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2,548,062

BONE CONDUCTING RECEIVER WITH ELECTROMAGNETIC VIBRATOR

Filed March 22, 1948

FIG. 3

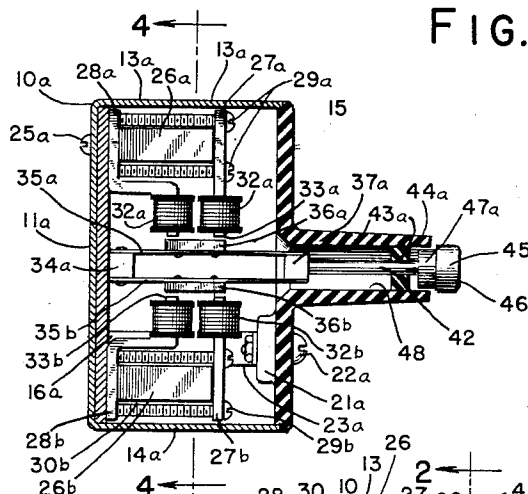


FIG. 1

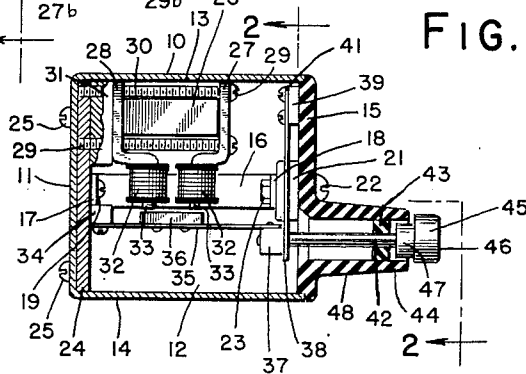


FIG. 4

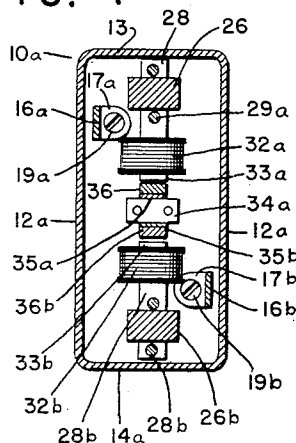
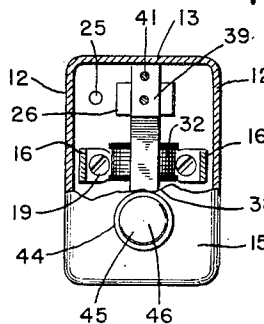


FIG. 2



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BONE CONDUCTING RECEIVER WITH
ELECTROMAGNETIC VIBRATOR

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21 Claims. (Cl. 179—107)

1

My invention relates to bone conducting receivers for use by persons hard of hearing.

An object of the invention resides in providing a bone conducting receiver capable of transforming electrical impulses produced by audible sounds as well as impulses produced by an electric generator into mechanical vibrations.

A still further object of the invention resides in producing a bone conducting receiver particularly capable of being used for test purposes as for example with an audiometer.

An object of the invention resides in providing a bone conducting receiver in which the mass of the moving parts is reduced to a minimum.

Another object of the invention resides in providing a receiver in which the output does not materially vary for variations in frequency of the electrical impulses.

A still further object of the invention resides in providing a bone conducting receiver in which the frequency response is not affected by variation in pressure on the contact member.

Another object of the invention resides in providing a bone conducting receiver having a contact member adapted to be pressed against a portion of the head of the user and in which the degree of pressure exerted does not affect the operation of the receiver.

A still further object of the invention resides in providing a receiver having a contact member movable in one direction and an actuating member therefore movable in a direction substantially at right angles to the direction of movement of the contact member.

An object of the invention resides in utilizing an electro-magnet providing a magnetic path and having an armature movable in said path in response to variations in the magnetic flux in said path and in further providing a reed to which said armature is attached and which is adapted to be vibrated transversely upon movement of the armature.

Another object of the invention resides in anchoring one end of the reed and in guiding the other end of said reed for longitudinal movement but limiting the transverse movement thereof whereby the span of the reed is varied upon vibration thereof.

A still further object of the invention resides in providing a contact member guided for movement in a longitudinal direction with respect to said reed.

Another object of the invention resides in attaching said contact member to the free end of the reed and in arranging the contact surface

2

thereof substantially at right angles to the direction of extent of the reed.

Other objects of the invention reside in the novel combination and arrangement of parts and in the details of construction hereinafter illustrated and/or described.

In the drawings:

Fig. 1 is an elevational sectional view of a bone conducting receiver illustrating an embodiment of my invention.

Fig. 2 is an elevational sectional view taken of line 2—2 of Fig. 1.

Fig. 3 is a view similar to Fig. 1 illustrating a modification of the invention.

Fig. 4 is an elevational sectional view taken of line 4—4 of Fig. 3.

In certain types of bone conducting receivers now in use, the output varies considerably with variation in the frequency of the electrical impulses and the frequency response is also affected by variation in pressure on the contact member. In other types considerable energy is required to operate the same. The instant invention provides a construction in which the faults of both of such types of bone conducting receivers are largely overcome.

The form of the invention shown in Figs. 1 and 2 comprise a case 10 having a back 11, side walls 12, and upper and lower walls 13 and 14. This case is open at the front and it is normally closed by means of a closure 15 which is detachably secured to the case. The case 10 and the closure 15 can be constructed of metal or of a molded plastic material.

The entire mechanism within the case 10 is supported from the closure 15 in the following manner. Disposed within the case 10 and resting on the back 11 of said case is a supporting plate 24. This plate is attached to the closure 15 by means of two legs 16 which have feet 17 and 18 extending outwardly therefrom. The feet 17 overlie the plate 24 and are secured thereto by means of screws 19 which extend through said feet and are threaded into the said plate. The feet 18 underlie pads 21 formed on the closures 15 and are attached to said closure by means of screws 22 which extend through the pads 21 and said feet and which have nuts 23 screwed upon the inner ends of the same. Screws 25 extending through the back 11 of case 10 and threaded into the plate 24 hold the closure 15 and attached parts mounted within the case 10.

The invention utilizes an electro-magnetic device 30 which consists of a permanent magnet

26. This magnet is clamped between two core members 27 and 28 which overlies the same at its ends. Screws 29 extend through these core members and are threaded into the plate 24. A spacer 31 is disposed between the core member 28 and the plate 24 and serves to bring the said core members toward the center of the case. The core members 27 and 28 have coils 32 mounted on the same and terminate in poles 33. Mounted on the plate 24 is a block 34 which supports a vibrating reed 35. Reed 35 has secured to it an armature 36 which lies in the magnetic path formed by the magnet 26 and the core members 27 and 28 and in itself forms a core member constituting a part of the magnet circuit through the coils 32. The reed 35 has attached to the free end thereof a mounting 37 which has also attached to it one end of a leaf spring 38. The other end of said leaf spring is secured by means of screws 41 to a pad 39 formed on the closure. By means of this construction the reed 35 is held from transverse movement but allowed to vibrate due to attraction and repulsion of the armature 36 by means of the poles 33 of the electromagnetic device 30. Attached to the mounting 37 is a spindle 42 which is guided for longitudinal movement by means of a bushing 43 mounted in a hollow boss 44 formed on the closure 15. This spindle has secured to the outer end of the same a contact member 45 which has a contact surface 46. The said contact member is in the form of a button and has a shank 47 which is spaced from the bore 48 in the boss 44. The surface 46 is adapted to be placed against a portion of the head of the user whereby vibrations of the member 45 are imparted to the bone structure of the head.

The operation of the invention is as follows: When pressure is applied to the surface 46 of the contact member 45 as is the case when the bone conducting receiver is placed in use, such pressure is end-wise against the reed 35 and does not affect movement of the reed. As pulsating currents received from a suitable transmitter pass through the coils 32, such currents cause a pulsating flux to flow through the magnetic circuit with which said coils are associated and through the armature 36. This causes the reed 35 to vibrate. Vibration of the reed changes the span of the same and causes the mounting 37 and the contact member 47 to move in a longitudinal direction and with respect to said reed. Such movement is substantially at right angles to the movement of the armature 36. I have found that exerting considerable pressure on the surface 36 by holding the contact member 45 firmly in contact with the head does not apparently affect the operation of the device.

In Fig. 3 I have shown a form of the invention which is similar to that illustrated in that Fig. 1. Due to the fact that certain of parts are the same, the description of such parts will not be repeated, and the same reference numerals to which the suffix "a" have been added will be used to designate corresponding parts.

The form of the invention shown in Fig. 3 uses a duplicate magnetic device indicated at 30b and a reed 35b operated thereby. The construction of these parts being the same as the corresponding parts of the device shown in Fig. 1, the same reference numerals followed by the character "b" will be used to describe such parts and the description thereof will not be repeated. It will be noted in this form of invention that both of the reeds 35a and 35b are attached to the block 34a,

likewise the said reeds are both attached to the mounting 37a. By means of this construction the leaf spring 38 may be dispensed with. At the same time more power can be derived from the receiver so that greater output may be had from the same.

The advantages of the invention are manifest. My invention requires a minimum amount of power to operate. My improved bone conducting receiver is very efficient in operation. Pressure exerted upon the contact member of the invention does affect or vary the normal operation of the same. The invention can be constructed at small expense and is extremely simple. In my invention there are no complicated parts to get out of order and the device will continue to operate indefinitely without attention.

Changes in the specific form of my invention, as herein described, may be made within the scope of what is claimed without departing from the spirit of my invention.

Having described my invention, what I claim as new and desire to protect by letters patent is:

1. In a bone conducting receiver having a contact member adapted to engage the user's head a vibrating member having movement in a first direction and having movement in a second direction at right angles to said first direction and of a lesser amplitude than the amplitude in said first direction, actuating means imparting movement to said vibrating member in said first named direction, said contact member being movable in the same direction as said second named direction and being energized by said vibrating member said contact member when pressure is applied thereto by engagement with the head of the user producing no perceptible resistance to the movement of said vibrating member in said first named direction.

2. In a bone conducting receiver having a contact member adapted to engage the user's head a vibrating member having movement in a first direction and having movement in a second direction at right angles to said first direction and of a lesser amplitude than the amplitude in said first direction, an armature movable in the same direction as said first named direction and imparting movement to said vibrating member, said contact member being movable in the same direction as said second named direction and being energized by said vibrating member said contact member when pressure is applied thereto by engagement with the head of the user producing no perceptible resistance to the movement of said vibrating member in said first named direction.

3. A vibrator for use in a bone conducting receiver having a contact member for engagement with the head of the user movable in a certain direction, said vibrator including a vibrating operating member having movement in a first direction and in a second direction at right angles to the first direction with the amplitude of vibration in the first direction being greater than the amplitude of vibration in the second direction said operating member being placed with the second direction of vibration parallel with the direction of movement of the contact member, actuating means imparting vibratory motion to said operating member in said first named direction, and motion transmitting means between said operating member and said contact member said contact member when pressure is applied thereto by engagement with the head of the user producing no perceptible resistance to the movement of said vibrating member in said first named direction.

4. A magnetic vibrator for use in a bone conducting receiver having a contact member formed with a contact surface for engagement with the head of the user and movable in a direction normal to said contact surface, said vibrator including an electro-magnet, an elongated reed adapted to flex and energized by said electro-magnet, one end of said reed being fixed and the other end of said reed being adapted to have longitudinal movement produced by change in the span of the reed occasioned by flexing thereof and motion transmitting means between said contact member and the last named end of the reed and transmitting longitudinal motion from said reed and to said contact member in a direction substantially normal to the contact surface thereof said contact member when pressure is applied to the same through engagement with the head of the user producing no perceptible resistance to the flexing of the reed.

5. In a bone conducting receiver having a contact member for engagement with the user's head and formed with a contact surface a support, an elongated reed having greater longitudinal rigidity than transverse rigidity, attaching means for attaching one end of said reed to said support, said attaching means holding said reed from longitudinal and transverse movement at such end, guide means at the other end of said reed for guiding said reed for longitudinal movement and for restraining lateral movement of the reed, motive means acting on said reed intermediate its ends and adapted to set up transverse vibrations in said reed to cause the second named end of the reed to move longitudinally of the reed toward and from the first named end of the reed, a contact member having a contact surface transverse of the direction of extent of said reed for transmitting force in the direction of extent of the reed, and motion transmitting means between said contact member and the end of the reed and having rigidity in the direction of extent of the reed said contact member when pressure is applied to the same through engagement with the head of the user producing no perceptible resistance to the movement of the reed in a transverse direction.

6. In a bone conducting receiver having a contact member for engagement with the user's head and formed with a contact surface a support, an elongated reed having greater longitudinal rigidity than transverse rigidity, attaching means for attaching one end of said reed to said support, said attaching means holding said reed from longitudinal and transverse movement at such end, guide means at the other end of said reed for guiding said reed for longitudinal movement and for restraining lateral movement of the reed, motive means acting on said reed intermediate its ends and adapted to set up transverse vibrations in said reed to cause the second named end of the reed to move longitudinally of the reed toward and from the first named end of the reed, a contact member having a contact surface and motion transmitting means for transmitting longitudinal motion from the second named end of the reed and to the contact member in a direction transverse to the contact surface of said contact member said contact member when pressure is applied to the same through engagement with the head of the user producing no perceptible resistance to the movement of the reed in a transverse direction.

7. A vibrator for use in a bone conducting receiver having a contact member for engagement

with the head of the user, said vibrator including an electro-magnet, an elongated reed adapted to be moved by said electro-magnet and arranged to flex in accordance with the force exerted by the electro-magnet, the span of said reed changing during flexing and motion transmitting means movable in accordance with the change in span of said reed and operating said contact member said contact member when pressure is applied to the same through engagement with the head of the user producing no perceptible resistance to the flexing of the reed.

8. A vibrator for use in a bone conducting receiver having a contact member for engagement with the head of the user, said vibrator including an electro-magnet, an elongated reed adapted to be moved by said electro-magnet and arranged to flex in accordance with the force exerted by the electro-magnet, the span of said reed changing during flexing, restraining means for restraining longitudinal movement of the reed at one end thereof, said contact member being connected to the reed at its other end and actuated by the changes in the span of the reed said contact member when pressure is applied to the same through engagement with the head of the user producing no perceptible resistance to the flexing of the reed.

9. A vibrator for use in a bone conducting receiver having a contact member for engagement with the head of the user, said vibrator including an electro-magnet, an elongated reed adapted to be moved by said electro-magnet and arranged to flex in accordance with the force exerted by the electro-magnet, the span of said reed changing during flexing, restraining means for restraining longitudinal and lateral movement of the reed at one end thereof, restraining means for restraining lateral movement of said reed at its other end, said end of the reed being free to move longitudinally, said contact member being actuated by longitudinal movement of the movable end of the reed said contact member when pressure is applied to the same through engagement with the head of the user producing no perceptible resistance to the flexing of the reed.

10. A vibrator for use in a bone conducting receiver having a contact member formed with a contact surface for engagement with the head of the user, said vibrator including an electro-magnet, an elongated reed adapted to be moved by said electro-magnet and arranged to flex in accordance with the force exerted by the electro-magnet, the span of said reed changing during flexing, restraining means for restraining longitudinal and lateral movement of said reed at one end thereof, restraining means for restraining lateral movement of said reed at its other end, said end of the reed being free to move longitudinally said contact member being attached to the movable end of said reed in a manner such that the direction of extent of said reed is substantially normal to said contact surface said contact member when pressure is applied to the same through engagement with the head of the user producing no perceptible resistance to the flexing of the reed.

11. A vibrator for use in a bone conducting receiver having a contact member for engagement with the head of the user, said vibrator including two electro-magnets having coils adapted to be simultaneously energized by a signal transmitter, said electro-magnets being provided with juxtaposed oppositely facing poles, two coextensive spaced vibratory reeds movable in opposite direc-

tions and adapted to be moved by said poles, supporting means to which corresponding ends of said reeds are attached, said reeds being free to simultaneously move longitudinally at their other ends, said contact member being actuated by longitudinal movement of the movable ends of said reeds and movable in a longitudinal direction with reference to said reeds.

12. A vibrator for use in a bone conducting receiver having a contact member for engagement with the head of the user, said vibrator including two electro-magnets having coils adapted to be simultaneously energized by a signal transmitter, said electro-magnets being provided with juxtaposed poles, two coextensive spaced vibratory reeds movable in different directions and adapted to be moved by said poles, supporting means to which corresponding ends of said reeds are attached, said reeds being free to simultaneously move longitudinally at their other ends, said contact member being actuated by longitudinal movement of the movable ends of said reeds and movable in a longitudinal direction with reference to said reeds.

13. In a bone conducting receiver having a contact member formed with a contact surface for engagement with the head of the user and movable in a direction normal to such surface, an armature, guide means for guiding said armature for movement in a certain direction and in a direction normal to said contact surface and actuating means between said contact member and said armature and transferring movement from armature member to said contact member in a manner such that the directions of movement of said armature and contact member are substantially at right angles to one another, said contact member when pressure is applied to the same through engagement with the user's head producing no perceptible resistance to the movement of said armature in said first named direction.

14. In a bone conducting receiver having a contact member for engagement with the head of the user, a movable armature, an elongated reed attached to said armature and arranged to flex to accommodate movement of the armature, the span of the reed changing during flexing, said contact member being actuated by changes in the span of the reed, said contact member when pressure is applied to the same through engagement with the head of the user producing no perceptible resistance to the movement of said armature.

15. In a bone conducting receiver having a contact member for engagement with the head of the user, a movable armature, an elongated reed attached to said armature and arranged to flex to accommodate movement of the armature, the span of said reed changing during flexing, means for restraining longitudinal movement of the reed at the end thereof, the other end of the reed being free to move longitudinally, said contact member being connected to the other end of said reed and actuated by changes in the span of the reed, said contact member when pressure is applied to the same through engagement with the head of the user offering no perceptible resistance to the flexing of the reed.

16. In a bone conducting receiver having a contact member for engagement with the head of the user, a movable armature, an elongated reed attached to said armature and arranged to flex to accommodate movement of the armature, the span of said reed changing during flexing, means for restraining longitudinal and lateral movement

of the reed at one end thereof, means for restraining lateral movement of said reed at its other end, said end of the reed being free to move longitudinally, said contact member being connected to the other end of said reed and actuated by the longitudinal movement of the other end of the reed, said contact member when pressure is applied to the same through engagement with the head of the user offering no perceptible resistance to the flexing of the reed.

17. In a bone conducting receiver having a contact member formed with a contact surface for engagement with the head of the user, said contact member being movable in a direction normal to said surface, a movable armature, a reed attached to said armature and arranged to flex to accommodate movement of the armature, the span of said reed changing during flexing, means for restraining longitudinal and lateral movement of said reed at one end, means for restraining lateral movement of said reed at its other end, said end of the reed being free to move longitudinally, said contact member being secured to the free end of said reed with its contact surface substantially at right angles to said reed and movable with said reed in the direction of extent of said reed, said contact member when pressure is applied to the same through engagement with the head of the user offering no perceptible resistance to the flexing of the reed.

18. In a bone conducting receiver having a contact member for engagement with the head of the user, a movable armature, an elongated reed attached to said armature and arranged to flex to accommodate movement of the armature, the span of said reed changing during flexing, means for restraining longitudinal and lateral movement of the reed at one end thereof, a leaf spring extending substantially at right angles to said reed and attached at one end to the free end of said reed, said spring restraining lateral movement of the free end of the reed in one direction, the free end of the reed being capable of movement longitudinally, said contact member being connected to the free end of the reed and actuated by the changes in span of the reed, said contact member when pressure is applied to the same through engagement with the head of the user offering no perceptible resistance to the flexing of the reed.

19. In a bone conducting receiver having a contact member for engagement with the head of the user, two electro magnets having coils adapted to be simultaneously energized and provided with juxtaposed facing poles, two juxtaposed armatures one for each electromagnet, said armatures being arranged to be attracted by said poles and simultaneously movable in opposite directions, two coextensive spaced vibratory reeds attached to said armatures, supporting means to which corresponding ends of the reeds are attached, said reeds being free to move longitudinally at their other ends, said contact member being actuated by the movable ends of the reeds, said contact member when pressure is applied to the same through engagement with the head of the user offering no perceptible resistance to the flexing of the reeds.

20. In a bone conducting receiver having a contact member for engagement with the head of the user, two electro magnets having coils adapted to be simultaneously energized and provided with juxtaposed facing poles, two juxtaposed armatures one for each electromagnet, said armatures being arranged to be attracted by said poles and

simultaneously movable in different directions, two coextensive spaced vibratory reeds attached to said armatures, supporting means to which corresponding ends of the reeds are attached, said reeds being free to move longitudinally at their other ends, said contact member being actuated by the movable ends of the reeds, said contact member when pressure is applied to the same through engagement with the head of the user offering no perceptible resistance to the flexing of the reeds.

21. In a bone conducting receiver having a contact member for engagement with the head of the user, a movable armature, an elongated reed attached to said armature and arranged to flex to accommodate movement of the armature, the span of the reed changing during flexing, supporting means to which one end of the reed is attached, said contact member being attached to the other end of said reed and actuated by longitudinal movement of the free end of the reed, said reed having sufficient longitudinal rigidity to resist flexing due to end pressure applied to the same by bringing the contact member into contact with the user's head.

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25

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