

(12) UK Patent Application (19) GB (11) 2 375 684 (13) A

(43) Date of A Publication 20.11.2002

(21) Application No **0203010.4**

(22) Date of Filing **08.02.2002**

(30) Priority Data

(31) **2001081270** (32) **21.03.2001** (33) **JP**

(71) Applicant(s)

NEC Corporation
(Incorporated in Japan)
7-1, Shiba 5-chome, Minato-ku, Tokyo,
Japan

(72) Inventor(s)

Mitsuru Kuroda

(74) Agent and/or Address for Service

W P Thompson & Co
Celcon House, 289-293 High Holborn,
LONDON, WC1V 7HU, United Kingdom

(51) INT CL⁷

H04M 1/03

(52) UK CL (Edition T)

H4J JDQ J30K
U1S S2215

(56) Documents Cited

GB 2249691 A **GB 2225192 A**
GB 1437751 A **WO 2000/076183 A1**
US 5937361 A **US 5836790 A**

(58) Field of Search

UK CL (Edition T) **H4J JAAB JDQ**
INT CL⁷ **H04M 1/03**
ONLINE: WPI, EPODOC, JAPIO

(54) Abstract Title

Mounting a loudspeaker in a radiotelephone

(57) A portable telephone body has an inner cavity in which a printed circuit board 13 is disposed and on which a speaker body 14 is mounted. A head portion of the speaker body is fitted with a cap 52 in which a net 51 is secured. An elastic rib 52A formed in the upper portion of the cap and having a triangular cross section is pressed against the upper casing to thereby block entrance of any moisture and dust through a sound aperture without requiring any adhesive or double-faced adhesive tape.

In a second embodiment a resilient cylindrical body 72 is retained in the casing of the telephone.

Fig. 2

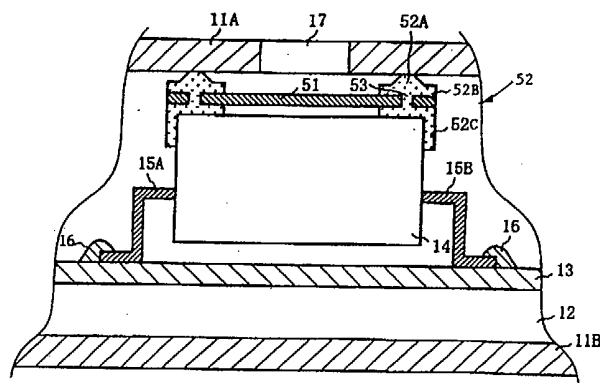
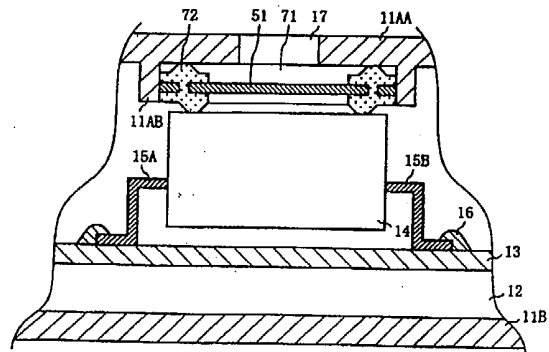


Fig. 4



GB 2 375 684 A

Fig. 1 (Prior Art)

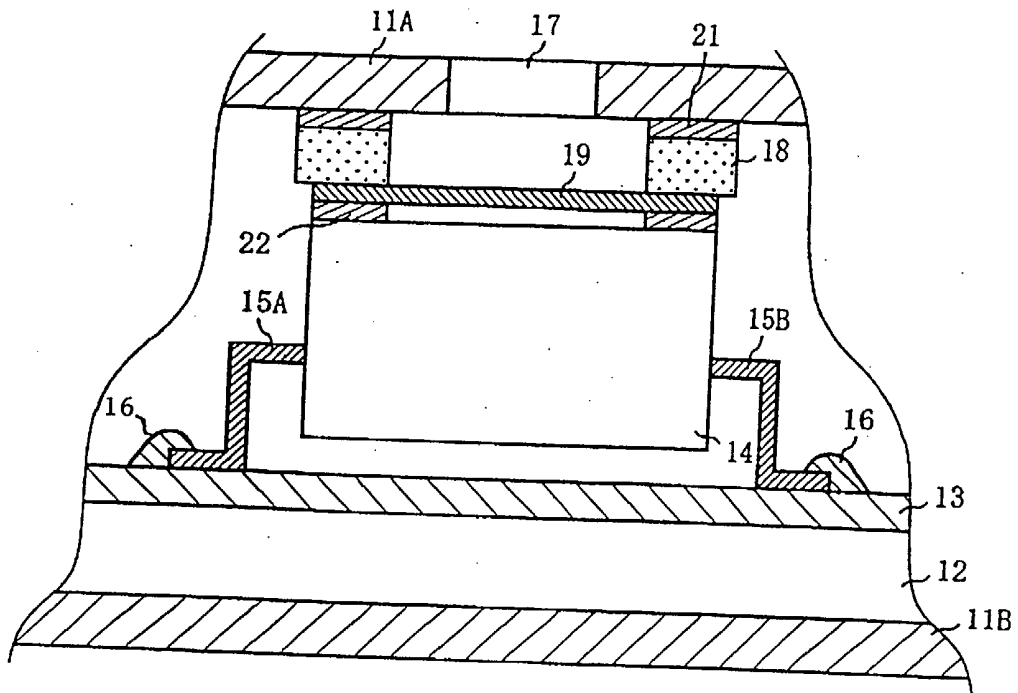


Fig. 2

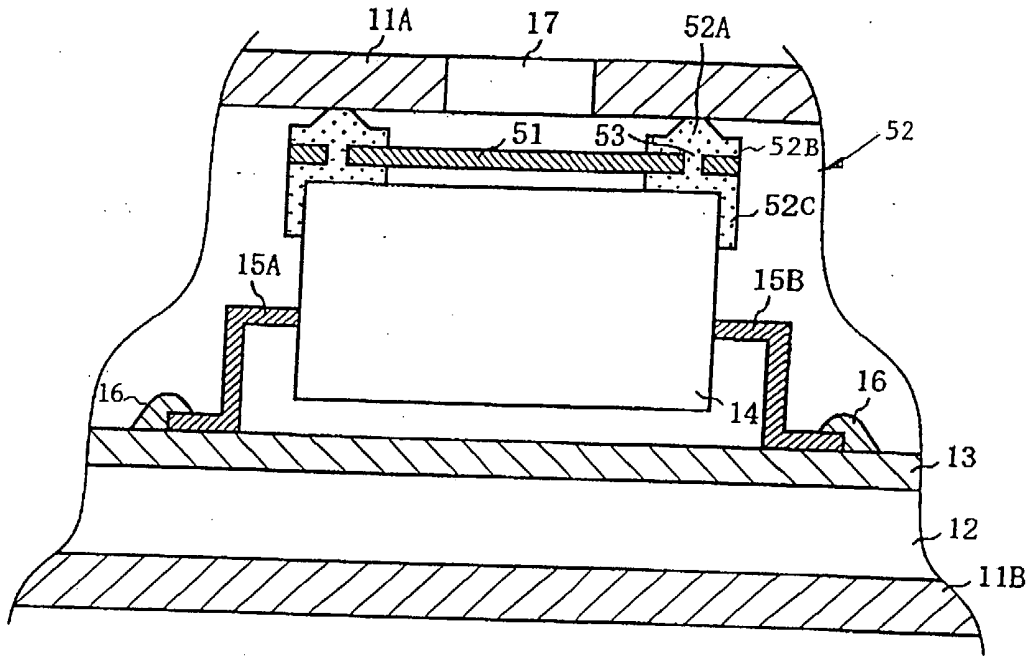


Fig. 3

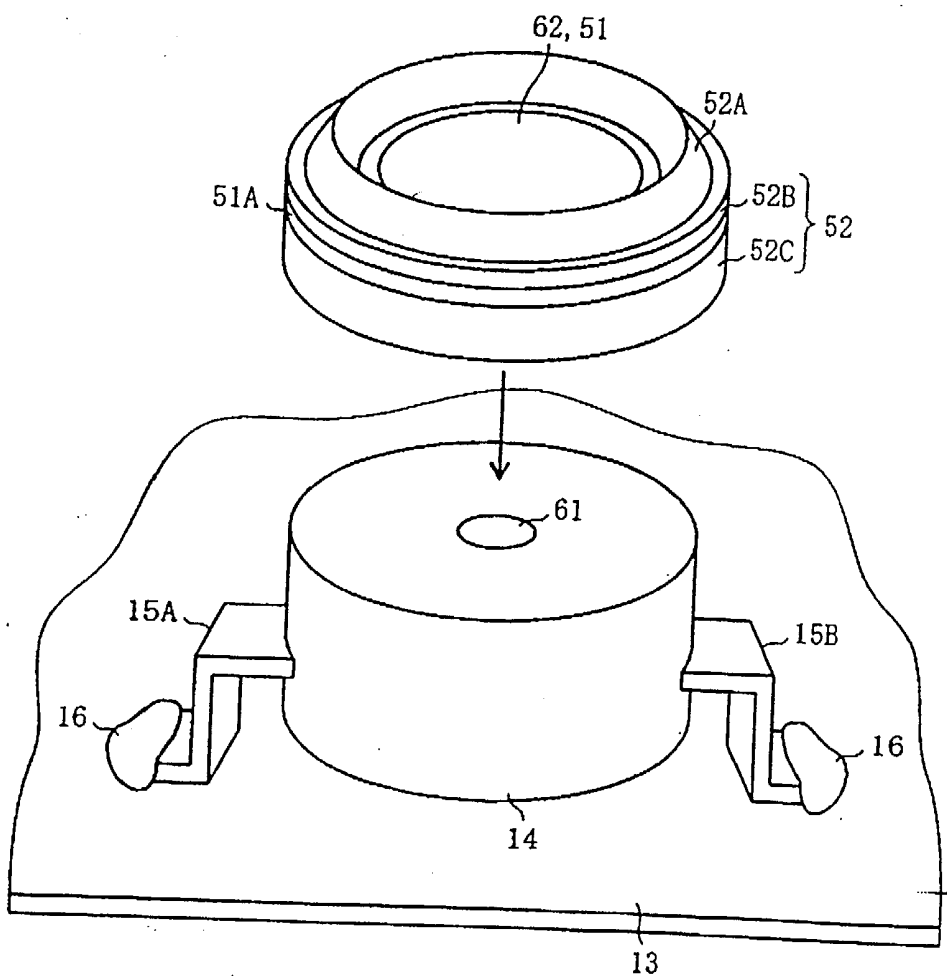


Fig. 4

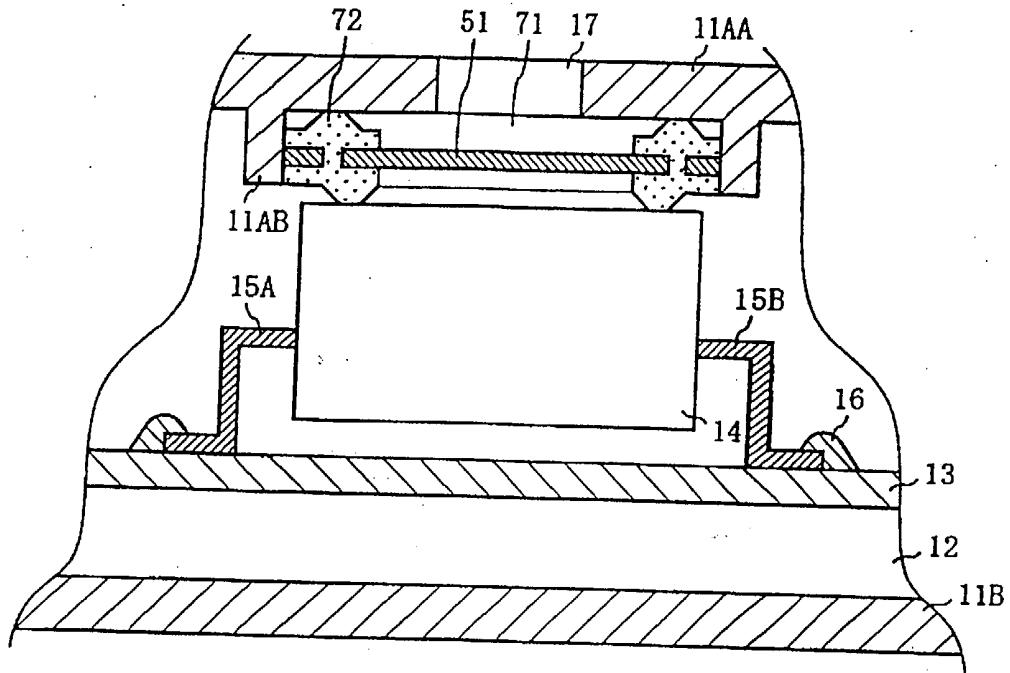
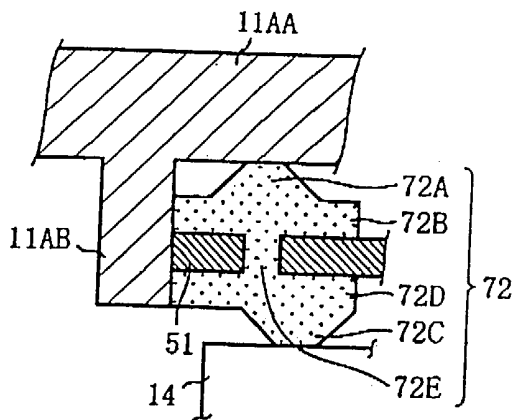


Fig. 5



MOUNTING STRUCTURE

The present invention relates to a mounting structure for mounting various electronic devices or components including for example acoustic components such as speakers on a casing. In particular the invention can relate to a mounting structure which is suitable for mounting components within a portable telephone.

With developments in communication networks, use of devices such as portable telephones has increased. Such devices employ acoustic components for sound input and output for communication and other various purposes. Typical examples of such acoustic components are speakers and microphones. These acoustic components are usually assembled in the interior of the devices and the casing of the device is formed with at least an aperture for permitting sound to be transmitted between the assembled acoustic components and the outside of the casing. However, the aperture permits not only sound to pass therethrough but moisture, dust and other various foreign materials and so which can enter the interior of the device. Such moisture and dust often lead to deterioration in the operative quality of the acoustic parts. Further, electronic parts operative to perform optical indications such as for display purposes may also be degraded due to the ingress of dust etc. Thus, it is quite usual for a membrane-like member to be disposed between the internal electronic components such as acoustic components and the aperture formed in the device casing for protection from moisture and dust.

Fig. 1 is a partial cross-sectional view illustrating an example of a mounting structure for electronic components in an information device such as, in this case, a portable telephone. Upper casing 11A and lower casing 11B which constitute the body of a portable telephone enclose an inner cavity 12 of the body, in which printed circuit board 13 is disposed. On this printed circuit board 13 there is a speaker body 14 mounted by means of SMT surface mount

technology (SMT). Namely, terminals 15A and 15B made of a thin metallic sheet project from both side portions of speaker body 14 in the shape of an approximate cylinder. These terminals have an L-shaped end which is fixed to the surface of printed circuit board 13 by means of solder 16.

Upper casing 11A is provided with a sound aperture 17 at a position opposing an upper middle region of the speaker body 14. Between the speaker body 14 and the upper casing 11A are mounted ring-like packing member 18 made of urethane foam material and effectively discharging sound through the sound aperture 17 without discharging it into the interior of the casing. A dust-proof net 19 is also provided. Onto the upper surface of the packing member 18 is bonded double-faced adhesive tape 21 in the shape of a ring identical with that of the packing member 18 in such a manner that the upper surface of the tape is bonded to the upper casing 11A. Double-faced adhesive tape 22 in the shape of a similar ring is attached to the dust-proof net 19 and offers a lower surface which is bonded to the upper surface of the speaker body 14.

When assembling these parts, an assembling operation is needed to attach the dust-proof net 19 to the upper surface of speaker body 14 that is surface-mounted on the printed circuit board 13, by the use of second double-faced adhesive tape 22. A further assembling operation is then needed to attach the packing member 18 around the sound aperture 17 of the upper casing 11A by the use of first double-faced adhesive tape 21. When these assembling operations are completed, the packing member 18 and the dust-proof net 19 are fixed by pressure so that all parts are integrated into one piece.

According to the mounting structure as shown in Fig. 1, the upper surface of speaker body 14 compresses packing 18 by constant pressure for tight contact therewith. Therefore, bonding of the dust-proof net 19 to the speaker body 14 as well as prevention of leakage of sound can be realized.

Nevertheless, this prior art mounting structure

requires attachment of double-faced adhesive tapes 21 and 22 to separate parts and, accordingly, requires two separate steps of assembling operations. Further, when the packing member 18 and the dust-proof net 19, which are fixedly mounted in position by the use of double-faced adhesive tapes 21, and 22, respectively, are compressed to come into tight contact with each other, it becomes necessary to adjust the positions of these two parts. This requires yet another additional step. Furthermore, the use of the double-faced adhesive tapes 21 and 22 for the bonding of the parts to one another requires that the bonded faces of the respective parts must be kept clean during the bonding operation. Accordingly, this in turn requires that movement of the parts must be adequately controlled during the assembling process.

The invention seeks to provide for a mounting arrangement having advantages over such known arrangements.

In a first aspect of the present invention, a mounting structure of electronic parts is formed by (i) a casing provided with an aperture through which sound wave is permitted to pass, and (ii) a cylindrical member arranged between the casing and an acoustic part for either input or output of the sound wave, which is fixedly disposed in the interior of the casing at a predetermined position opposing the aperture. The cylindrical member has one end thereof enclosing an end circumferential portion of an aperture opposed side of the acoustic part and is fitted to the end circumferential portion. The other end thereof is in press contact with a surface extending along an entire periphery of the aperture of the casing. The cylindrical member has a length extending from the aperture opposed end of the acoustic part to a casing side extreme end of the above-mentioned other end, being larger than a distance from the end of the acoustic part to a press contact position of the casing, when the above-mentioned one end is kept to be fitted on the acoustic part. And further, at least the other end of the cylindrical member is constituted by

material having elasticity and deformed by pressure.

Accordingly when the acoustic part is accommodated in the casing, the other end of the cylindrical member comes in press contact with the periphery of the aperture of the casing. Thus, none of adhesive and double-faced adhesive tape is required.

In a second aspect of the invention, a mounting structure of electronic parts is formed by (i) a casing provided with an aperture through which sound wave is permitted to pass, and (ii) a member formed in a cylindrical shape as a whole and interposed between the casing and an acoustic part fixedly disposed in the interior of the casing at a predetermined position opposing the aperture for either input or output of the sound wave. The cylindrical member is kept in press contact with an entire periphery of the aperture by an opposing surface of the acoustic part, which opposes the aperture side, and a face extending along a periphery of the aperture of the casing. The cylindrical member has an axial length larger than a distance from the opposing surface of the acoustic part to a press-contact position of the casing, and at least portions of the cylindrical member in contact with the above-mentioned opposing surface and the casing being constituted by material that has elasticity and is deformed by pressure.

The present invention therefore advantageously provides a mounting structure of electronic parts, which is capable of easily mounting electronic parts such as acoustic parts including a speaker and other various parts.

Thus, under a condition such that the acoustic part is accommodated in the casing, the other end of the cylindrical member comes in press contact with the periphery of the aperture, and therefore none of adhesive and double-faced adhesive tape is required.

Each of the present inventions as described above can further comprise a sheet-like member disposed so as to obstruct the ingress of any moisture and dust into the interior of the cylindrical member.

The sheet-like member may be a net-like member having minute openings therein. The disposition of this sheet-like member can prevent moisture and dust from entering the acoustic part through the aperture.

5 In further aspect of the invention, the mounting structure of electronic parts is provided with a closing member deformed by pressure and blocking between the electronic parts disposed in the interior of the casing and the other parts in the interior of the casing.

10 Namely, the electronic parts disposed in the interior of the casing can be protected by the closing member that is deformed by pressure from the dust left in the interior of the casing.

The above objects, features and advantages of the present invention will become apparent from the following description based on the accompanying drawings, which illustrate an example of a preferred embodiment of the present invention.

15 Fig. 1 is a cross-sectional view of a principal portion of a portable telephone, representing an example of a mounting structure of electronic parts, according to the prior art;

20 Fig. 2 is a cross-sectional view of a principal portion of a portable telephone, representing a mounting structure of electronic parts, according to an embodiment of the present invention;

25 Fig. 3 is a perspective view of the mounting structure of electronic parts, according to the embodiment of Fig. 2, representing a state in which a cap is mounted on a speaker surface-mounted on a printed circuit board;

30 Fig. 4 is a cross-sectional view of a principal portion of a portable telephone, representing a mounting structure of electronic parts, according to a modified embodiment of the present invention; and

35 Fig. 5 is an enlarged cross-sectional view representing

a portion of a cap together with its surrounding in the modified embodiment of Fig. 4.

Fig. 2 illustrates a mounting structure for electronic components, according to an embodiment of the present invention, and features corresponding to those shown in Fig. 1 are designated by the same reference numerals. In this embodiment, upper and lower casings 11A and 11B constituting the body of a portable telephone again encloses a body inner cavity 12 in which a printed circuit board 13 is disposed. On this printed circuit board 13 there is mounted a speaker body 14 by the use of SMT. As in Fig. 1, both sides of the speaker body 14 in the shape of an approximately cylinder project terminals 15A and 15B made of thin metallic sheet. The ends of these terminals are bent to L-shape form and are fixed to the surface of the printed circuit board 13 by means of solder 16.

Upper casing 11A is provided with sound aperture 17 at a position opposing an upper middle region of the speaker body 14. An annular cap 52 to which a net 51 is fixed is fitted on an upper portion of speaker body 14. On the upper surface of the cap 52 there is disposed an annular rib 52A, which is a triangular in cross-section and is formed to be abutted against the upper casing 11A.

Fig. 3 illustrates the manner in which the cap is attached to the speaker and the speaker mounted on the printed circuit board. As clearly shown, terminals 15A and 15B, made of a thin metallic sheet, project from the outer circumference of the speaker body 14 in the opposite direction to each other and are fixed to the printed circuit board 13 by means of solder 16. These terminals 15A and 15B are electrically connected to a circuit (not shown) on the printed circuit board 13 for outputting a sound signal.

Speaker body 14 includes, at its upper middle region, a sound port 61 through which sound is discharged. The cap 52 is formed by upper half 52B having the rib 52A disposed

at its upper end portion, and a lower half 52C arranged to be press-fitted in an outer circumferential portion of the speaker body 14. The cap 52 is formed with a bore and has at its centre, an aperture 62 which is covered by the net 51
5 cut as a circular plate and attached to the inside of the aperture 62. A ring-like peripheral portion of the net 51 is fixedly arranged between the upper half 52B and the lower half 52C of the cap. As can be seen from Fig. 2, the rib 52A, upper half 52B of the cap and lower half 52 of the cap
10 are formed as one integral part, and are made of elastomer exhibiting a high elasticity at room temperature. The elastomer has excellent characteristics such as shock-absorbability, high rebound elasticity, high coefficient of friction, vibration suppression faculty and sealing
15 function. Alternatively, however, an elastomer, silicone rubber may be employed.

A method of integrally fixing the net 51 to the cap 52 is now described. The net 51 is a thin sheet-like member and has a function for preventing dust and dirt from
20 entering the speaker body 14 or inner cavity in the casing. This type of thin sheet-like member must prevent entrance of any dust, dirt and moisture from the outside. Also, the sheet-like member must keep attenuation of sound to a minimum. To this end, in the present embodiment, the net 51
25 is made of either a woven fabric material or a porous material having minute openings therein.

On the other hand, the net 51 can include an arbitrary size and number of holes 53. Since the cap 52 is formed by the employment of a non-illustrated metallic mould, the net
30 51 must be disposed in the metallic mould so that it is accommodated at a predetermined position in relation to cap 52. Therefore, the net 51 is initially cut in a size somewhat larger than that shown in Fig. 2 or 3, and is set in a predetermined position of the metallic mould. Then,
35 when material for forming the cap 52 is poured into the

metallic mould, rib 52A, upper half 52B and lower half 52C of the cap are formed to become integral with one another via the holes 53. After the molding of the cap 52, any extra portion of net 51 projecting from the outer circumference of the cap is removed by cutting to obtain the size and shape as shown in Fig. 2 or 3.

Cap 52 formed by the above-described method has a portion to be fitted onto the outer circumferential portion of speaker body 14, and this fitted portion of the cap 52 has a diameter slightly smaller than the diameter of the outer circumferential portion of speaker body 14. Therefore, when the cap 52 having elasticity is press-fitted on the outer circumferential portion of speaker body 14, it can be surely secured to the speaker.

The speaker body 14 onto which the cap 52 is fixed is surface-mounted on a printed circuit board 13 through the soldering of the thin metallic plate-made terminals 15A and 15B to the board 13. This printed circuit board 13 is then fixed in position in the interior of casing 11 by means of fixing means such as screws or the like (not shown). Rib 52A of the cap is designed to have a shape and a height such that the rib is deformed by pressure generated when the printed circuit board 13 is pressed against the upper casing 11A during fixing of the printed circuit board 13 in the casing 11, until it is brought into tight contact with the upper casing 11A. Therefore, if a position where the speaker body 14 is surface-mounted on the printed circuit board 13 were preliminarily determined in relation to the position of sound aperture 17, a very simple assembling operation for the fixing printed circuit board 13 to a predetermined position within the casing allows the annular rib 52A of the cap to come in press-contact with upper casing 11A. The sound generated by the speaker body 14 can be effectively output through the sound aperture 17 without leaking into the interior of the casing. Also, a barrier

formed by the upper half 52B of the cap and the net 51 adequately prevents dust, dirt or moisture from entering not only the interior of the speaker body but also the interior of the device per se, via the barrier.

5 Furthermore, according to this embodiment, since the number of the constituent parts can be reduced, it is possible to reduce the spacing between the upper surface of the speaker and the casing to thereby contribute to a reduction in the entire size or thickness of the device such
10 as a portable telephone and so on.

Fig. 4 illustrates a mounting structure according to another embodiment of the present invention. It should be understood that, in Fig. 4 the same parts as those of Fig. 2 are designated by the same reference numerals, and the
15 description thereof will be omitted.

In Fig. 4 an annular rib 11AB having an inner diameter equal to an outer diameter of the circular net 51 is arranged in an undersurface of the upper casing 11AA so as to project downwardly therefrom. Thus, in a cylindrical
20 cavity 71 enclosed by rib 11AB, an annular cap 72 together with an integral net 51 can be accommodated.

Fig. 5 illustrates by enlarged scale a portion of the cap 72 along with its surrounding. The cap 72 can be made of either elastomer or silicone rubber, and is constituted
25 by an upper half 72B provided, on its upper portion, with a first annular rib 72A having a triangular cross section, and a lower half 72D provided, on its lower portion, with second annular rib 72C having a triangular cross section. The upper half 72B and the lower half 72D of the cap are connected
30 together by a connecting portion 72E, so as to form an integral cap 72 as a whole. The connecting portion 72E is formed by elastomer or silicone rubber that fills the holes bored in the net 51.

In this embodiment, the diameters of the upper half 72B
35 and the lower half 72D are slightly larger than the inner

diameter of rib 11AB. Accordingly, the cap 72, integral with the net 51, can be fixedly arranged when these two halves 72B and 72D are press-fitted in the inner face of rib 11AB. Also the height of the cap 72 in the direction of the height (in a vertical direction) is larger by a predetermined amount than a distance from the undersurface of the upper casing 11AA to the position of the upper surface of the speaker body 14. Therefore, under a condition that cap 72 is inserted in the inner face of rib 11AB, when the printed circuit board 13 mounting thereon speaker body 14 is fixed to a predetermined position within the interior of the casing, the first rib 72A is in press-contact with the undersurface of upper casing 11AA and is resultantly deformed to thereby be in tight contact with that undersurface. Further, the second rib 72C comes in press-contact with the upper surface of speaker body 14 so as to be deformed while being in tight contact therewith.

As a result, the sound produced from the speaker body 14 can be effectively output through the sound aperture 17 without leaking into the interior of the casing. Further, a portion formed by the upper half 72B of the cap and net 51 prevents entrance of dust, dirt or moisture into, not only the interior of the speaker, but also into the interior of the device from the outside via this portion.

Furthermore, according to this embodiment, the number of constituent parts can be reduced so as to reduce the space between the upper surface of the speaker and the casing, and so distribute to a reduction in the entire size or the thickness of a device such as a portable telephone.

It should be appreciated that in the described embodiments, although the speaker is taken as an example of an acoustic device, the present invention will be equally applied to other devices and components, such as a microphone.

Further, in the described embodiments, a consideration

was paid to the protection of electronic parts from the entrance of either moisture or dust and dirt from the outside of the casing. However, the deformation of the elastic member, or members, by pressure will allow the
5 electronic parts to be well protected against the movement of dust and moisture from the interior of the casing.

It will be understood from the foregoing description that in accordance with the inventions as claimed in claims 1 through 5, since the electronic parts within a casing are
10 protected against entrance of moisture or dust and dirt by the employment of a material capable of deforming by pressure, use of any adhesive and double-faced adhesive tape for that purpose is not needed or can be restricted to a given purpose only. Therefore, a positive employment of
15 materials such as silicone, which is unsuitable to the adhesive and the double-faced adhesive tape, can be realized resulting in an increase of the choice of materials. Furthermore, since more adequate materials can be used, the quality of products in which electronic parts are
20 accommodated can be improved.

Although certain preferred embodiments of the present invention have been shown and described in detail, it should be understood that various changes and modifications may be made therein without departing from the scope of the
25 appended claims.

CLAIMS

1. A mounting structure for an acoustic component comprising a casing provided with an aperture through which sound is permitted to pass; and a cylindrical member fitted on the acoustic component and disposed in the interior of the casing at a predetermined position aligned with the aperture for either the input or output of sound, wherein the cylindrical member has one end thereof aligned with the acoustic component and fitted to an end circumferential portion thereof and the other end thereof being in press contact with a surface extending along the periphery of the aperture of said casing; the cylindrical member having an axial dimension greater than the distance from the acoustic component to the casing such that when the said one end of said cylindrical member is fitted on the acoustic component the said other end engages the casing and at least said other end of the cylindrical member is resiliently deformable.

20

2. A mounting structure for an acoustic component comprising a casing provided with an aperture through which sound is permitted to pass and a cylindrical member interposed between the casing and the acoustic component and disposed in the interior of said casing at a predetermined position opposing said aperture for either the input or the output of sound, wherein the cylindrical member is kept in press contact with the periphery of the aperture in the casing the cylindrical member having an axial length larger than the distance between opposing surfaces of the acoustic component and the casing, and at least part of the casing arranged for engaging cylindrical member being resiliently deformable.

35

3. A mounting structure according to Claim 1 or 2,

further comprising a sheet-like member disposed so as to obstruct the interior of said cylindrical member to thereby prevent entrance of any moisture and dust.

5 4. A mounting structure according to Claim 1, 2, or 3, wherein at least one annular end surface of the cylindrical member includes an annular rib formation.

10 5. A mounting structure according to Claim 1, 2, 3 or 4, wherein the cylindrical member is formed integrally with a net member extending across the aperture defined by the cylindrical member.

15 6. A mounting structure for at least one electronic component and including a closing member arranged to be resiliently deformable and to be press-fitted within a casing for the at least one component so as to be disposed in the interior of the casing and to separate the one electronic component from other electronic components that
20 are included in the interior of the casing.

 7. A mounting structure for an acoustic component substantially as hereinbefore described with reference to, and as illustrated in, Figs. 2 and 3; and Figs. 4 and 5 of
25 the accompanying drawings.



INVESTOR IN PEOPLE

Application No: GB 0203010.4
Claims searched: 1-6

llx

Examiner: Peter Easterfield
Date of search: 10 September 2002

Patents Act 1977 Search Report under Section 17

Databases searched:

UK Patent Office collections, including GB, EP, WO & US patent specifications, in:

UK Cl (Ed.T): H4J (JAAB, JDQ)

Int Cl (Ed.7): H04M 1/03

Other: Online: WPI, EPODOC, JAPIO

Documents considered to be relevant:

Category	Identity of document and relevant passage	Relevant to claims
X	GB 2249691 A (MOTOROLA)	2,4,6
X	GB 2225192 A (AT & T) see gaskets 200, 500	1,4,6
X	GB 1437751 A (SIEMENS)	1,4,6
X	US 5937361 A (SMITH)	1,4,6
X	US 5836790 A (BARNETT) see fig 3	1,4,6
X	WO 00/76183 A1 (ERICSSON)	1,4,6

X	Document indicating lack of novelty or inventive step	A	Document indicating technological background and/or state of the art.
Y	Document indicating lack of inventive step if combined with one or more other documents of same category.	P	Document published on or after the declared priority date but before the filing date of this invention.
&	Member of the same patent family	E	Patent document published on or after, but with priority date earlier than, the filing date of this application.