3; and the proportion between the length of the channel 7 and the length of the channel 8 must also be approximately 2:3, and so forth concerning the rest of the channels. As the cross section of all the channels is made the same, the resonance frequencies of the standing waves produced therein by the vibrations of the diaphragm form accordingly a series of numbers, the terms of which have the proportion 2:3.

Due to the fact that the dimensions and the material of the vibrating diaphragm determines its fundamental resonance frequency, it may be desirable to adjust the resonance frequencies of the standing waves within the channels of the multi-cavity resonator in consideration hereof, consequently it may be required to alter the form, numbers and the length of these channels.

In Fig. 3 therefore is shown a slightly altered construction of the earcap itself, whereby the length of the channels respectively has been

doubled as compared to the length shown in Fig. 1 and Fig. 2. As is obvious from Fig. 3 and Fig. 4, this is obtained by placing two similar multi-cavity resonators together, whereby one corresponding channel in each set is interconnected through the apertures 10 shown in Fig. 4. At the same time it is arranged that all the channels start and end within the centre aperture of the earcap, whereby these apertures are better protected from dirt coming from the outside as compared to the construction shown in Fig. 1 and Fig. 2.

As a telephone receiver according to the nature of its construction can also be a reversible device and can therefore serve as a detector of sound waves, a multi-cavity resonator, as here described, may be applied also to a microphone in connection with a sound directing member (not shown on the drawing) or similar device which will improve the concentration of sounds.

What I claim is:

1. A sound conveying member comprising a suitably formed body for clamping an elastic diaphragm, and constructed so that sound waves can be conducted to or from said diaphragm, a multi-cavity resonator comprising a plurality of separate channels open at both ends and so incorporated in the said body that on the one hand said multi-cavity resonator has access to the chamber of which the vibrating diaphragm makes a part and on the other hand has access to the space outside the said body.

2. A sound conveying member comprising a suitably formed body for clamping an elastic diaphragm, said member having a central opening adopted to conduct the sound waves to or from the said diaphragm, in the said member a plurality of separate channels open at both ends defining a multi-cavity resonator, the apertures of these channels at the one end connecting with the said central opening, and the apertures at the other ends of these channels connecting with the external atmosphere.

3. A sound conveying member comprising a suitably formed body for clamping an elastic diaphragm, said member having a central opening adopted to conduct the sound waves to or from the said diaphragm, in the said member a plurality of separate channels open at both ends defining a multi-cavity resonator, the apertures of these channels at the one end connecting with the said central opening, and the apertures of these channels at the other end also connecting with the central opening.

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