Dec. 2, 1941. W. T. WEIDENMAN, SR 2,264,684

BONE TELEPHONE RECEIVER

Filed March 17, 1938

Fig. 1,

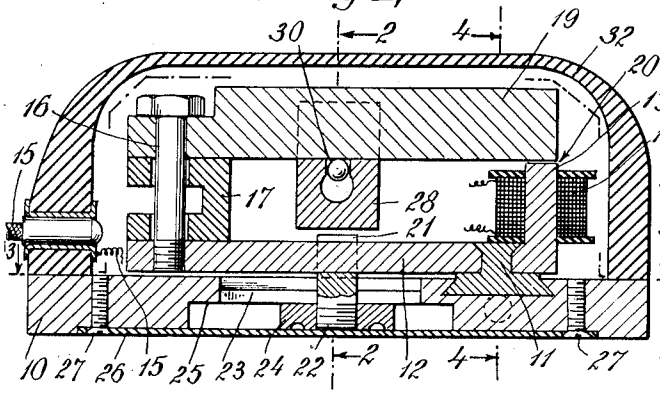


Fig. 2,

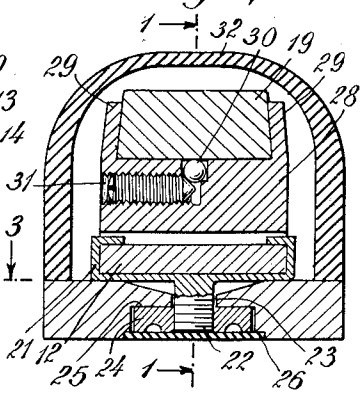


Fig. 3,

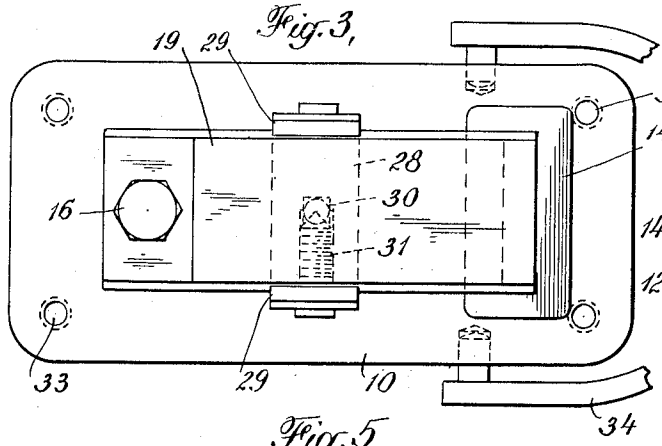


Fig. 4,

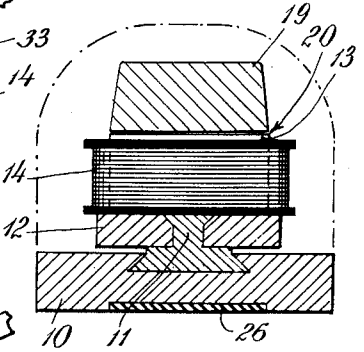


Fig. 5,

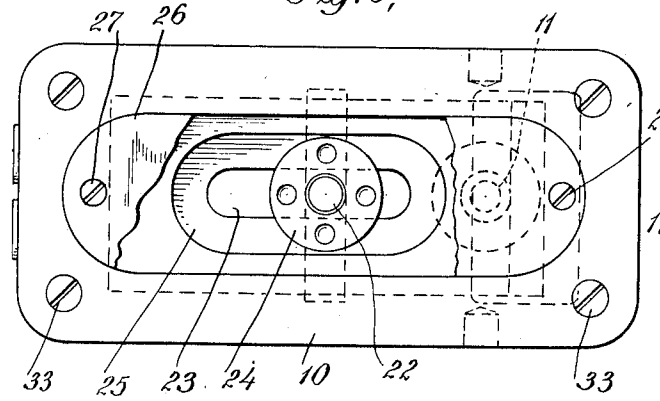
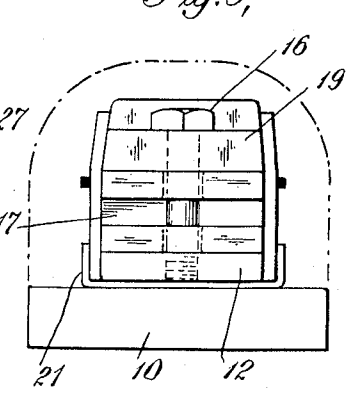


Fig. 6,



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BONE TELEPHONE RECEIVER

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Application March 17, 1938, Serial No. 196,329

4 Claims. (Cl. 179—107)

This invention relates to bone telephone receivers and has particular reference to a bone telephone receiver that operates on the reaction principle.

Bone telephone receivers are particularly adaptable for communication during gun fire, in aeroplanes, or in other places where the level of surrounding sound is of such magnitude as to make extremely difficult the clear perception of sound by the usual air conduction method. Under such conditions the pitch of the receiver has a material bearing on the sound perception, since transmitted sounds at normal pitch and frequency are frequently difficult to distinguish even with bone conduction, because of the normal response of the hearing organs to the surrounding predominating sound. Different levels of predominating sounds require a different pitch of the bone receiver to enable clear perception above the predominating sounds.

In accordance with the present invention, a bone telephone receiver is provided for use by those of normal hearing, as well as by those of subnormal hearing, which is adjustable as to pitch, and also as to corresponding magnetic air gap, so that the most sound-perceptive combination is obtainable under the specific conditions of use, whether it be due to a deafened condition or a condition where predominating surrounding sounds render difficult normal hearing at those sound levels.

The present invention comprises a bone receiver of the reaction type in which three preferred adjustments are provided, namely, first, a positive adjustment of the magnetic air gap without requiring bodily shifting of parts or adjustment of one element of a vibratory part comprising several cooperating elements; second, an adjustment of the center of mass of a vibratory part of the receiver for altering the frequency thereof, which in some cases is made most effective by simultaneous air gap adjustment; and third, an arrangement for varying the length of the stroke of a vibratory part of the receiver to change the pitch thereof, which also is made most effective in some cases by simultaneous air gap adjustment. All of these adjustments may be made in the reaction type bone telephone receiver of this invention in a simple way without requiring dismounting of any part, whereby the receiver may be readily and rapidly adapted to use under the abnormal conditions mentioned.

For a more complete understanding of the invention, reference may be had to the accompanying drawing, in which:

Figure 1 is a longitudinal section through the bone telephone receiver of this invention as seen along the line 1—1 of Fig. 2;

Fig. 2 is a vertical section therethrough as seen along the line 2—2 of Fig. 1;

Fig. 3 is a plan view of the receiver with the housing removed;

Fig. 4 is a vertical section as seen along the line 4—4 of Fig. 1;

Fig. 5 is a bottom view of the device with the cover plate partially broken away to illustrate a detail of the pitch adjusting means; and

Fig. 6 is an end view of the receiver with the housing removed.

Referring to the drawing, numeral 10 designates a base, preferably formed of a synthetic resin or the like, and having anchored in the upper surface thereof a stud 11 inserted through an opening in one end of the L-shaped plate 12 and riveted over as shown in Figs. 1 and 4, so that plate 12 is supported at one end and extends in parallel spaced relation to the upper surface of the base 10.

The upturned end 13 of the plate 12 serves as a pole piece upon which is mounted the energizing winding 14, the terminals of which are suitably connected to the conductors 15 leading from a microphone and amplifier, radio receiver or the like, not shown, adapted to transmit the speech or voice currents to the winding 14. The other or free end of the plate 12 is tapped for the bolt 16 passing through a U- or channel-shaped, resilient, deflectable spacer 17 and supporting thereon one end of a bar magnet 19, whose other or free end is closely spaced with respect to the end of the pole piece 13 to form the magnetic air gap 20. The plate 12, pole piece 13, and spacer 17 are formed of magnetically permeable material to afford with the magnet 19 a closed flux path across the gap 20.

The air gap 20 may be increased at will by tightening bolt 16 to deflect by compression the resilient, channel-shaped spacer 17 sufficiently to provide the desired width of the air gap 20. By relieving or loosening bolt 16, the spacer will expand, thus reducing the width of the air gap 20.

It will be observed that this air gap adjustment is positive, remaining unchanged after being once set, the change being effected without dismounting or bodily shifting any part, and can be done with extreme precision by reason of the construction. The stiffness of the spacer, or its resistance to compression, serves as a lock for the threads of the bolt 16 so that the latter cannot work loose and change the adjustment of the air gap. Also, by this arrangement, assembly is a simple matter and machining of the magnet 19 is reduced to drilling the hole for bolt 16.

Although anchored to the base plate 10 at 11, the plate 12 is fulcrumed at an intermediate point on the yoke 21 having a threaded stud 22 projecting through a longitudinal slot 23 in the base 10, as shown in Figs. 1, 2 and 5. The yoke 21 is adjustable along the plate within the length of the slot 23 and is locked in any adjusted posi-

tion by the nut 24 or stud 23, the nut 24 clamping the base flanges 25 around the slot 23 between it and the bottom surface of yoke 21. A cover plate 26, inset flush with the face of base 10 and held in place by screws 27 covers the nut 24 and other fulcrum yoke 21 adjusting means, and must be removed to effect the adjustment.

It will be observed that the position of the fulcrum yoke 21 determines the extent of movement or stroke of the free end of the magnet 19 and consequently the pitch of the receiver, since it provides the fulcrum point about which the bending of the plate 12 takes place in response to vibration of the free end of the magnet 19 by the voice currents traversing coil 14. For example, a shorter spring provides greater stiffness which, with about same mass, gives a higher pitch.

Thus the nearer the fulcrum yoke 21 is positioned to the anchor point 11, the greater the stroke and the lower the pitch, and vice versa. The air gap 20 may be readily adjusted to accommodate an increased or decreased stroke simply by drawing up on bolt 16 for increased stroke, and vice versa for decreased stroke. In this way, the air gap adjustment afforded by the bolt 16 and spacer 17 combination cooperates with the pitch adjustment afforded by the shiftable fulcrum yoke 21.

The adjustment of pitch is, also effected by shifting the center of mass of the relatively heavy vibratory magnet 19 and its appurtenant parts. Included among these vibratory parts is a weight 28 having upwardly converging side arms 29 which cooperate with the upwardly converging sides of the magnet 19 to hold the weight 28 thereon.

The weight is slidable along the magnet 19 and is locked in any adjusted position therealong by a ball 30 wedged frictionally against the under surface of the magnet 19 by the conical tip of a set screw 31 threaded into the weight 28, as shown particularly in Figs. 1 and 2. Thus, by changing the position of the weight 28 along the magnet 19, the center of mass thereof is shifted, so that the frequency of its vibration is altered correspondingly, i. e., the nearer the weight 28 is positioned toward the free end of the magnet 19, the lower the frequency, and vice versa.

The air gap 20 adjustment afforded by the bolt 16 and deflectable spacer 17 also cooperates with the frequency adjustment just described to enable a wide range of frequencies to be accommodated in one instrument.

The receiver includes a suitable cover 32 secured on the base 10, by screws 33 or the like, and is suitably supported in contact with the bone, such as on the mastoid bone behind the ear, by means of a head-band pivoted on the base 10 as is partially shown at 34 in Fig. 3, or in an aviator's helmet, or by other suitable supporting means.

In operation, the receiver is adjusted to the desired pitch in the manner described with commensurate air gap adjustment, and is placed with its base 10 in contact with the bone of the user, such as on the mastoid bone behind the ear. The voice currents, or currents representing other sounds within the audible frequency range, traversing coil 14 vary the flux across the air gap 20 and cause relative vibration of the magnet 19 about the fulcrum yoke 21. The relatively stiff connection between the plate 12 and the vibrating magnet 19, causes a reaction which results in concomitant bodily vibration of the entire receiver. Since the mass of the magnet 19, the weight 28 and the other vibrating parts, is considerably greater than that of the plate 12 and the housing the vibration is the result of inertia reaction, so that the vibration is powerful and readily distinguishable and intelligible even in severe conditions of deafness or magnitude of surrounding sounds.

It will thus be seen that a very simple but effective bone telephone receiver, readily adaptable to universal use, is provided by this invention, and although a preferred embodiment of the invention is illustrated and described herein, it is to be understood that the invention is not limited thereby, but is susceptible of change in form and detail within the scope of the appended claims.

I claim:

1. In a bone telephone receiver, the combination of a base, a plate fixed at one end to and otherwise spaced from said base, an elongated magnet supported thereon at another end and forming an air gap therewith at its fixed end, said magnet and plate forming a magnetic path across said air gap and including a voice coil, whereby the magnet and plate vibrate relatively to each other in response to the voice currents traversing said coil, a support on said base engageable with said plate intermediate its ends, and means for shifting said support to change the pitch of the receiver.

2. In a bone telephone receiver, the combination of a plate, an elongated magnet supported thereon at one end and forming an air gap therewith at its other end, said magnet and plate forming a magnetic path across said air gap and including a voice coil, whereby the magnet and plate vibrate relatively to each other in response to the voice currents traversing said coil, a support for said plate intermediate its ends, means for shifting said support to change the pitch of the receiver, and means for adjusting said air gap to accommodate the change in pitch of the receiver.

3. In a bone telephone receiver, the combination of a plate, an elongated magnet supported thereon at one end and forming an air gap therewith at its other end, said magnet and plate forming a magnetic path across said air gap and including a voice coil, whereby the magnet and plate vibrate relatively to each other in response to the voice currents traversing said coil, a housing for said plate and magnet, means fixedly connecting an end of said plate adjacent said voice coil to said housing with the plate otherwise spaced from said housing, and a support movably mounted on said housing engageable with said plate intermediate its ends to vary the pitch of the receiver.

4. In a bone telephone receiver, the combination of a plate, a voice coil thereon, a bar magnet supported at one end of said plate with its free end spaced from the plate to form a magnetic air gap therewith, means supporting said plate in contact with the bone, whereby the voice currents traversing said coil effect relative vibration of said magnet and plate which is imparted by the latter to the bone, a weight adjustable along said magnet for adjusting the pitch of the receiver, a support for said plate shiftable along said plate to adjust the pitch of the receiver, and means for adjusting the air gap to accommodate the said pitch adjustments.

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