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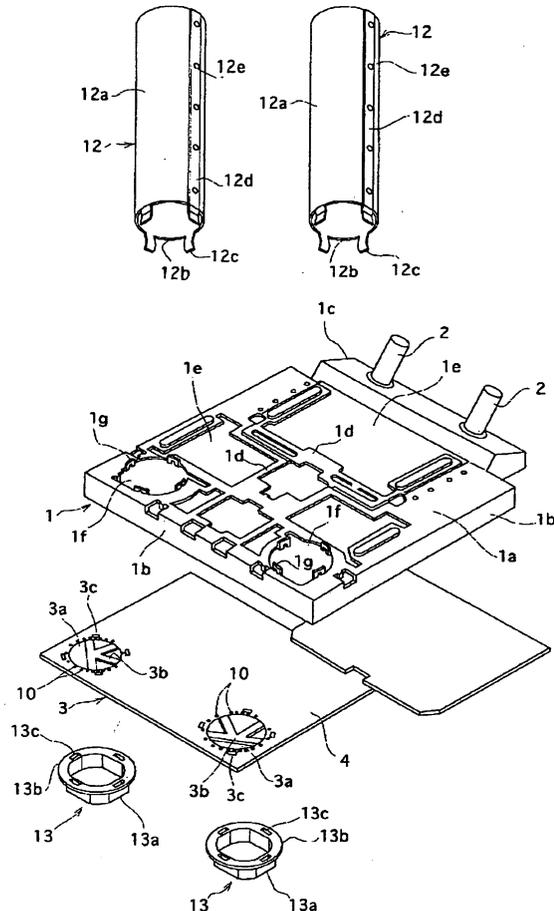
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(54) **Converter for receiving satellite Broadcasting**

(57) To provide a low-priced, light-weight converter for receiving satellite broadcasting.

In the converter for receiving satellite broadcasting according to the present invention, since a first and a second earth patterns 9, 4, in which a plurality of through holes 10 is formed, are provided to face an end face 12b of the waveguide 12 in both sides of the circuit board 3, the through holes 10 being provided in close proximity along the outer surface and/or the inner surface of the circumference of the waveguide 12, and the short cap 13 is soldered to the first earth pattern 9 located within the shield case 1 and the end face side of the waveguide 12 is soldered to the second earth pattern 4, by means of the solder which passes through the through holes 10, it is possible to provide the low-priced, light-weight converter for receiving satellite broadcasting.

FIG. 1



Description

[0001] The present invention relates to a converter for receiving satellite broadcasting which receives radio-waves transmitted from the satellite.

[0002] The configuration of the conventional converter for receiving satellite broadcasting will be described with reference to Fig. 8. Referring to Fig. 8, a case 51 made of zinc diecast comprises a box-shaped frame exterior 52, and a waveguide 53 projected in the shape of a tube from the front wall 52a of the frame exterior 52.

[0003] Within the frame exterior 52, a circuit board 55 having a probe 54 is mounted and a short cap 56 is also fixed with a screw 57 so as to close up an opening end of the waveguide 53, and the inside of the frame exterior 52 is electrically shielded by both a cover 58 mounted to close the opening of the frame exterior 52 and the box-shaped frame exterior 52 (for example, refer to Japanese Unexamined Patent Application Publication No. 10-233705).

[0004] A problem has arisen in that since the conventional converter for receiving satellite broadcasting is made of a case 51 of zinc diecast in which the frame exterior 52 and the waveguide 53 are integrally formed, it is not only expensive but also too heavy.

[0005] Moreover, a problem has arisen in that since the short cap 56 is fixed with a screw 57, it is not easy to assemble and therefore it costs a great deal.

[0006] Accordingly, the object of the present invention is to provide a low-priced, light-weight converter for receiving satellite broadcasting.

[0007] As first means for solving the above-mentioned problems, the converter for receiving satellite broadcasting according to the present invention is configured to comprise a shield case formed of a metal plate, a circuit board which is mounted in the shield case and has a probe, a tubular waveguide which is disposed vertically to the circuit board and is formed by bending the metal plate, and a short cap which is located within the shield case and closes an opening end of the waveguide;

wherein a first and a second earth patterns, in which a plurality of through holes is formed, are provided to face an end face of the waveguide on both sides of the circuit board, the through holes being provided in close proximity along the outer surface and/or the inner surface of the circumference of the waveguide, and

the short cap is soldered to the first earth pattern located within the shield case and the end face side of the waveguide is soldered to the second earth pattern exposed from the shield case, by means of the solder which passes through the through holes.

[0008] As second means for solving the above-mentioned problems, the short cap is soldered to the first earth pattern and the waveguide is soldered to the second earth pattern, by means of cream solder provided on the first earth pattern side.

[0009] As third means for solving the above-men-

tioned problems, the waveguide has an overlapping portion in which both ends of the waveguide overlap each other in the direction of the tube, and the solder passing through the through hole is attached along the overlapping portion.

[0010] As fourth means for solving the above-mentioned problems, the circuit board has a hole which is formed leaving a remnant portion in which the probe is provided, and the end face of the waveguide is disposed along the outer circumference of the hole.

[0011] As fifth means for solving the above-mentioned problems, a holding portion for holding the outer surface of the circumference of the waveguide is provided in the shield case.

[0012] As sixth means for solving the above-mentioned problems, the waveguide has a protrusion projecting from the end face, and the protrusion passes through the hole provided in the short cap via the penetration hole of the circuit board.

[0013] As seventh means for solving the above-mentioned problems, the second earth pattern is provided over most of the surface of the circuit board so that it closes the hole provided in the front wall of the shield case to electrically shield the inside of the shield case.

[0014] The converter for receiving satellite broadcasting according to the present invention is configured to comprise a shield case formed of a metal plate, a circuit board which is mounted in the shield case and has a probe, a tubular waveguide which is disposed vertically to the circuit board and formed by bending the metal plate, and a short cap which is located within the shield case and closes an opening end of the waveguide;

wherein a first and a second earth patterns, in which a plurality of through holes is formed, are provided to face an end face of the waveguide in both sides of the circuit board, the through holes being provided in close proximity along the outer circumferential surface of the waveguide and/or the inner circumference surface of the waveguide, and

the short cap is soldered to the first earth pattern located within the shield case and the end face side of the waveguide is soldered to the second earth pattern exposed from the shield case, by means of the solder which passes through the through holes.

[0015] Like this, when the shield case and the waveguide are formed of a metal plate, it is possible to provide a low-priced, light-weight converter for receiving satellite broadcasting because of a low material cost and a low production cost, compared with the conventional case made of zinc diecast. In addition, owing to the through hole, even when soldering is performed in a first or second earth pattern, the waveguide and the short cap which are disposed in different locations can be soldered to the earth pattern.

[0016] In addition, since the short cap is soldered to the first earth pattern and the waveguide is soldered to the second earth pattern by means of cream solder applied on the first earth pattern side, not only the elec-

tronic components but the waveguide and the short cap are soldered, thereby improving productivity.

[0017] In addition, since the waveguide has an overlapping portion in which both ends of the waveguide overlap each other in the direction of the tube, and the solder passing through the through hole is attached along the overlapping portion, the gap of the overlapping portion is closed, whereby the step difference is reduced and the overlapping portions are reliably stuck together.

[0018] In addition, since the circuit board has a hole which is formed leaving a remnant portion in which a probe is provided, and the end face of the waveguide is disposed along the outer circumference of the hole, radiowaves received from the waveguide can be effectively sent to the short cap.

[0019] In addition, since a holding portion for holding the outer circumference surface of the waveguide is provided in the shield case, it is possible to temporarily affix the waveguide and thus to reliably assemble it.

[0020] In addition, since the waveguide has a protrusion projecting from the end face, and the protrusion passes through the hole provided in the short cap via the penetration hole of the circuit board, it is possible to temporarily affix the short cap and thus to reliably assemble it.

[0021] In addition, since the second earth pattern is provided over most of the surface of the circuit board so that it closes the hole provided in the front wall of the shield case to electrically shield the inside of the shield case, it is possible to remove the unnecessary front wall of the shield case and thus to obtain a shield case of a lighter weight.

[0022] Reference is now made to the drawings of a converter for receiving satellite broadcasting according to the present invention.

[0023] Fig. 1 is an exploded perspective view showing a converter for receiving satellite broadcasting according to the present invention.

[0024] Fig. 2 is a sectional view of a main part showing the setup of a waveguide in connection with a converter for receiving satellite broadcasting according to the present invention.

[0025] Fig. 3 is a sectional view showing a main part of a waveguide in connection with a converter for receiving satellite broadcasting according to the present invention.

[0026] Fig. 4 is a front view showing a circuit board related to a converter for receiving satellite broadcasting.

[0027] Fig. 5 is a rear view showing a circuit board related to a converter for receiving satellite broadcasting.

[0028] Fig. 6 is a front view showing the position of the waveguide to the circuit board in connection with a converter for receiving satellite broadcasting according to the present invention.

[0029] Fig. 7 is a front view showing the position of the waveguide to the circuit board in connection with an-

other embodiment of the converter for receiving satellite broadcasting according to the present invention.

[0030] Fig. 8 is a sectional view showing the conventional converter for receiving satellite broadcasting.

[0031] Next, reference will now be made to the configuration of the converter for receiving satellite broadcasting according to the present invention in conjunction with Figs. 1 to 6. The present embodiment relates to the converter for receiving satellite broadcasting capable of receiving radiowaves transmitted from two satellites, wherein a shield case 1, which is formed by pressing and bending a metal plate, comprises a front wall 1a, three sidewalls 1b bent from three sides of the front wall 1a, and an inclined wall 1c provided on one side of the front wall 1a.

[0032] In addition, a plurality of holes 1e, which is formed leaving a bridge portion 1d and a pair of circular holes 1f, is provided in the front wall 1a, and a plurality of holding portion 1g is provided to project upwardly in the brim of the pair of holes 1f.

[0033] Two coaxial connectors 2 are affixed to an inclined wall 1c by caulking or the like.

[0034] The first circuit board 3 formed of a printed circuit board comprises two circular holes 3a which are spaced apart, a K-shaped remnant portion 3b provided in the circular holes 3a, and a plurality of rectangular penetration holes 3c provided in the periphery of the circular holes 3a.

[0035] An earth pattern 4 (a second earth pattern) is provided over most of the surface of the first circuit board except over the remnant portion 3b in the front face of the first circuit board 3, and a wiring pattern 5, a first and a second probes 6, 7 provided in two remnant portions 3b which are disposed at intervals of 90 degrees respectively, a radial pattern 8 provided in another remnant portion 3b, and a substantially ring-shaped earth pattern 9 (a first earth pattern) provided in the proximity of the outer circumference of the circular hole 3a are provided in the rear of the first circuit board 3.

[0036] In addition, the earth patterns 4, 9 are disposed to face each other with an insulation substrate interposed therebetween, and a plurality of through holes 10 is provided along the outer circumference of the hole 1f on the position of the earth patterns 4, 9.

[0037] Various electronic components (not shown) such as a resistor and capacitor are mounted in the wiring pattern 5 of the first circuit board 3 to form a desired electric circuit, and also the first circuit board 3 is mounted within the shield case 1.

[0038] When the first circuit board 3 is mounted, holes 3a are placed in a pair of holes 1f of the shield case 1, and the other holes 1e are closed with the earth pattern 4 and an electric circuit is electrically shielded by the earth pattern 4.

[0039] Although a circuit board 11 formed of a printed circuit board is not shown here, a desired electric circuit is formed by providing an earth pattern over most of the surface of the front of the circuit board and by mounting

a variety of electronic components in a wiring pattern provided in the rear of the circuit board, wherein the second circuit board 11 is provided within the shield case 1 so as to overlap a portion of the first circuit board 3, with the holes 1e of the shield case 1 closed with an earth pattern.

[0040] The tubular waveguide 12 formed by bending a metal plate comprises a cylindrical tube portion 12a, an end face 12b on one side of the tube portion 12a, a curve protrusion 12c projecting from the end face 12b, an overlapping portion 12d in which both ends of the tube portion 12a overlap each other in the direction of the tube, and a plurality of caulking portions 12e provided in the overlapping portion 12d.

[0041] In the waveguide 12, especially as shown in Fig. 3, a hole is provided on one side of the overlapping portion 12d and an eyelet is provided on the other side of the overlapping portion 12d, and a caulking portion 12e is formed by caulking the eyelet with the eyelet inserted through the hole, thereby forming the overlapping portion 12d with a narrow gap.

[0042] If the waveguide 12 is inserted from the side of the end face 12b into the pair of holes 1f of the shield case 1, the protrusion 12c projects to the opposite side via a penetration hole 3c of the first circuit board, and the outer surface of the circumference of the tube portion 12a is held by a holding portion 1g.

[0043] When the waveguide 12 is disposed on the first circuit board 3, as shown in Fig. 6, the end face 12b is located to be in contact with the earth pattern 4 between the hole 3a and the through holes 10, and the through holes 10 are disposed in close proximity along the outer circumference surface of a tube portion 12a.

[0044] A short cap 13 made of metal material comprises a cap portion 13a, a flange portion 13b provided in the end of the cap portion 13a, and a plurality of holes 13c provided in the flange portion 13b.

[0045] As shown in Fig. 2, the short cap 13 is disposed to close up the opening end of the waveguide 12, and the protrusion 12c is inserted through the hole 13c so that the short cap 13 is snap-fixed to the protrusion 12c, whereby the short cap 13 is temporarily fixed.

[0046] In this state, the waveguide 12 and the short cap 13 are soldered to the earth patterns 4, 9, and the solder flows into the overlapping portion 12d to fill up the gap of the overlapping portion 12.

[0047] Next, a method for soldering the waveguide 12 and the short cap 13, i.e., a method for assembling the waveguide and the short cap, is set forth. First, cream solder is applied on the earth pattern 9 of the first circuit board 3, and the protrusion 12c of the waveguide 12 is then inserted through the penetration hole 3c. Or, the protrusion 12c of the waveguide 12 is inserted through the penetration hole 3c, and cream solder is then applied on the earth pattern 9 of the first circuit board 3.

[0048] Next, the short cap 13 is temporarily fixed to the protrusion 12c, which is then carried into a reflow furnace with the short cap 13 placed in the upside and

the waveguide 12 placed in the downside.

[0049] And then, cream solder melts, and the melted solder remains between the earth pattern 9 and the flange portion 13b. In addition, cream solder flows out to the earth pattern 4 via the through hole 10 and flows in the outer circumference portion of the tube portion 12a and the overlapping portion 12d.

[0050] Then, after being taken out of the reflow furnace, the solder solidifies. Consequently, the short cap 13 is soldered to the earth pattern 9, the outer circumference portion including the end face 12b of the tube portion 12a of the waveguide 12 is soldered to the earth pattern 4, and the solder in the overlapping portion 12d closes the gap of the overlapping portion 12d. By doing this, assembly is completed.

[0051] Although cream solder has been applied on the side of the earth pattern 9 in the above-mentioned embodiment, the cream solder may be applied on the side of the earth pattern 4.

[0052] In this case, when it is carried into the reflow furnace with the short cap 13 placed in the up side and the waveguide 12 in the down side, melted solder flows in the outer circumference portion of the tube portion 12a and the overlapping portion 12d, and flows between the earth pattern 9 and the flange portion 13b via a through hole 10 by the capillary phenomenon, whereby each portion is soldered.

[0053] In addition, when it is carried into the reflow furnace with the short cap 13 placed in the down side and the waveguide 12 in the up side, the melted solder flows in the outer circumference portion of the tube portion 12a, flows by the capillary phenomenon in the overlapping portion 12d, and flows between the earth pattern 9 and the flange portion 13b via a through hole 10, whereby each portion is soldered.

[0054] While not shown here, an opening side of the sidewall 1b of the shield case 1 is configured to be closed with a lid.

[0055] In addition, a converter for receiving satellite broadcasting having such a configuration is configured to receive radiowaves transmitted from other satellites through each of two waveguides 12 and to take the signal out of a coaxial connector 2.

[0056] Furthermore, although a converter for receiving satellite broadcasting comprising two waveguides has been set forth in the present embodiment, a converter for receiving satellite broadcasting comprising a single waveguide may be employed.

[0057] In addition, reference will now be made to another embodiment of the converter for receiving satellite broadcasting according to the present invention in conjunction with Fig. 7. In the present embodiment, a plurality of through holes 10 is disposed to be in close proximity along the inner surface of the circumference of a tube portion 12a of a waveguide 12.

[0058] Since the rest of the configuration is the same as the above-mentioned embodiment, the same components are indicated by the same reference numerals

and description thereof is omitted.

[0059] In the present embodiment, as well, solder flows through the through hole 10, whereby the short cap 13 is soldered to the earth pattern 9, the inner circumference portion including the end face 12b of the tube portion 12a of the waveguide 12 is soldered to the earth pattern 4, and the overlapping portion 12d is also soldered.

Reference Numerals:

[0060]

1:	SHIELD CASE	
1a:	FRONT WALL	15
1b:	SIDEWALL	
1c:	INCLINED WALL	
1d:	BRIDGE PORTION	
1e:	HOLE	
1f:	HOLE	20
1g :	HOLDING PORTION	
2:	COAXIAL CONNECTOR	
3:	FIRST CIRCUIT BOARD	
3a:	HOLE	
3b:	REMNANT PORTION	25
3c:	PENETRATION HOLE	
4:	EARTH PATTERN (SECOND EARTH PATTERN)	
5:	WIRING PATTERN	
6:	FIRST PROBE	30
7:	SECOND PROBE	
8:	RADIAL PATTERN	
9:	EARTH PATTERN (FIRST EARTH PATTERN)	
10:	THROUGH HOLE	
11:	SECOND CIRCUIT BOARD	35
12:	WAVEGUIDE	
12a:	TUBE PORTION	
12b:	END FACE	
12c:	PROTRUSION	
12d:	OVERLAPPING PORTION	40
12e:	CAULKING PORTION	
13:	SHORT CAP	
13a:	CAP PORTION	
13b:	FLANGE PORTION	
13c:	HOLE	45

Claims

1. A converter for receiving satellite broadcasting comprising:
- a shield case formed of a metal plate;
a circuit board which is mounted in the shield case and has a probe;
a tubular waveguide which is disposed vertically to the circuit board and formed by bending the metal plate; and

a short cap which is located within the shield case and closes an opening end of the waveguide;

wherein a first and a second earth patterns, in which a plurality of through holes is formed, are provided to face an end face of the waveguide on both sides of the circuit board, the through holes being provided in close proximity along the outer circumference surface and/or the inner circumference surface of the waveguide, and

wherein the short cap is soldered to the first earth pattern located within the shield case, and the end face side of the waveguide is soldered to the second earth pattern exposed from the shield case, by means of the solder which passes through the through holes.

2. The converter for receiving satellite broadcasting according to Claim 1,
wherein the short cap is soldered to the first earth pattern and the waveguide is soldered to the second earth pattern, by means of cream solder applied on the first earth pattern side.
3. The converter for receiving satellite broadcasting according to Claim 2,
wherein the waveguide has an overlapping portion in which both ends of the waveguide overlap each other in the direction of the tube, and the solder passing through the through hole is attached along the overlapping portion.
4. The converter for receiving satellite broadcasting according to any one of Claims 1 to 3,
wherein the circuit board has a hole which is formed leaving a remnant portion in which a probe is provided, and the end face of the waveguide is disposed along the outer circumference of the hole.
5. The converter for receiving satellite broadcasting according to any one of Claims 1 to 4,
wherein a holding portion for holding the outer circumference surface of the waveguide is provided in the shield case.
6. The converter for receiving satellite broadcasting according to any one of Claims 1 to 5,
wherein the waveguide has a protrusion projecting from the end face, and the protrusion passes through the hole provided in the short cap via the penetration hole of the circuit board.
7. The converter for receiving satellite broadcasting according to any one of Claims 1 to 6,
wherein the second earth pattern is provided over most of the surface of the circuit board so that it closes the hole provided in the front wall of the

shield case to electrically shield the inside of the shield case.

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FIG. 1

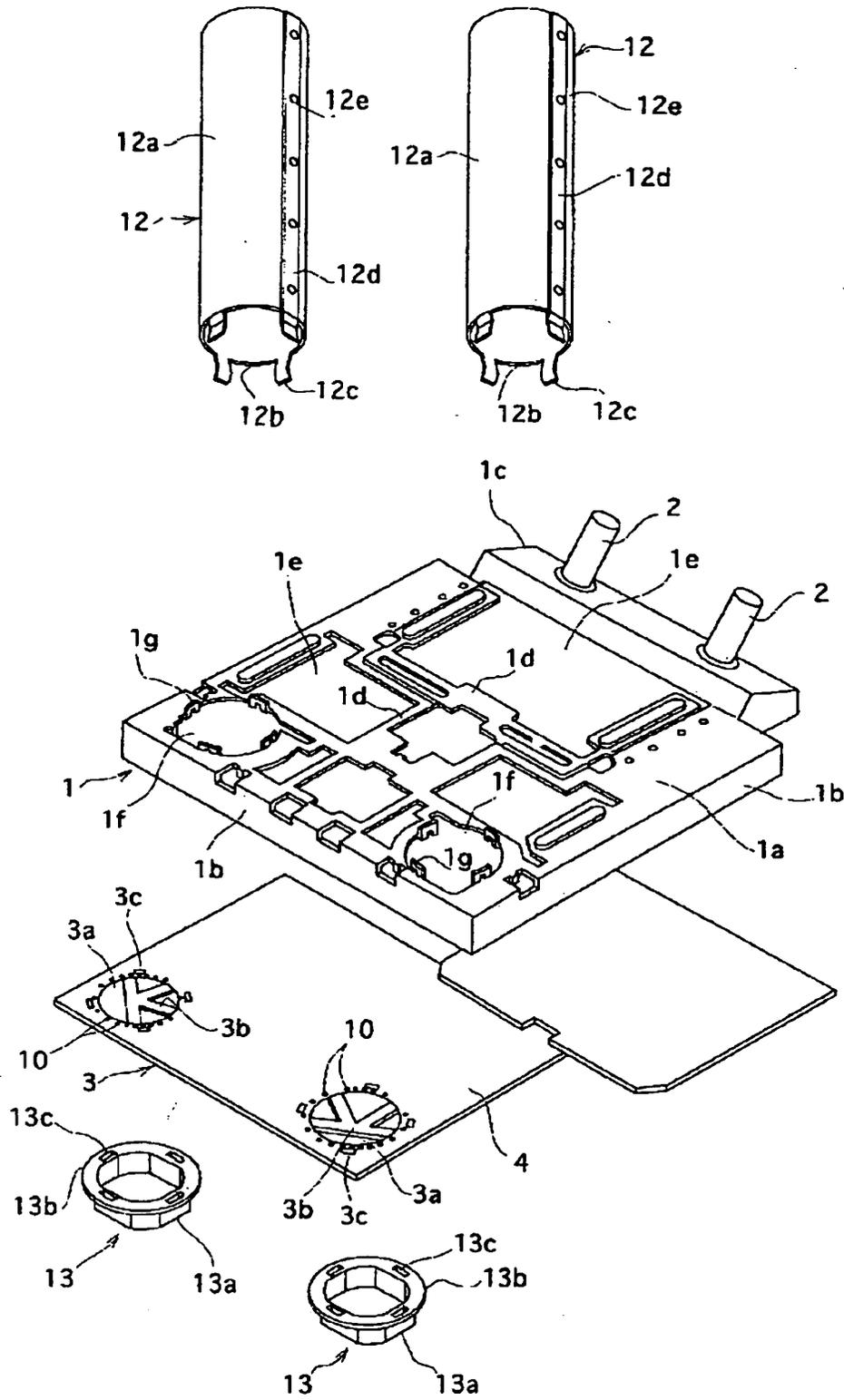


FIG. 2

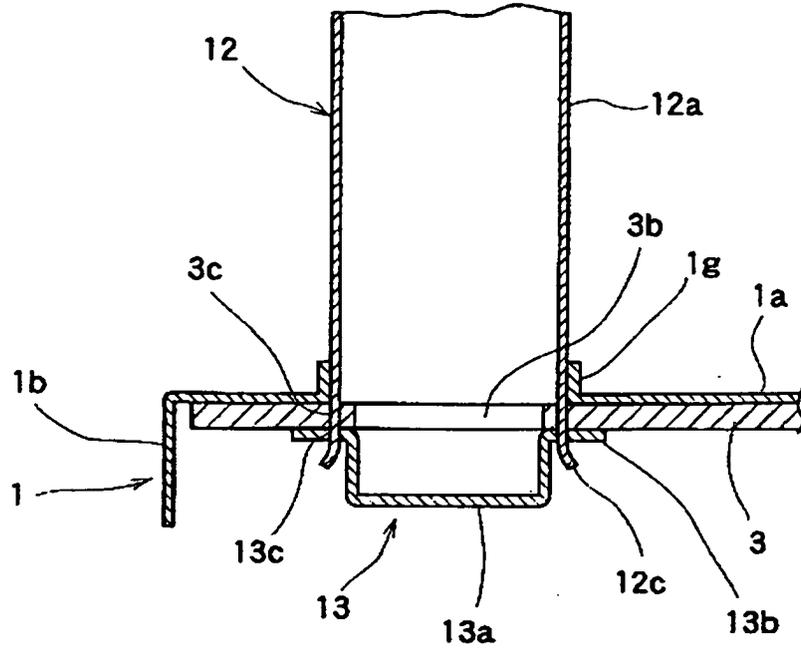


FIG. 3

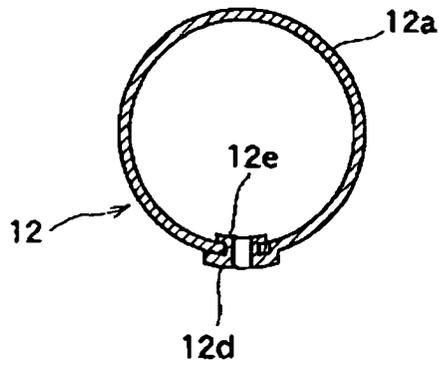


FIG. 4

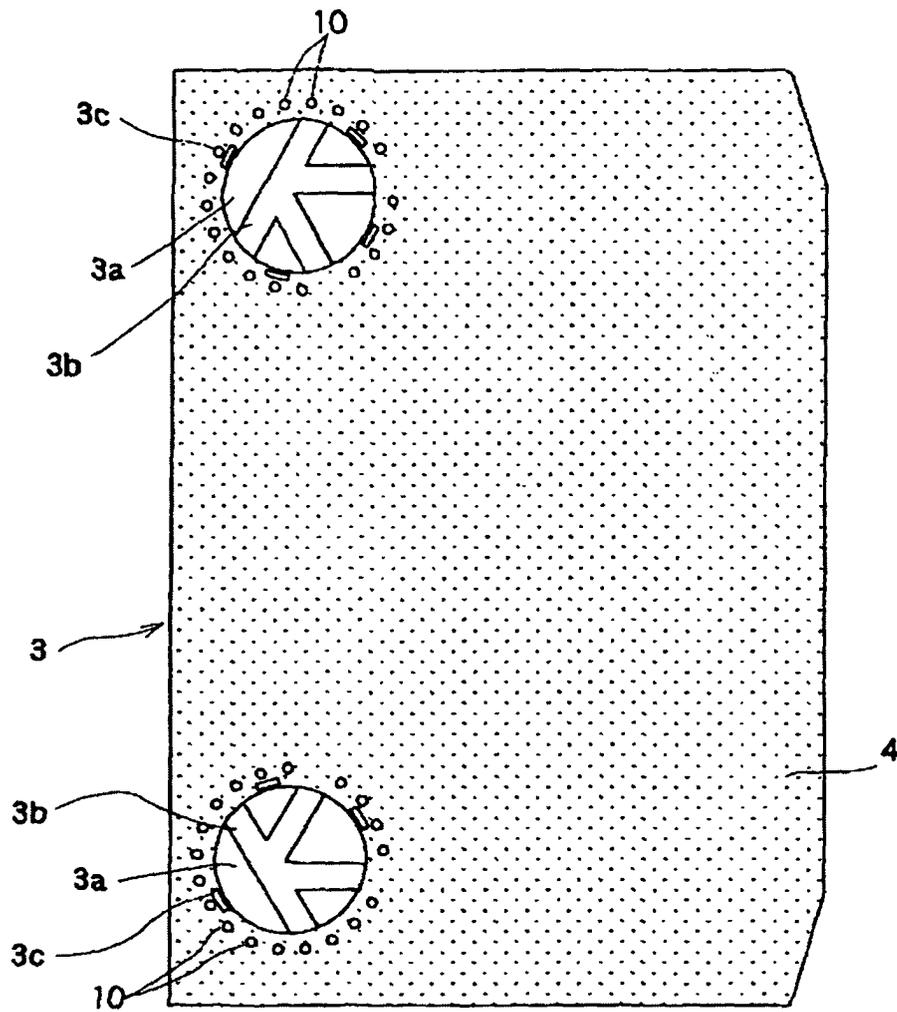


FIG. 5

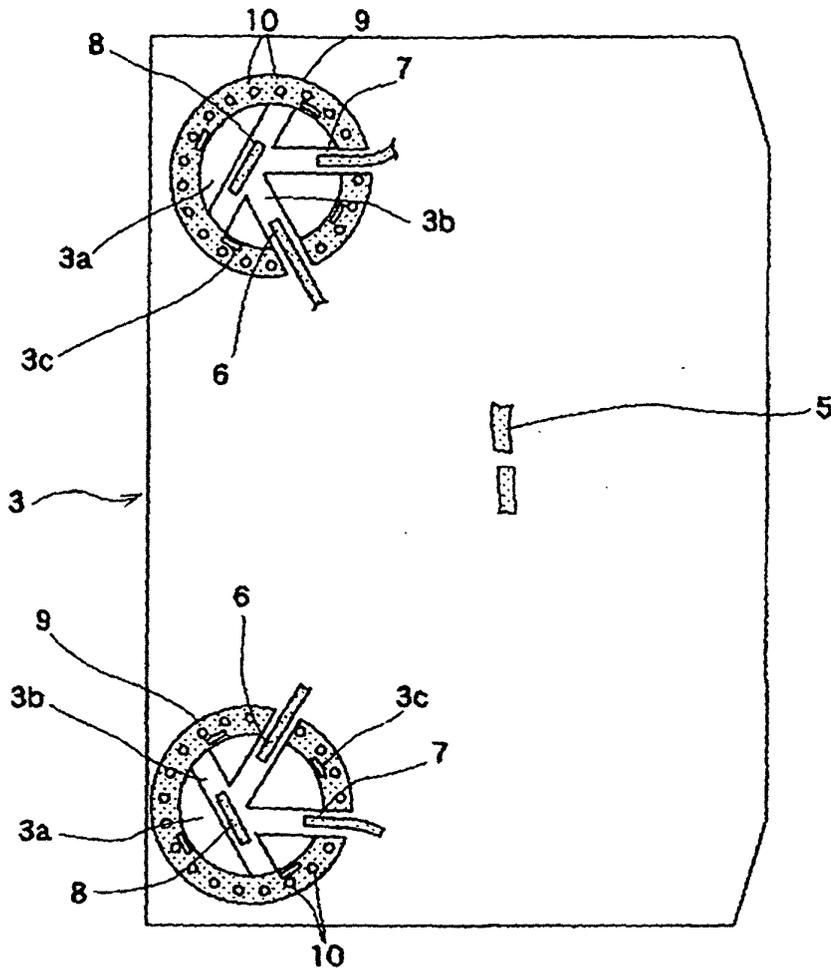


FIG. 6

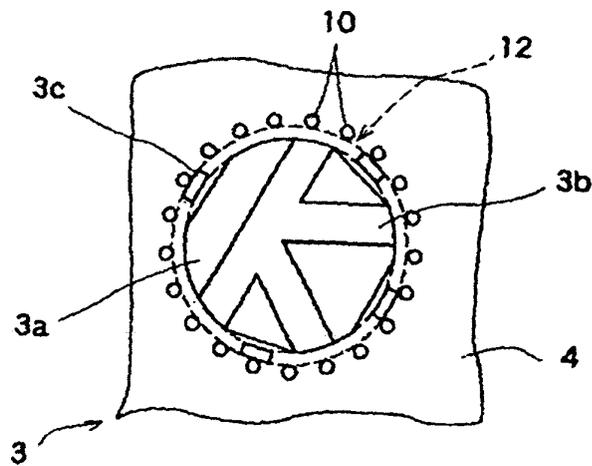


FIG. 7

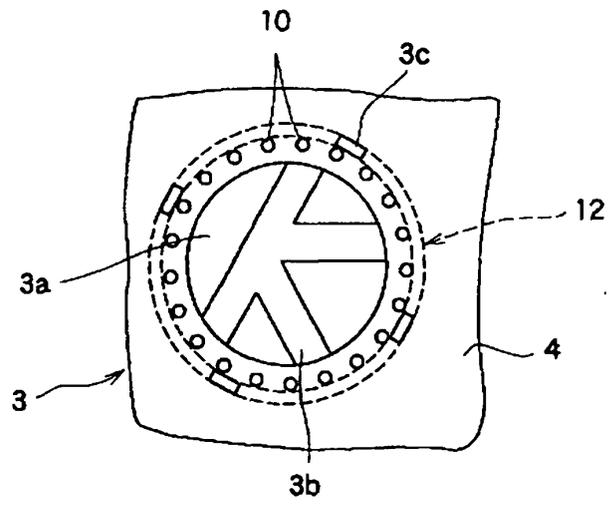
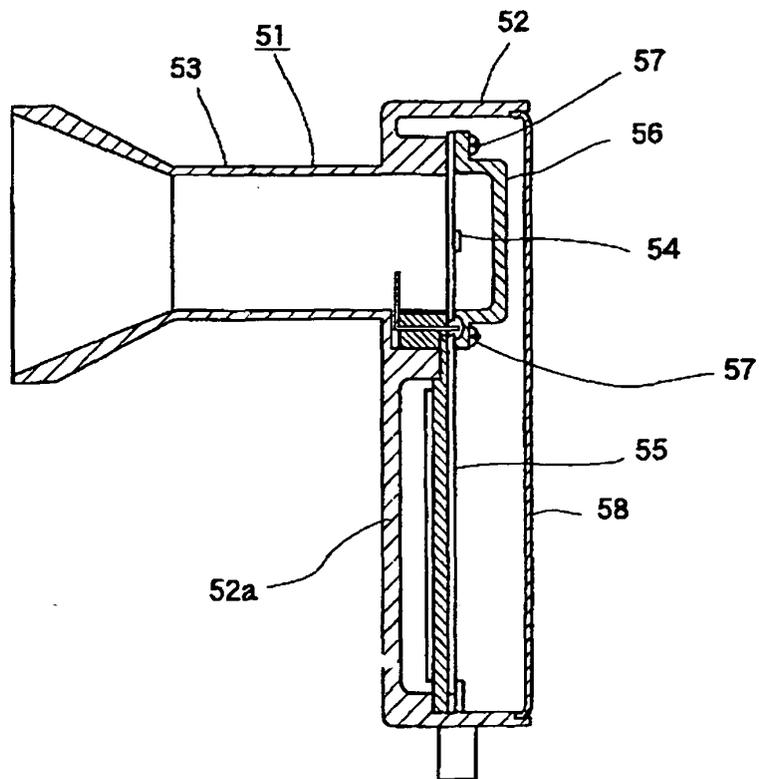


FIG. 8





DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.7)
A	PATENT ABSTRACTS OF JAPAN vol. 1997, no. 06, 30 June 1997 (1997-06-30) -& JP 09 046102 A (SONY CORP), 14 February 1997 (1997-02-14) * abstract; figures 2-4 *	1	H01P5/107 H01P1/161
A	WO 02/33782 A (JOKIO KALLE ; KEMPPINEN ESA (FI); KORHONEN VESA (FI); KOIVISTO MARKKU) 25 April 2002 (2002-04-25) * page 8, line 25 - page 12, line 7; figure 7 *	1	
P,A	EP 1 296 405 A (ALPS ELECTRIC CO LTD) 26 March 2003 (2003-03-26) * paragraph [0036] - paragraph [0040]; figures 10,14 * * paragraph [0062] *	1	
			TECHNICAL FIELDS SEARCHED (Int.Cl.7)
			H01P H01Q
The present search report has been drawn up for all claims			
Place of search		Date of completion of the search	Examiner
MUNICH		17 May 2004	La Casta Muñoa, S
CATEGORY OF CITED DOCUMENTS			
X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document		T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document	

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**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

EP 04 00 1114

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
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17-05-2004

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