

(21) Application No 8323559

(22) Date of filing 26 Jul 1981

Date lodged 2 Sep 1983

(30) Priority data

(31) 55/087936	(32) 30 Jun 1980	(33) JP
55/090547	30 Jun 1980	
55/090521	4 Jul 1980	
55/090522	4 Jul 1980	

(60) Derived from application No. 8119788 under section 15(4) of the Patents Act 1977.

(71) Applicants
Pioneer Electronic Corporation (Japan),
No 4-1 Meguro 1-chome, Meguro-ku, Tokyo, Japan

(72) Inventor
Toshikazu Yoshimi

(74) Agent and/or Address for Service
Marks & Clerk, Alpha Tower, Suffolk Street Queensway,
Birmingham B1 1TT

(51) INT CL⁴
H04R 1/10

(52) Domestic classification
H4J 30K 31H L

(56) Documents cited
GB 1402238 GB 1065454 GB 0851503
GB 0382268

(58) Field of search
H4J

(54) Ear speaker

(57) A magnetic circuit 60 and a diaphragm 61 are carried by an annular frame 63 which is coupled to an outer case 74 by means of a recess portion 63d so that a flush outer surface is formed between the case 74 and the frame 63. A front cover 76 having sound holes 76a therein is coupled to the frame 63 by further recess means 63c so that a flush outer surface is also formed between the cover 76 and the frame 63.

FIG. 2.

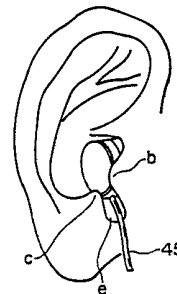


FIG. 3.

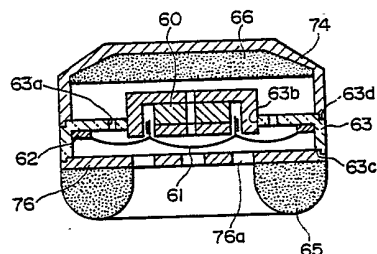


FIG. 1(a)

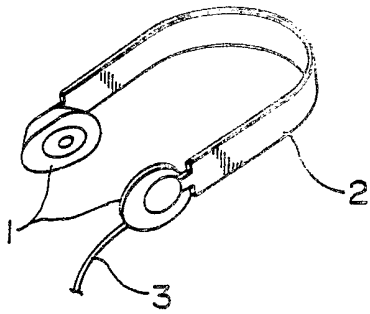


FIG. 1(b)

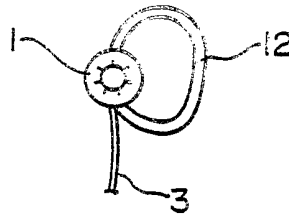


FIG. 1(c)

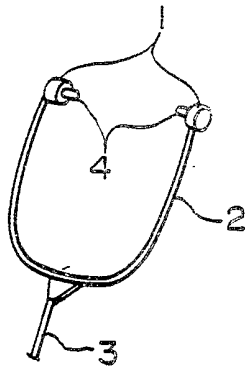


FIG. 1(d)

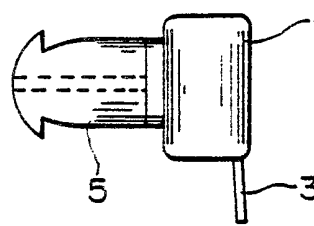


FIG. 1(e)

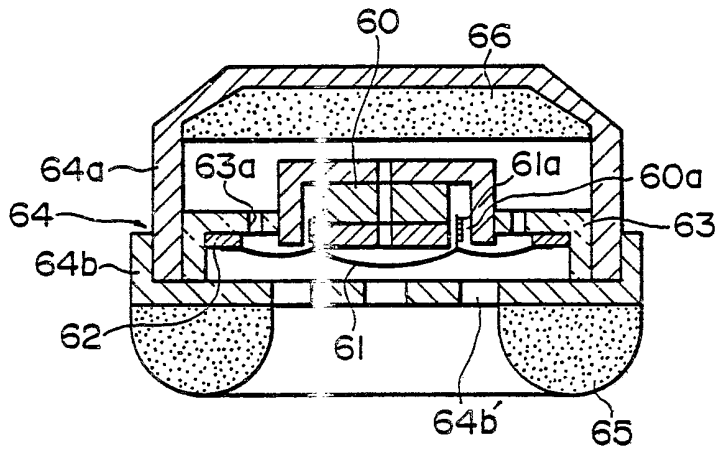


FIG. 2.

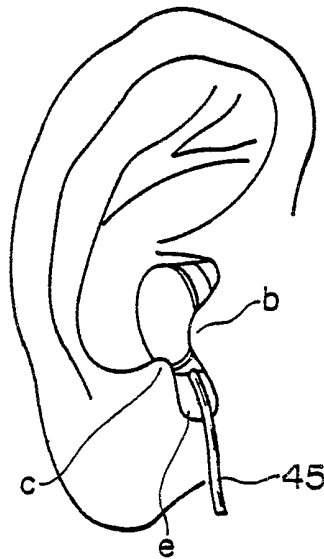
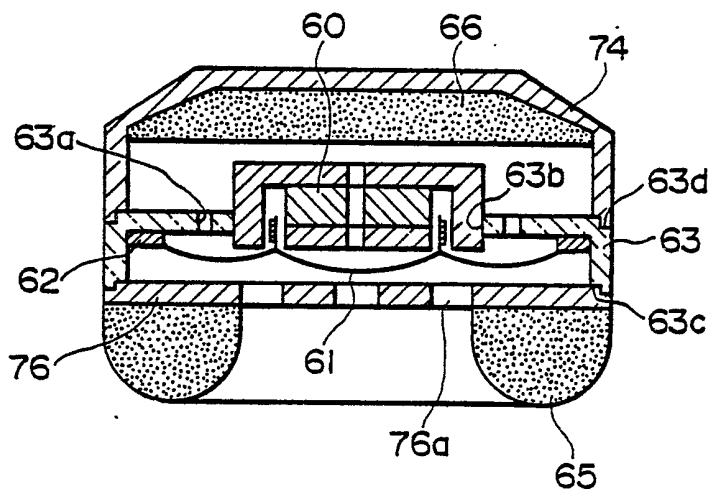


FIG. 3.



SPECIFICATION

Ear speaker

5 The present invention relates to speakers adapted to be attached to human ears so that sounds can be heard therefrom.

A variety of so-called ear speakers have been proposed previously, and can be generally classified into four types according to the manner in which they are worn, as depicted in Figures 1(a) to 1(d) of the accompanying drawings. Figure 1(a) shows a pair of ear speakers in the form of a so-called "headphone", which is made up of a pair of speaker units 1, a head band 2 coupling the speaker units 1 together and a cord 3 through which electrical signals are supplied to the speaker units 1. The head band 2 has a resiliency so as to fit the speaker units 1 to the user's external ears, respectively. For this reason, a rather large pressure is applied to the user's temples and/or the external ears or pinnae, as a result of which the feel of the headphones when worn will deteriorate. Also, with such a construction, since the speaker units 1 are fitted on the external ears or pinnae in order for the user to hear the sounds emitted thereby, each speaker unit 1 is far from an inlet to the external auditory meatus and the space defined therebetween is rather bulky. Therefore only part of the acoustic energy emanating from each speaker unit 1 is supplied to the auditory meatus, the remainder being leaked away so that efficiency is decreased. Moreover, due to the acoustic circuit defined by the speaker unit 1 and the external ear, sound reflections from the surface of the external ear and the unit results in a degradation of acoustic characteristics. For this reason, it is difficult to provide high performance speakers of this type.

Figure 1(b) shows a so-called ear hook type speaker, which comprises a speaker unit 1, an ear suspension loop 12 formed integrally with the unit 1 and a cord 3 through which electrical signals are supplied. The ear speaker is hooked around the external ear or pinna to hold the unit 1 in position. However, the fitting is not stable and it is difficult to attach the ear speaker to the external ear or detach it therefrom. Furthermore, the unit 1 is in contact with the external ear or positioned in the vicinity thereof, so that for the same reasons as mentioned above in relation to the headphones, the ear speaker is inferior in its acoustic characteristics.

Figure 1(c) shows a stethophone or jaw suspension speaker, composed of a pair of speaker units 1, a band 2 in the form of a stethoscope and a cord 3 through which electrical signals are supplied. The units 1 are held close to the external ears or pinnae with a pair of projecting acoustic tubes 4 being held in contact with parts of the external ears or pinnae by the resilient force of the band 3. Figure 1(d) shows a so-called earphone which is composed of a speaker unit 1, an ear plug 5 extending from a front surface of the unit 1 and a cord 3 through which electrical signals are supplied. The ear plug 5, which serves as an acoustic tube, is inserted into the external auditory meatus and is then held there. The fitting characteristics obtained

with the devices shown in Figures 1(c) and (d) are not stable, so that the devices are liable to be pulled out of the user's ears resulting in an inferior feeling in use. Moreover, with these devices, generated sounds are propagated via the acoustic tubes. Such constructions cannot provide desirable acoustic characteristics.

Figure 1(e) shows a conventional headphone wherein a speaker unit is composed of a magnetic circuit 60 having a magnetic gap 60a, a vibrating diaphragm 61 having a voice coil 61a and a frame 63 to which the magnetic circuit 60 is directly secured and to which the diaphragm 61 is secured through a ring 62. The speaker unit is encased and secured in a protection case 64 made up of a body 64a and a cover 64b. An ear pad 65 is attached around sound holes 64b' in the cover 64b, while a sound absorbing material 66 is attached to the bottom of the body 64a. Reference numeral 63a denotes sound holes formed in the frame 63. In assembling this headphone the outer periphery of the frame 63 in which the diaphragm 61 is provided is secured to the inner periphery of the body 64a of the case 64, thereby fixing the speaker unit in a predetermined position, and then cover 64b is attached to the outer periphery of the body 64a. The outer diameter of the case 64 is considerably larger than the diameter of the diaphragm 61, so that space efficiency is inferior. Consequently, with such a construction, it is very difficult to miniaturize the ear speaker.

As will be apparent from the above description, the various types of known ear speakers cannot simultaneously satisfy the compactness and high performance requirements available commercially in the audio equipment market. In view of the above noted defects inherent to conventional constructions, it is an object of the present invention to provide a novel ear speaker which can be made compact and which can have a high performance.

Accordingly, the present invention provides an ear speaker comprising a substantially cup-shaped outer case, sound generating means including a magnetic circuit and a vibrating circuit, an annular frame carrying the sound generating means, and coupling means coupling the outer case and the annular frame so as to form a flush outer surface between the outer case and the annular frame.

Preferably, the ear speaker also comprises a front cover member in which at least one hole is formed, and further coupling means coupling the annular frame and the front cover so as to form a further flush outer surface between the outer case and the annular frame.

The present invention will now be further described, by way of example, with reference to the remaining figures of the accompanying drawings, in which:—

Figure 2 is a schematic view of a human ear as viewed obliquely from a front side thereof, having an ear speaker according to the invention fitted therein; and

Figure 3 is a cross-sectional view of a headphone to which the invention is applied.

In Figure 2, there is shown an ear speaker fully

accommodated and attached in the concha *d* of the external ear under the tragus *b* and the anti-tragus *c*, positioned in front of the external auditory meatus *a*. The ear speaker has a configuration and a size such

5 that it is held by the frictional force generated between the walls of the concha *d*, the tragus *b* and the anti-tragus *c*. A cord 45 of the speaker extends through a tragus slit (the incisura intertragica) *e* to the outside.

Figure 3 shows the present invention as applied to a 10 headphone, the same reference numerals as in Figure 1(e) being used to denote similar components. The speaker unit shown in Figure 3 is a general moving coil type dynamic unit. A central hole 63*b* is formed in the cup-shaped frame 63, and a magnetic circuit 60 is 15 inserted into the central hole 63*b*. A vibrating diaphragm 61 is secured to a ring 62 fixed to the bottom portion of the frame 63. Concave portions 63*c* and 63*d* are formed in the frame 63 as shown. The rear side of the speaker is covered by a cup-shaped rear cover 74 20 having the same diameter as the outer periphery of the frame 63. The recess portion 63*d* serves as a positioning member when the cover 74 is attached to the speaker by means of adhesive or the like. The front side of the speaker is covered by a planar front cover 25 76 having the same diameter as the outer periphery of the frame 63. The recess portion 63*c* serves as a positioning member when the cover 76 is attached to the speaker unit by means of adhesive or the like. Sound holes 76*a* are formed in the front cover 76 and 30 an ear pad 65 is attached thereto. In the same way, a sound absorbing member 56 is encased in the bottom of the rear cover 74.

As mentioned above, the outer periphery of the frame in which the speaker unit is fixed with the 35 magnetic circuit 60 and the diaphragm 61 extends to the outside of the speaker because the outer diameter of the frame is substantially the same as that of the rear cover and the front cover. With such a construction, the diameter of the speaker unit and the vibrating 40 unit can be relatively widened when the physical size of the speaker is limited for compactness.

CLAIMS

1. An ear speaker comprising a substantially cup-shaped outer case, sound generating means 45 including a magnetic circuit and a vibrating circuit, an annular frame carrying the sound generating means, and coupling means coupling the outer case and the annular frame so as to form a flush outer surface between the outer case and the annular frame.
- 50 2. An ear speaker as claimed in claim 1, further comprising a front cover member in which at least one hole is formed, and further coupling means coupling the annular frame and the front cover so as to form a further flush outer surface between the outer case and 55 the annular frame.
3. An ear speaker substantially as hereinbefore described with reference to Figure 3 of the accompanying drawings.

60 New claims or amendments to claims filed on 21st November 1984.
Superseded claims 1, 2, 3.

1. An ear speaker comprising an annular frame 65 having a central opening in which a magnetic circuit is

mounted, an integral rim on said frame, a vibratable diaphragm mounted on said frame and coacting with said magnetic circuit to constitute sound generating means, a substantially planar front cover attached to said rim, said diaphragm being contained within a space defined by said frame, said rim and said front cover, and a substantially closed cup-shaped back cover attached to said rim, the outer edges of the rim, the front cover and the back cover forming a substantially flush outer surface of the ear speaker.

2. An ear speaker substantially as hereinbefore described with reference to Figure 2 of the accompanying drawings.

Printed in the United Kingdom for Her Majesty's Stationery Office, 8818935, 5/85, 18996. Published at the Patent Office, 25 Southampton Buildings, London WC2A 1AY, from which copies may be obtained.