(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) **EP 1 968 159 B1**

(12) **EUROPEAN PATENT SPECIFICATION**

(45) Date of publication and mention of the grant of the patent:
18.10.2017 Bulletin 2017/42

(51) Int Cl.:
H01Q 9/04 *(2006.01)*

(21) Application number: **07004583.6**

(22) Date of filing: **06.03.2007**

(54) **Circularly polarized patch antenna assembly**

Zirkular polarisierte Patchantennenanordnung

Ensemble d'antenne à plaque à polarisation circulaire

(84) Designated Contracting States:
DE FR GB NL

(43) Date of publication of application:
10.09.2008 Bulletin 2008/37

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EP 1 968 159 B1

Printed by Jouve, 75001 PARIS (FR)

Description

BACKGROUND OF THE INVENTION

1. Field of the Invention

[0001] The present invention relates to an antenna, and in particular to a relatively compact patch antenna assembly.

2. Description of Prior Art

[0002] Nowadays, automotive satellite navigation systems rapidly become more and more popular. In addition to be combined with an in-car AV system, many kinds of GPS products are developed in which the satellite navigation system is integrated with a PDA, Notebook or mobile phone. The GPS product which is most closely related to the car owner is the portable automobile GPS. As to the car owner whose car is not originally equipped with a GPS, it is good for him/her to choose a portable automobile GPS because the price thereof is reasonable and the portability thereof allows to be used out of the car. Further, even the car owner buys a new car in the future, he/she can still use this portable automobile GPS.

[0003] When the GPS is integrated with various electronic products such a PDA, Notebook or mobile phone, a GPS signal-receiving antenna assembly is necessarily built in the electronic device. With reference to Fig. 1, the antenna comprises a substrate 1A, a radiation metal pieces 2A, a grounded metal pieces 3A and a signal-inputting body 4A. The substrate of this kind of antenna is made of ceramic materials having a high dielectric constant (8-150). The resonant frequency of the circularly polarized patch antenna is 1575.42MHz

[0004] Recently, since the volume of the PDA or mobile phone is made more and more compact, when the GPS is to be integrated with the PDA or mobile phone, a phenomenon may occurs that the existing circularly polarized patch antenna shown in Fig. 1 cannot be mounted therein. Moreover, it is difficult for this kind of circularly polarized patch antenna to further reduce the size thereof because the area of the radiation metal piece 2A connected on the surface of the substrate 1 A will be reduced accordingly when the volume of the substrate 1A is reduced. On the condition that the substrate dielectric constant is not changed, once the area of the radiation metal piece 2A is reduced, the resonant frequency of the antenna will rise to depart from the frequency band that can be received by the GPS, which causes the GPS unable to receive the signals. Although the antenna can be mounted in a small-volume PDA or mobile phone, the function of receiving satellite signals may not be obtained. Therefore, it is an important issue in the field of the present invention to reduce the area and volume of the circularly polarized patch antenna.

[0005] KR 10-2004-0072974 describes a circularly polarized wave patch antenna having a upper radiation metal sheet and a lower ground electrode, wherein a substrate is provided therebetween. A second ground electrode extends from the first ground electrode, wherein one or more adjustment electrodes are arranged at portions extending from the second ground electrode on the side surface of the surfaces of the substrate.

[0006] US 2002/0033770 A1 describes a circularly polarizes wave antenna device having an upper radiation metal piece and a lower ground electrode. Between the upper and the lower electrode there are capacity loading conductors on the side surfaces of a substrate.

[0007] EP 1 536 511 A1 describes an antenna device having an upper radiating conductor plate, which is connected to a ground conductor plate via a supporting member, wherein the upper radiating conductor plate has extending portions arranged perpendicular to the upper radiating conductor plate.

[0008] EP 1 531 517A1 describes a circularly polarized wave antenna made of a sheet metal with high reliability having an upper radiating conductor plate and a ground conductor arranged on top of a substrate. The substrate is arranged below the upper radiating conductor plate and the ground conductor.

[0009] EP 0 400 872 A1 describes a flat-plate antenna for use in mobile communications having a table shape frame and a lower ground plate, which is connected via connecting members with the table shape frame.

[0010] EP 1 536 514 A1 describes an antenna device having a dialectical substrate formed on a ground conductor plate and a plurality of electrodes, which are provided on the dielectric substrate. Each electrode form capacitor with a substrate. A radiating conductor plate is arranged with a distance to the substrate and having a plurality of leg pieces passing through the substrate.

[0011] JP 2004-312532 describes patch antenna having a substrate, a radiation metal piece, and a grounded metal piece. A signal inputting body penetrates through the substrate. Metal pins are spaced apart and separated from the top face and the side faces of the substrate.

[0012] EP 0 993 069A2 describes a circularly polarized wave antenna having a first ground electrode, a feeding electrode at a side face and a second ground electrode. On top of the substrate, there is a radiation electrode having two diagonally arranged chamfers.

SUMMARY OF THE INVENTION

[0013] The present invention is characterized in that the side face of the patch antenna is additionally provided with a frequency down-conversion metal piece, so that the volume of the circularly polarized patch antenna having the same dielectric constant can be reduced by 10% to 50% while maintaining the original resonant frequency and circularly polarized property.

[0014] In order to achieve the above objects, the present invention provides a circularly polarized patch antenna assembly according to the independent claim 1, in which a plurality of frequency down-conversion met-

al pieces extends from the grounded metal piece. The frequency down-conversion metal pieces are adhered on the side face of the substrate made of dielectric materials, so that the frequency down-conversion metal piece on one side face is arranged diagonally with respect to the frequency down-conversion metal piece on the opposite side face. When the resonant frequency of the antenna is to be reduced, the position and the area of the frequency down-conversion metal piece can be adjusted but the increased area of the frequency down-conversion metal piece cannot be larger than a half area of the side face of the substrate. Alternatively, the length of the frequency down-conversion metal piece can be increased.

BRIEF DESCRIPTION OF THE DRAWINGS

[0015]

Fig. 1 is a schematic view showing a conventional circularly polarized patch antenna assembly;
Fig. 2 is a perspective view showing the patch antenna assembly of the first embodiment of the present invention;
Fig. 3 is an exploded view showing the patch antenna assembly of the first embodiment of the present invention;
Fig. 4 is a top view showing the patch antenna assembly of the first embodiment of the present invention;
Fig. 5 is a side view showing the patch antenna assembly of the first embodiment of the present invention;
Fig. 6 is a top view showing the patch antenna assembly of the second embodiment of the present invention;
Fig. 7 is a side view showing the patch antenna assembly of the second embodiment of the present invention;
Fig. 8 is a schematic view showing the patch antenna assembly of the third embodiment of the present invention;
Fig. 9 is a schematic view showing the patch antenna assembly of the fourth embodiment of the present invention;
Figs. 10A and 10B are schematic views showing the patch antenna assembly of the fifth embodiment of the present invention;
Fig. 11 is a schematic view showing the patch antenna assembly according to an example; and
Figs. 12A and 12B are schematic views showing the patch antenna assembly according to an other example.

DETAILED DESCRIPTION OF THE INVENTION

[0016] The technical contents and detailed description of the present invention will be explained with reference to the accompanying drawings.

[0017] Fig. 2 is a perspective view showing the patch antenna assembly of the first embodiment of the present invention, and Fig. 3 is an exploded view showing the patch antenna assembly of the first embodiment of the present invention. The miniaturized circularly polarized patch antenna assembly shown in these figures includes a substrate 1, a radiation metal piece 2, a grounded metal piece 3 and a signal inputting body 4. The above components are combined to form a miniaturized antenna assembly that can be built and used in a portable GPS satellite navigation system.

[0018] The above substrate 1 is a cubical body and made of ceramic materials having a high dielectric constant (8-150). The upper surface of the substrate has a penetrating hole 11 for penetrating the substrate 1.

[0019] The radiation metal piece 2 is a square sheet provided on the surface of the substrate 1, and provided thereon with a through hole 21 corresponding to the above penetrating hole 11. The radiation metal piece 2 has four corners. Any two diagonal chamfers 22 can form a dextrorotary or levorotary circularly polarized patch antenna. In the figures, the chamfers 22 on the radiation metal piece 2 are provided in the right-upper portion and the corresponding left-lower portion thereof. Therefore, it belongs to a dextrorotary circularly polarized patch antenna.

[0020] With reference to Fig. 4, the grounded metal piece 3 is a square sheet and has a sheet 31 connected to the bottom of the substrate 1. The sheet 31 has a penetrating hole 32 whose inner diameter is larger than that of the penetrating hole 11. Further, a plurality of frequency down-conversion metal pieces in a form of an elongated sheet extends from four sides of the sheet 31. The frequency down-conversion metal piece 33 is adhered onto the side face 12 of the substrate 1, so that the frequency down-conversion metal piece 33 on the one side face 12 is diagonally arranged with respect to the frequency down-conversion metal piece 33' on the opposite side face 12'. In this figure, the frequency down-conversion metal piece 33 is used to reduce the resonant frequency of the antenna. When the volume of the substrate 1 of the antenna is reduced, the area of the radiation metal piece 2 is also reduced, which causes the increase of the resonant frequency of the antenna. Therefore, the frequency down-conversion metal piece 33 can be used to recover the resonant frequency of the antenna to a desired frequency band.

[0021] The signal-inputting body 4 is formed into a T-lettered shape and has a pillared solid or tubular hollow conductor body 41. One end of the body 41 has a head portion 42. After the body 41 of the signal-inputting body 4 penetrates through the penetrating hole 11, the through hole 21 and the penetrating hole 32, the head portion 42 at one end of the body 41 is electrically connected with the radiation metal piece 2. When the radiation metal piece 2 receives signals, the signal-inputting body 4 forms a signal-inputting point.

[0022] Owing to the design of the frequency down-conversion metal piece 33, the volume of the antenna made of the material having the same dielectric constant can be reduced by 10% to 50%. Therefore, the thus-formed antenna can be built in the current compact portable electronic device.

[0023] Fig. 4 and Fig. 5 are a top view and a side view of the patch antenna of the present invention. As shown in these figures, when the chamfers 22 of the radiation metal piece 2 on the substrate 1 of the patch antenna are arranged in the right-upper portion and the corresponding left-lower portion thereof, the frequency down-conversion metal piece 33 extending from the grounded metal piece 3 is arranged on the left side face 121 of the side face 12, thereby to form a dextrorotary circularly polarized patch antenna for receiving and transmitting a dextrorotary circularly polarized electronic wave.

[0024] When the resonant frequency of the antenna is to be further reduced, the area of the frequency down-conversion metal piece 33 can be increased. However, the increased area of the frequency down-conversion metal piece 33 cannot be larger than a half area of the side face 12 of the substrate 1. If the area of the frequency down-conversion metal piece 33 is larger than a half area of the side face of the substrate 1, the radiation gain and efficiency of the antenna will be seriously affected.

[0025] Fig. 6 and Fig. 7 are a top view and a side view of the patch antenna of the second embodiment of the present invention. As shown in these figures, when the chamfers 22 of the radiation metal piece 2 on the substrate 1 of the patch antenna are arranged in the left-upper portion and the corresponding right-lower portion thereof, the frequency down-conversion metal piece 33 extending from the grounded metal piece 3 is arranged on the right side face 122 of the side face 12, thereby to form a levorotary circularly polarized patch antenna for receiving and transmitting a levorotary circularly polarized electronic wave.

[0026] When the resonant frequency of the antenna is to be reduced, the area of the frequency down-conversion metal piece 33 can be increased. However, the increased area of the frequency down-conversion metal piece 33 cannot be larger than a half area of the side face 12 of the substrate 1. If the area of the frequency down-conversion metal piece 33 is larger than a half area of the side face of the substrate 1, the radiation gain property of the antenna will be seriously affected.

[0027] Fig. 8 is a schematic view showing the patch antenna assembly of the third embodiment of the present invention. As shown in this figure, the frequency down-conversion metal piece 33 of the circularly polarized patch antenna shown in Figs. 8A to 8D can be formed into any one of triangle, oblique stripe, wave, L-lettered shape or the like. By means of coating or adhesion, the frequency down-conversion metal piece 33 can be adhered onto the left side face 121 or right side face 122 of the side face 12 of the substrate 1, or extending from the left side face 121 to the right side face 122, or vice versa. However, the coated or adhered area of the frequency down-conversion metal piece 33 cannot be larger than a half area of the side face 12.

[0028] Fig. 9 is a schematic view showing the patch antenna assembly of the fourth embodiment of the present invention. As shown in the figure, when the resonant frequency of the antenna is to be reduced, in addition to increase the area of the frequency down-conversion metal piece 33, the length thereof can be alternatively increased. The length of the frequency down-conversion metal piece 33 can be extended on the surface substrate 1 but not contact with the radiation metal piece 2.

[0029] Figs. 10A and 10B are schematic views showing the patch antenna assembly of the fifth embodiment of the present invention. As shown in the figures, the radiation metal piece 2 is formed into a circular shape. The circumference of the radiation metal piece 2 is provided with bumps or notches 23 arranged in the left-upper portion and the corresponding right-lower portion thereof. The frequency down-conversion metal piece 33 extending from the grounded metal piece 3 is provided on the right side face 122 of the side face 12, thereby to form a levorotary circularly polarized patch antenna for receiving and transmitting a levorotary circularly polarized electronic wave.

[0030] Fig. 11 is a schematic view of the patch antenna of the sixth embodiment according to an example. As shown in this figure, when the substrate 1 and the grounded metal piece 3 are both formed into a circular shape, and the chamfers 22 of the radiation metal piece 2 on the surface are arranged in the right-upper portion and the corresponding left-lower portion thereof, the frequency down-conversion metal piece 33 extending from the grounded metal piece 3 is arranged on the circumferential surface 14, thereby to form a dextrorotary circularly polarized patch antenna for receiving and transmitting a dextrorotary circularly polarized electronic wave.

[0031] Fig. 12A and Fig. 12B are schematic views of the patch antenna according to an other example. As shown in theses figures, when the substrate 1, the radiation metal piece 2 and the grounded metal piece 3 of the patch antenna are formed into a circular shape, and the circumference of the radiation metal piece 2 is provided with bumps or notches 23 in the left-upper portion and the corresponding right-lower portion thereof, the frequency down-conversion metal piece 33 extending from the grounded metal piece 3 is provided on the circumferential surface 14, thereby to form a levorotary circularly polarized patch antenna for receiving and transmitting a levorotary circularly polarized electronic wave.

[0032] Although the present invention has been described with reference to the foregoing preferred embodiments, it will be understood that the invention is not limited to the details thereof. Various equivalent variations and modifications can still be occurred to those skilled in this art in view of the teachings of the present invention. Thus, all such variations and equivalent modifications

are also embraced within the scope of the invention as defined in the appended claims.

Claims

1. A circularly polarized patch antenna assembly, comprising:

- a substrate (1) having a substrate penetrating hole (11) penetrating the substrate (1), the substrate (1) having a bottom face, a top face opposite to the bottom face, and four side faces (12) connected between the bottom face and the top face;
- a radiation metal piece (2) attached on the top surface of the substrate (1) and provided with a through hole (21) corresponding to the substrate penetrating hole (11);
- a grounded metal piece (3) attached on the bottom surface of the substrate (1) and having a sheet (31), wherein the sheet (31) has a sheet penetrating hole (32) corresponding to the through hole (21), wherein the sheet penetrating hole (32) has an inner diameter larger than that of the substrate penetrating hole (11),
- a signal-inputting body (4) penetrating the substrate penetrating hole (11), the through hole (21) and sheet penetrating hole (32), the signal-inputting body (4) is electrically connected with the radiation metal piece (2) to form a signal-inputting point,
- a plurality metal pieces (33) for down converting the resonant frequency of the antenna, the plurality of metal pieces extend from four sides of the sheet (31), wherein metal pieces (33) are adhered on the side faces (12) of the substrate (1),

characterized in that the metal piece (33) on any one side face (12) is arranged diagonally with respect to the opposite metal piece (33') on the opposite side face (12'), such that a projection of said opposite metal piece (33') on said one side face (12) is symmetrical to said one metal piece (33) with respect to the centre vertical line of said side face (12).

- the metal pieces (33) further extend to the top face of the substrate (1), wherein the area of the portion of the metal piece (33) on the side face (12) of the substrate (1) is smaller than half area of the corresponding side face (12),
- the signal-inputting body (4) has a body (41) and a head portion (42) at one end of the body (41), wherein the head portion (42) has a diameter larger than that of the through hole (21) and is in contact with the radiation metal piece (2), wherein the body (41) penetrates the through hole (21), the substrate penetrating hole (11) and the sheet penetrating hole (32) and exposes out of the sheet penetrating hole (32) when the signal-inputting body (4) is placed on the radiation metal piece (2), whereby a signal can be transmitted from the radiation metal piece (2) to the exposed end of the body (41).

2. The circularly polarized patch antenna assembly according to claim 1, wherein the metal pieces (33) are formed as an elongated sheets.

3. The circularly polarized patch antenna assembly according to one of the claims 1-2, wherein the length of the metal pieces (33) extend onto the top surface of the substrate (1) without connecting with the radiation metal piece (2).

4. The circularly polarized patch antenna assembly according to one of the claims 1-3, wherein the substrate (1) is formed as a cubical shape.

5. The circularly polarized patch antenna assembly according to one of the claims 1-4, wherein the radiation metal piece (2) is formed as a square sheet.

6. The circularly polarized patch antenna assembly according to one of the claims 1-5, wherein the grounded metal piece (3) is formed as a square sheet.

7. The circularly polarized patch antenna assembly according to one of the claims 1, wherein each of the metal pieces (33) is formed as a triangular sheet.

8. The circularly polarized patch antenna assembly according to one of the claims 1, wherein each of the metal pieces (33) is formed as an oblique strip.

9. The circularly polarized patch antenna assembly according to one of the claims 1, wherein each of the metal pieces (33) is formed as a waved sheet.

10. The circularly polarized patch antenna assembly according to one of the claims 1, wherein each of the metal pieces (33) has an L-shape.

11. The circularly polarized patch antenna assembly according to claim 1, wherein the radiation metal piece (2) is formed as a circular sheet.

12. The circularly polarized patch antenna assembly according to claim 11, wherein the circumference of the radiation metal piece (2) is provided with any one of bumps and notches (23) in a diagonal position thereof.

13. The circularly polarized patch antenna assembly according to claim 1, wherein the grounded metal piece

(3) is formed as a circular sheet.

14. The circularly polarized patch antenna assembly according to claim 5, wherein the radiation metal piece (2) has four corners, two diagonal corners are provided respectively with a symmetrical chamfer (22).

Patentansprüche

1. Zirkular polarisierte Patch-Antennenanordnung, die umfasst:

- ein Substrat (1) mit einem Substratdurchdringungsloch (11), das das Substrat (1) durchdringt, wobei das Substrat (1) eine untere Fläche, eine obere Fläche gegenüber der unteren Fläche und vier Seitenflächen (12), die zwischen der unteren Fläche und der oberen Fläche verbunden sind, besitzt;
- ein Strahlungsmetallstück (2), das an der oberen Oberfläche des Substrats (1) angebracht ist und mit einem Durchgangsloch (21) ausgestattet ist, das dem Substratdurchdringungsloch (11) entspricht;
- ein geerdetes Metallstück (3), das an der unteren Oberfläche des Substrats (1) angebracht ist und eine Folie (31) besitzt, wobei die Folie (31) ein Foliendurchdringungsloch (32) besitzt, das dem Durchgangsloch (21) entspricht, wobei das Foliendurchdringungsloch (32) einen inneren Durchmesser besitzt, der größer als der des Substratdurchdringungslochs (11) ist,
- einen Signaleingabekörper (4), der das Substratdurchdringungsloch (11), das Durchgangsloch (21) und das Foliendurchdringungsloch (32) durchdringt, wobei der Signaleingabekörper (4) mit dem Strahlungsmetallstück (2) elektrisch verbunden ist, um einen Signaleingabepunkt zu bilden,
- mehrere Metallstücke (33) zum Abwärtsumsetzen der Resonanzfrequenz der Antenne, wobei sich die mehreren Metallstücke von vier Flächen der Folie (31) erstrecken, wobei Metallstücke (33) an den Seitenflächen (12) des Substrats (1) haften,

dadurch gekennzeichnet, dass das Metallstück (33) auf einer Seitenfläche (12) diagonal in Bezug auf das gegenüberliegende Metallstück (33') auf der gegenüberliegenden Fläche (12') derart angeordnet ist, dass eine Projektion des gegenüberliegenden Metallstücks (33') auf die eine Seitenfläche (12) in Bezug auf die mittlere vertikale Linie der Seitenfläche (12) symmetrisch zu dem einen Metallstück (33) ist,

- sich die Metallstücke (33) ferner zu der oberen Fläche des Substrats (1) erstrecken, wobei die Fläche des Teils des Metallstücks (33) auf der Seitenfläche (12) des Substrats (1) kleiner als die halbe Fläche der entsprechenden Seitenfläche (12) ist,
- der Signaleingabekörper (4) einen Körper (41) und einen Kopfteil (42) an einem Ende des Körpers (41) besitzt, wobei der Kopfteil (42) einen Durchmesser besitzt, der größer als der des Durchgangslochs (21) ist, und in Kontakt mit dem Strahlungsmetallstück (2) ist, wobei der Körper (41) das Durchgangsloch (21), das Substratdurchdringungsloch (11) und das Foliendurchdringungsloch (32) durchdringt und aus dem Foliendurchdringungsloch (32) freiliegt, wenn der Signaleingabekörper (4) auf dem Strahlungsmetallstück (2) positioniert ist, wobei ein Signal von dem Strahlungsmetallstück (2) zu dem freiliegenden Ende des Körpers (41) gesendet werden kann.

2. Zirkular polarisierte Patch-Antennenanordnung nach Anspruch 1, wobei die Metallstücke (33) als langgestreckte Folien gebildet sind.

3. Zirkular polarisierte Patch-Antennenanordnung nach einem der Ansprüche 1-2, wobei sich die Länge der Metallstücke (33) auf die obere Oberfläche des Substrats (1) erstreckt, ohne sich mit dem Strahlungsmetallstück zu verbinden.

4. Zirkular polarisierte Patch-Antennenanordnung nach einem der Ansprüche 1-3, wobei das Substrat (1) als eine kubische Form gebildet ist.

5. Zirkular polarisierte Patch-Antennenanordnung nach einem der Ansprüche 1-4, wobei das Strahlungsmetallstück (2) als eine quadratische Folie gebildet ist.

6. Zirkular polarisierte Patch-Antennenanordnung nach einem der Ansprüche 1-5, wobei das geerdete Metallstück (3) als eine quadratische Folie gebildet ist.

7. Zirkular polarisierte Patch-Antennenanordnung nach einem der Ansprüche 1, wobei jedes der Metallstücke (33) als eine dreieckige Folie gebildet ist.

8. Zirkular polarisierte Patch-Antennenanordnung nach einem der Ansprüche 1, wobei jedes der Metallstücke (33) als ein schräger Streifen gebildet ist.

9. Zirkular polarisierte Patch-Antennenanordnung nach einem der Ansprüche 1, wobei jedes der Metallstücke (33) als eine gewellte Folie gebildet ist.

10. Zirkular polarisierte Patch-Antennenanordnung

nach einem der Ansprüche 1, wobei jedes der Metallstücke (33) eine L-Form besitzt.

11. Zirkular polarisierte Patch-Antennenanordnung nach Anspruch 1, wobei das Strahlungsmetallstück (2) als eine kreisförmige Folie gebildet ist.

12. Zirkular polarisierte Patch-Antennenanordnung nach Anspruch 11, wobei der Umfang des Strahlungsmetallstücks (2) mit Erhebungen oder Aussparungen (23) in einer diagonalen Position von ihm ausgestattet ist.

13. Zirkular polarisierte Patch-Antennenanordnung nach Anspruch 1, wobei das geerdete Metallstück (3) als eine kreisförmige Folie gebildet ist.

14. Zirkular polarisierte Patch-Antennenanordnung nach Anspruch 5, wobei das Strahlungsmetallstück (2) vier Ecken besitzt, wobei zwei diagonale Ecken jeweils mit einer symmetrischen Abschrägung ausgestattet sind.

Revendications

1. Ensemble d'antenne à plaque à polarisation circulaire, comprenant :

- un substrat (1) comportant un trou de pénétration de substrat (11) pénétrant dans le substrat (1), le substrat (1) comportant une face inférieure, une face supérieure à l'opposé de la face inférieure, et quatre faces latérales (12) reliées entre la face inférieure et la face supérieure ;
- une pièce de métal de rayonnement (2) attachée à la surface supérieure du substrat (1) et pourvue d'un trou traversant (21) correspondant au trou de pénétration de substrat (11) ;
- une pièce de métal mise à la masse (3) attachée à la surface inférieure du substrat (1) et comportant une feuille (31), dans lequel la feuille (31) comporte un trou de pénétration de feuille (32) correspondant au trou traversant (21), dans lequel le trou de pénétration de feuille (32) présente un diamètre intérieur supérieur à celui du trou de pénétration de substrat (11),
- un corps d'entrée de signal (4) pénétrant dans le trou de pénétration de substrat (11), le trou traversant (21) et le trou de pénétration de feuille (32), le corps d'entrée de signal (4) étant électriquement relié à la pièce de métal de rayonnement (2) pour constituer un point d'entrée de signal,
- une pluralité de pièces de métal (33) pour convertir à la baisse la fréquence résonante de l'antenne, la pluralité de pièces de métal s'étendant de quatre côtés de la feuille (31), dans lequel des pièces de métal (33) adhèrent aux faces latérales (12) du substrat (1),

caractérisé en ce que la pièce de métal (33) sur n'importe quelle face latérale (12) est agencée diagonalement par rapport à la pièce de métal opposée (33') sur la face latérale opposée (12'), de sorte qu'une projection de ladite pièce de métal opposée (33') sur ladite face latérale (12) soit symétrique avec ladite pièce métallique (33) par rapport à la ligne verticale centrale de ladite face latérale (12),

- les pièces de métal (33) s'étendent davantage vers la face supérieure du substrat (1), dans lequel la superficie de la portion de la pièce de métal (33) sur la face latérale (12) du substrat (1) est inférieure à la moitié de la superficie de la face latérale correspondante (12),
- le corps d'entrée de signal (4) comporte un corps (41) et une portion de tête (42) à une extrémité du corps (41), dans lequel la portion de tête (42) présente un diamètre supérieur à celui du trou traversant (21) et est en contact avec la pièce de métal de rayonnement (2), dans lequel le corps (41) pénètre dans le trou traversant (21), le trou de pénétration de substrat (11) et le trou de pénétration de feuille (32) et est exposé hors du trou de pénétration de feuille (32) lorsque le corps d'entrée de signal (4) est placé sur la pièce de métal de rayonnement (2), de telle manière qu'un signal puisse être transmis de la pièce de métal de rayonnement (2) à l'extrémité exposée du corps (41).

2. Ensemble d'antenne à plaque à polarisation circulaire selon la revendication 1, dans lequel les pièces de métal (33) sont constituées sous forme de feuilles allongées.

3. Ensemble d'antenne à plaque à polarisation circulaire selon l'une des revendications 1 et 2, dans lequel la longueur des pièces de métal (33) s'étend sur la surface supérieure du substrat (1) sans liaison avec la pièce de métal de rayonnement (2).

4. Ensemble d'antenne à plaque à polarisation circulaire selon l'une des revendications 1 - 3, dans lequel le substrat (1) présente une forme cubique.

5. Ensemble d'antenne à plaque à polarisation circulaire selon l'une des revendications 1 - 4, dans lequel la pièce de métal de rayonnement (2) est constituée sous la forme d'une feuille carrée.

6. Ensemble d'antenne à plaque à polarisation circulaire selon l'une des revendications 1 - 5, dans lequel la pièce de métal mise à la masse (3) est constituée sous la forme d'une feuille carrée.

7. Ensemble d'antenne à plaque à polarisation circulaire selon la revendication 1, dans lequel chacune des pièces de métal (33) est constituée sous la forme d'une feuille triangulaire.

8. Ensemble d'antenne à plaque à polarisation circulaire selon la revendication 1, dans lequel chacune des pièces de métal (33) est constituée sous la forme d'une bande oblique.

9. Ensemble d'antenne à plaque à polarisation circulaire selon la revendication 1, dans lequel chacune des pièces de métal (33) est constituée sous la forme d'une feuille ondulée.

10. Ensemble d'antenne à plaque à polarisation circulaire selon la revendication 1, dans lequel chacune des pièces de métal (33) présente une forme en L.

11. Ensemble d'antenne à plaque à polarisation circulaire selon la revendication 1, dans lequel la pièce de métal de rayonnement (2) est constituée sous la forme d'une feuille circulaire.

12. Ensemble d'antenne à plaque à polarisation circulaire selon la revendication 11, dans lequel la circonférence de la pièce de métal de rayonnement (2) est pourvue de l'une quelconque de bosses et d'encoches (23) dans une position diagonale de celle-ci.

13. Ensemble d'antenne à plaque à polarisation circulaire selon la revendication 1, dans lequel la pièce de métal mise à la masse (3) est constituée sous la forme d'une feuille circulaire.

14. Ensemble d'antenne à plaque à polarisation circulaire selon la revendication 5, dans lequel la pièce de métal de rayonnement (2) comporte quatre coins, deux coins diagonaux étant respectivement pourvus d'un biseau symétrique (22).

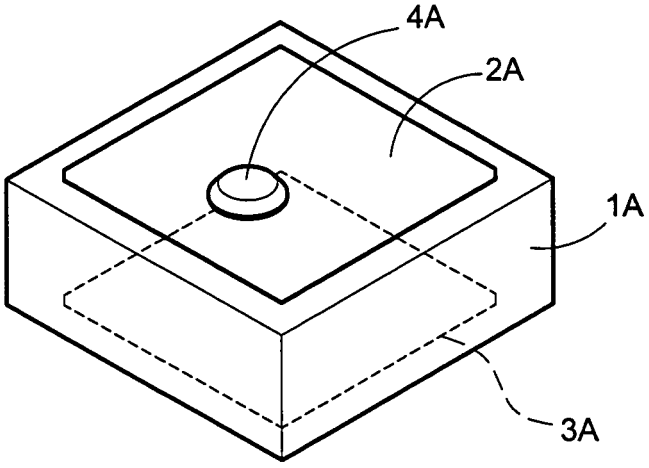


FIG.1
(Prior Art)

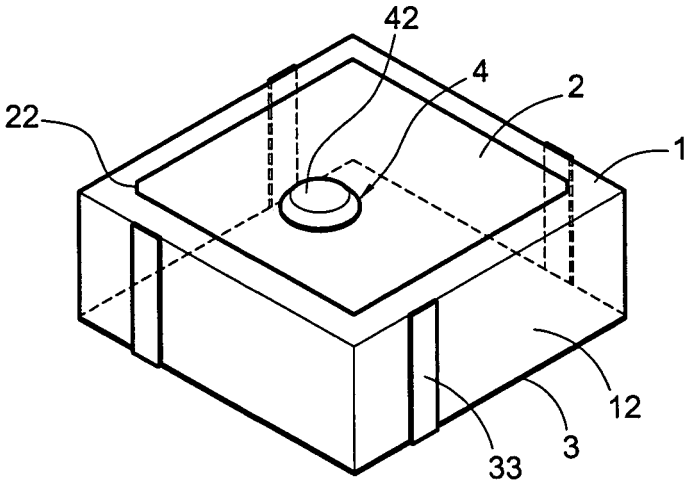


FIG.2

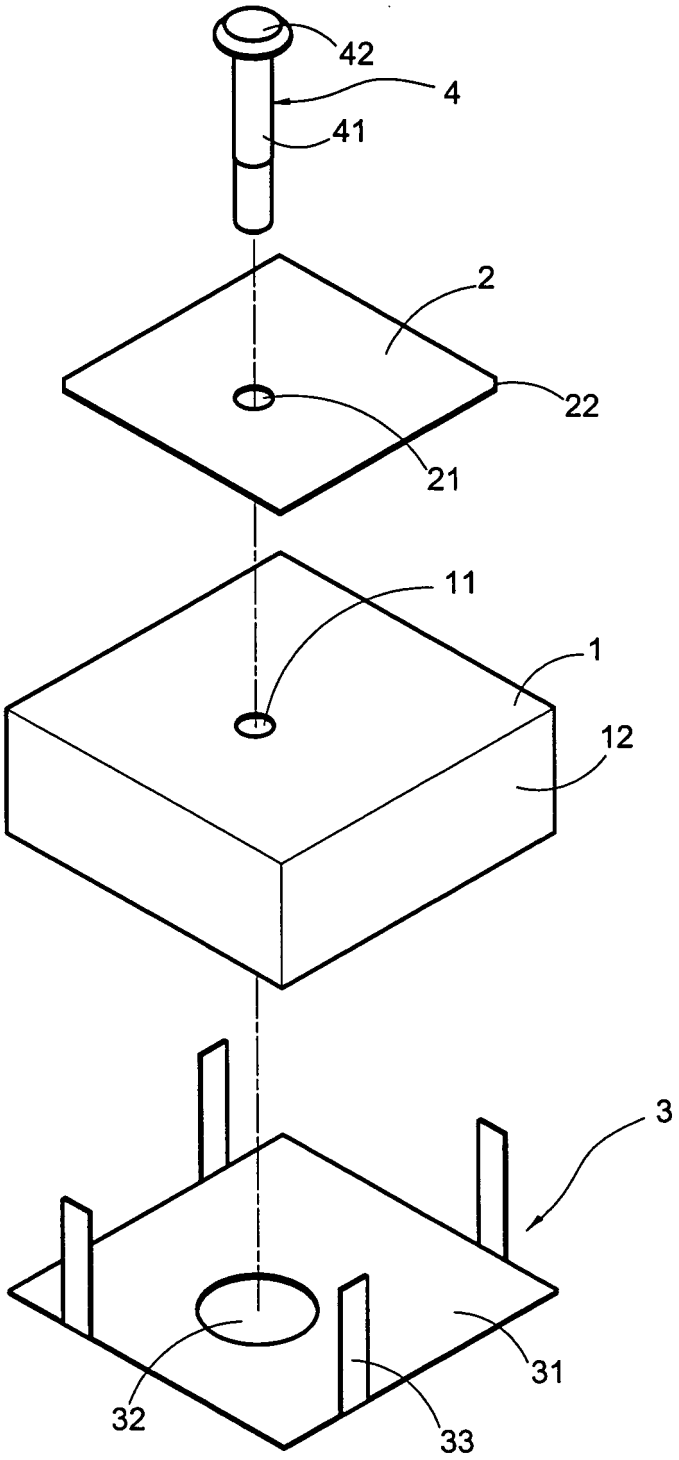


FIG.3

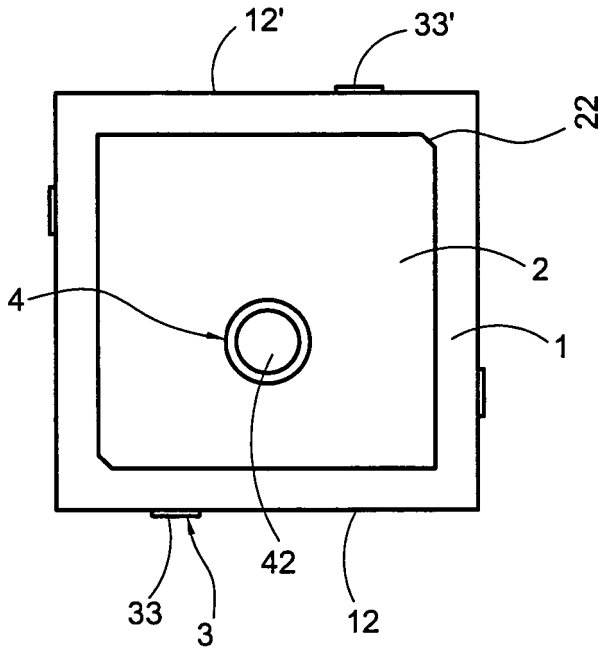


FIG.4

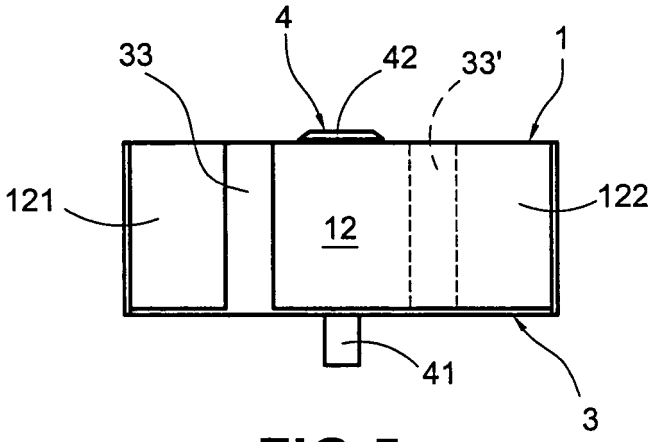


FIG.5

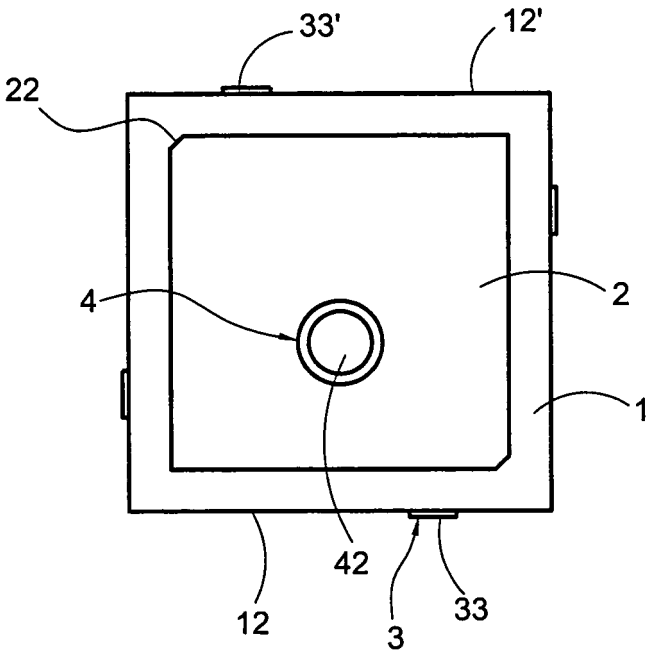


FIG.6

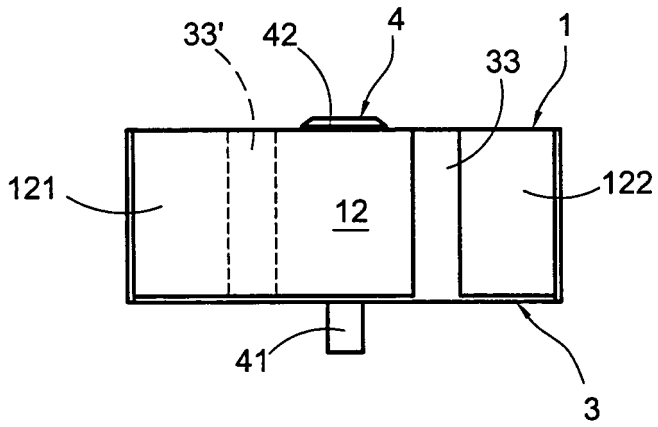


FIG.7

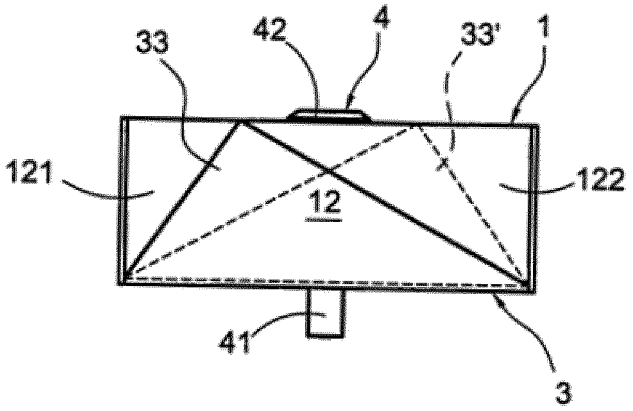


FIG.8A

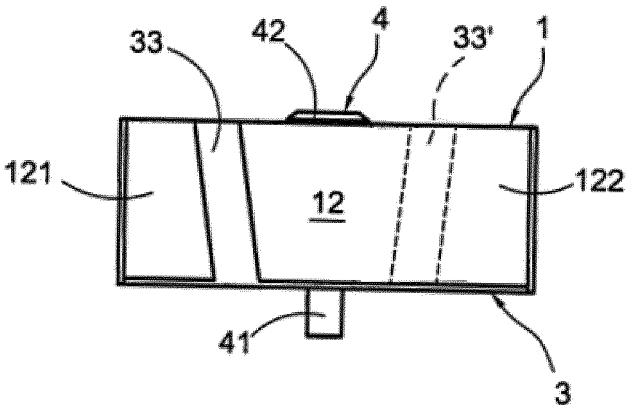


FIG.8B

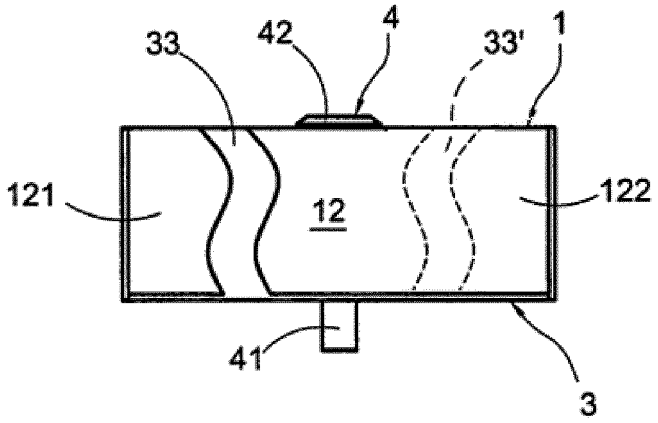


FIG.8C

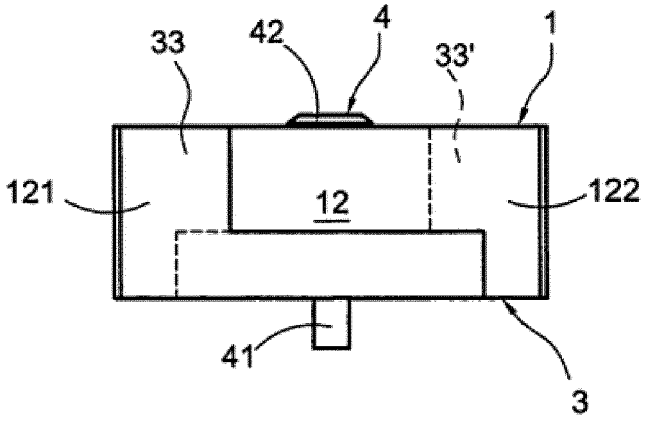


FIG.8D

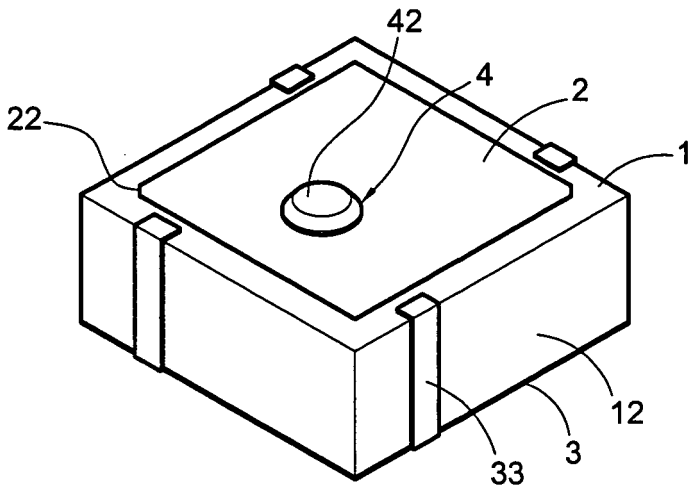


FIG.9

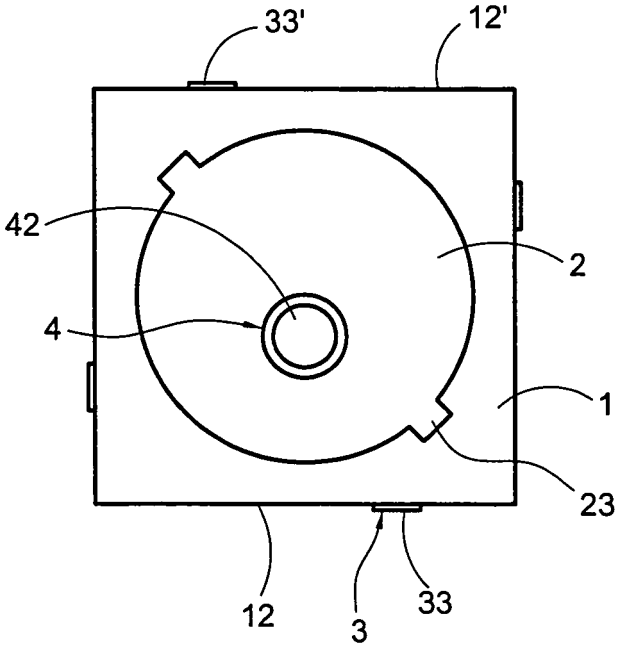


FIG.10A

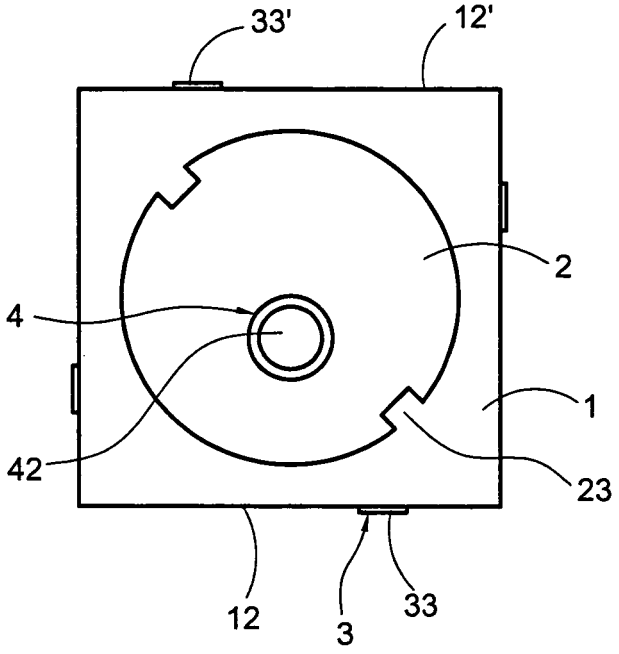


FIG.10B

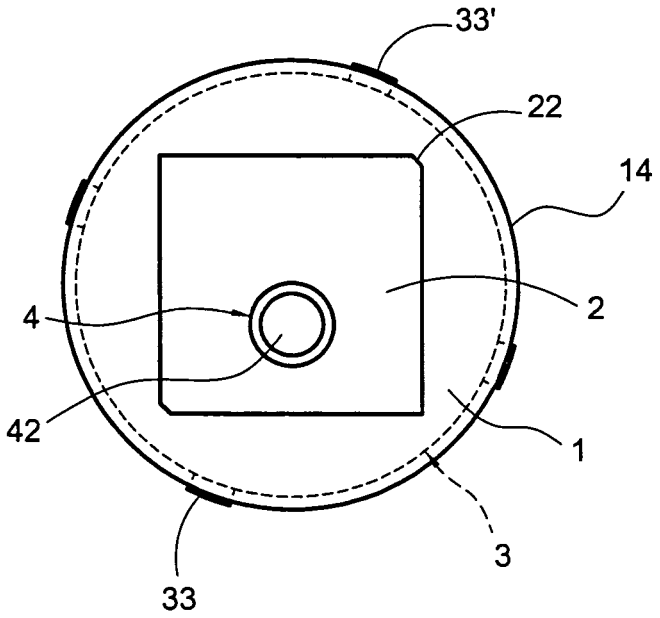


FIG.11

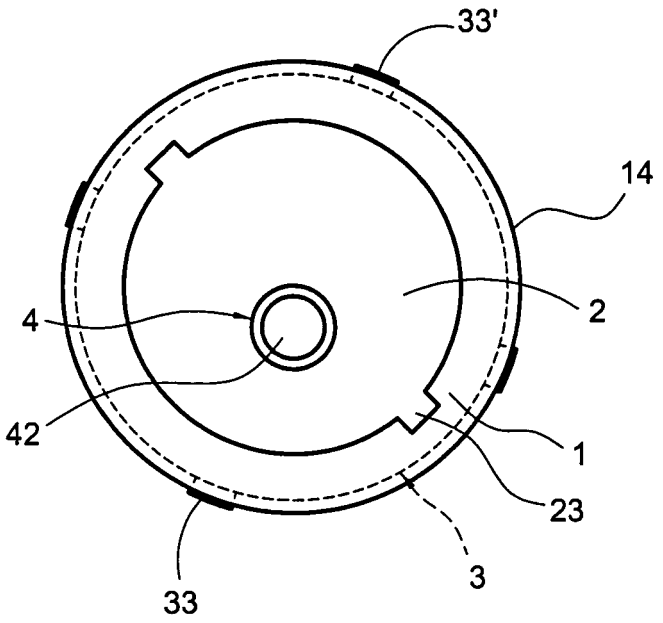


FIG.12A

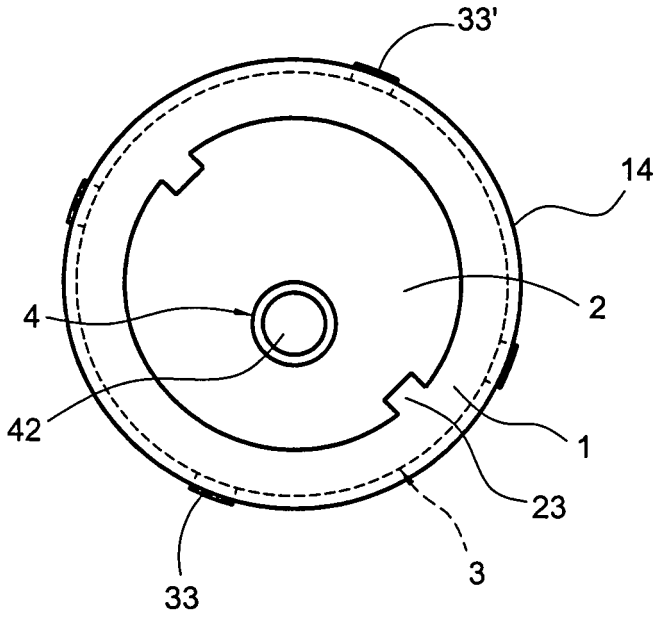


FIG.12B

REFERENCES CITED IN THE DESCRIPTION

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