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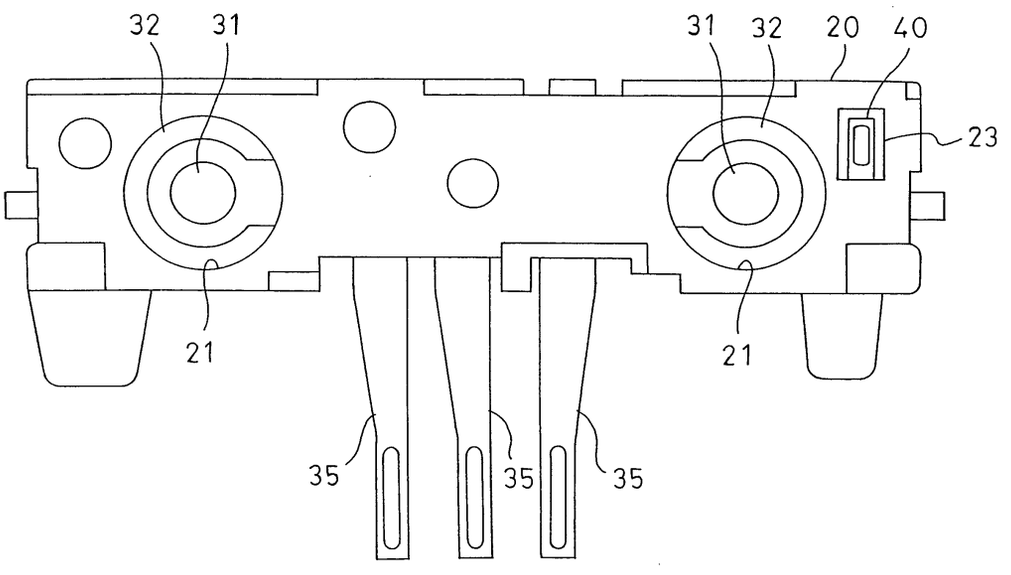
(54) Switch unit, and method of electrically connecting an electromagnetic wave shielding member with a grounding terminal in a switch unit

(57) According to the invention, in a switch unit, the dust resistance of a switch portion is ensured by an electromagnetic wave shielding member and an operation sense is hardly impaired. An electrical connection between a conductive portion of the electromagnetic wave shielding member and a grounding terminal is conducted surely and easily. A plate-like body 20 has a stationary electrode and a movable electrode 36 in a switch portion 30. The movable electrode 36 is configured by a snap plate. An electromagnetic wave shielding member 50 is overlaid on the plate-like body 20. The electromagnetic wave shielding member 50 is configured by a laminated member having a base layer 51 formed by a polyethylene terephtalate film, and an electromagnetic wave shielding layer 52 formed by an aluminum thin film. The switch portion 30 is covered by the electromagnetic wave shielding member 50. The electromagnetic wave shielding layer 52 of the electromagnetic wave shielding member 50 is electrically connected via an electrically conductive coating composition 60 with a grounding terminal 40 formed on the plate-like body 20.

Fig. 2



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Description

Background of the Invention

1. Field of the invention

[0001] The present invention relates to a switch unit, and also to a method of electrically connecting an electromagnetic wave shielding member with a grounding terminal in a switch unit.

2. Description of the Prior Art

[0002] As a switch unit which is to be used in a mobile communication apparatus such as a portable telephone, a switch unit having the following structure is sometimes used in order to prevent the unit body having a switch portion from becoming bulky when the switch unit is incorporated into such an apparatus. In such a switch unit, the body is formed into a plate-like shape, and leads of electrodes which form a switch portion are embedded into the plate-like body by insert molding. Fig. 8 is a view showing a part of a portable telephone in which such a switch unit is used. In the figure, 1 denotes a case of the portable telephone which is formed by joining a front case 2 and a rear case 3 together. The reference numeral 4 denotes a display screen. The switch unit is fittingly attached into mount grooves (not shown) which are formed in the inner sides of the front and rear cases 2 and 3. An operation member 5 of the switch unit is placed in an opening 6 which is opened in a side face of the case 1. The ON/OFF modes of the switch portion of the switch unit are controlled by pressingly operating the operation member 5.

[0003] Fig. 9 shows the conventional switch unit which has been described with reference to Fig. 8, and which is operated by the operation member 5. In the figure, 10 denotes a slender plate-like body which is formed by a synthetic resin molded product that is electrically insulative. Switch portions 12 are placed respectively in the lateral sides of the body. Each of the switch portions 12 comprises a stationary electrode, and a movable electrode serving as a counter electrode for the stationary electrode. A doughnut-shaped snap plate which is housed in a recess formed in the plate-like body 10 is used as the movable electrode. A slender electromagnetic wave shielding member 13 formed by a metal plate overlaps with the plate-like body 10. The leads embedded into the plate-like body 10 are electromagnetic-wave shielded by the electromagnetic-wave shielding function of the electromagnetic wave shielding member 13.

[0004] In the switch unit of Fig. 9, openings 15 which are opened in the electromagnetic wave shielding member 13 face respectively the switch portions 12, and protrusions (not shown) disposed on the rear side of the operation member 5 that has been described with reference to Fig. 8 are opposed to the movable electrodes each formed by a snap plate, through the openings 15, respectively. When the operation member 5 is pressed, the movable electrodes perform an operation of inversion from the initial shape, and, when the pressing force by the operation member is released, the movable electrodes are returned from the inverted shape to the initial shape.

[0005] Another switch unit is known in which, in the conventional switch unit that has been described with reference to Fig. 9, the electromagnetic wave shielding member 13 formed by a metal plate is replaced with an electrically conductive and flexible sheet member, and the switch portions 12 are covered by the sheet member to enhance the dust resistance of the switch portions 12. In the switch unit, as means for electrically contacting the sheet member with a grounding terminal of the body, a conductive portion of the sheet member is elastically contacted with the grounding terminal, or a conductive portion of the sheet member is contacted with the grounding terminal by means of caulking.

[0006] In the conventional switch unit that has been described with reference to Fig. 9, the openings 15 of the electromagnetic wave shielding member 13 formed by a metal plate face the switch portions 12, and the protrusions of the operation member 5 are opposed to the movable electrodes each formed by a snap plate, through the openings 15. Therefore, the switch unit has a problem in dust resistance of the switch portions 12. Specifically, as described with reference to Fig. 8, the switch unit is placed inside the opening 6 of the case 1 in which the operation member 5 is disposed, and therefore dust which has passed through the opening 6 enters the switch portions 12 of the switch unit through the openings 15 of the electromagnetic wave shielding member 13, thereby causing the possibility of lowering the switching performance and the operability. By contrast, when the openings 15 of the electromagnetic wave shielding member 13 are eliminated and the switch portions 12 are covered by the electromagnetic wave shielding member 13, dust is prevented from entering the switch portions 12, and hence the switching performance and operability of the switch portions 12 themselves can be easily maintained. In such a configuration, when the operation member 5 is operated, however, it is necessary to cause the snap plates of the switch portions 12 to perform the inversion operation via an operation in which the electromagnetic wave shielding member 13 formed by a metal plate is bent by the protrusions of the operation member 5. Consequently, there arises a problem in that an operation sense of the operation member 5 due to the inversion operation of the snap plates is hardly obtained.

[0007] By contrast, in the conventional switch unit in which the electromagnetic wave shielding member 13 formed by a metal plate is replaced with an electrically conductive and flexible sheet member, the switch portions 12 have an excellent dust resistance because the electromagnetic wave shielding member 13 covers the

switch portions 12. In order to electrically connect the conductive portion of the sheet member with the grounding terminal of the body, however, springs must be additionally used, or a cumbersome work such as caulking must be conducted, thereby causing problems in that the cost is correspondingly raised, and also that the resulting product is thickened and the required installation space is correspondingly increased.

Summary of the invention

[0008] The invention has been conducted in view of the above-discussed problems. It is an object of the invention to provide a switch unit in which, although the dust resistance of a switch portion is ensured by an electromagnetic wave shielding member and the switching performance and operability of the switch portion itself are hardly impaired, an operation sense of an operation member due to an inversion operation of a snap plate used in the switch portion is hardly impaired.

[0009] It is another object of the invention to provide a switch unit in which, in the case where the dust resistance is ensured by using an electrically conductive and flexible sheet member as an electromagnetic wave shielding member, a conductive portion of the sheet member can be surely electrically connected with a grounding terminal of the body without using a spring or a caulking process.

[0010] It is a further object of the invention to provide a method of electrically connecting an electromagnetic wave shielding member with a grounding terminal in a switch unit in which, in the case where the dust resistance is ensured by using an electrically conductive and flexible sheet member as the electromagnetic wave shielding member, an electrical connection between a conductive portion of the sheet member and the grounding terminal can be conducted surely and easily.

[0011] In the switch unit of the invention, an electrically insulative plate-like body which is formed by a synthetic resin molded product comprises a stationary electrode of a switch portion, and a movable electrode serving as a counter electrode for the stationary electrode; the movable electrode is housed in a recess formed in the plate-like body, and faces an opening of the recess; the movable electrode is configured by a snap plate which, when the snap plate is pressed by an operation member, performs an operation of inversion from an initial shape, and, when a pressing force by the operation member is released, returns from an inverted shape to the initial shape; a lead which is continuous to the stationary electrode is embedded into the plate-like body; and an electromagnetic wave shielding member is overlaid on the plate-like body. The electromagnetic wave shielding member is formed by an electrically conductive and flexible sheet member, the opening of the recess is closed by the sheet member, and a conductive portion of the sheet member and a grounding terminal formed on the plate-like body are electrically connected with each other via an electrically conductive material which is fluid in a softened state, and in which, when hardened, the fluidity is lowered.

[0012] According to the invention, the electromagnetic wave shielding member covers the switch portion, and hence the switch portion has an excellent dust resistance. Moreover, the conductive portion of the sheet member is electrically connected with the grounding terminal on the plate-like body via the electrically conductive material, and the electrically conductive material has the property that the material is fluid in a softened state, and, when hardened, the fluidity is lowered. Therefore, the conductive portion of the sheet member and the grounding terminal on the plate-like body can be electrically connected with each other simply by applying and charging between them the conductive material in the softened state. Furthermore, the connection of the conductive portion of the sheet member and the grounding terminal does not require a process in which a spring must be additionally used or a cumbersome work such as caulking must be conducted. Correspondingly, the effects that cost can be easily reduced, and that the thickness of the product is suppressed and the required installation space can be easily reduced are attained. Since the electromagnetic wave shielding member which covers the switch portion is formed by an electrically conductive and flexible sheet member, a situation in which an operation sense of the operation member due to the inversion operation of the snap plate used in the switch portion is impaired by the electromagnetic wave shielding member hardly occurs, and a satisfactory operation sense is obtained.

[0013] As a preferred embodiment, the switch unit of the invention is configured so that the sheet member is configured by a laminated member consisting of a base layer formed by a polyethylene terephtalate film, and an electromagnetic wave shielding layer formed by an aluminum thin film. Preferably, a configuration is employed in which the sheet member is configured by a laminated member having two layers of a base layer formed by a polyethylene terephtalate film, and an electromagnetic wave shielding layer formed by an aluminum thin film, and the base layer is bonded to the plate-like body via an adhesive layer. According to the configuration, the base layer is provided with excellent durability which is exerted by the polyethylene terephtalate film. Therefore, a damage in which the electromagnetic wave shielding layer formed by an aluminum thin film is broken hardly occurs, and the initial electromagnetic wave shielding function is maintained for a long term. In the configuration in which the base layer is bonded to the plate-like body via an adhesive layer, the electromagnetic wave shielding layer can be held by the plate-like body at high workability and without conducting a special mechanical process such as a bending process.

[0014] As another preferred embodiment, the switch unit of the invention is configured so that an annular flexible portion having a shape which is pressed into the

opening of the recess in an outer peripheral portion of the opening is shaped in the sheet member, and a part of the sheet member which is surrounded by the flexible portion is closely contacted with a surface of the snap plate. According to the configuration, the flexible portion of the sheet member follows the inversion operation of the snap plate without producing resistance, or without generating tension in the sheet member. Therefore, a situation in which an operation sense of the operation member due to the inversion operation of the snap plate is impaired by the electromagnetic wave shielding member configured by the sheet member hardly occurs, and a satisfactory operation sense is obtained.

[0015] As a further preferred embodiment, the switch unit of the invention is configured so that the grounding terminal which protrudes from the plate-like body is passed through an opening formed in the sheet member configured by the laminated member in which an outermost layer is formed by the electromagnetic wave shielding layer, and the grounding terminal and the electromagnetic wave shielding layer which is opposed to the grounding terminal in an opening edge portion of the opening are electrically connected with each other via an electrically conductive material. In this case, preferably, an electrically conductive coating composition is used as the electrically conductive material. According to the configuration, the grounding terminal and the electromagnetic wave shielding layer which is opposed to the grounding terminal in the opening edge portion of the opening are electrically connected with each other via the electrically conductive material, preferably, an electrically conductive coating composition. Therefore, the electromagnetic wave shielding layer and the grounding terminal can be electrically connected with each other simply by applying and charging between them an electrically conductive coating composition which is fluid in a softened state, and then allowing them to stand to harden the electrically conductive coating composition. Consequently, it is not necessary to use extra components such as a spring, nor to conduct a cumbersome work such as caulking.

[0016] As a still further preferred embodiment, the switch unit of the invention is configured so that the grounding terminal protrudes from a wall face of a recess formed in the plate-like body, into the recess, and a place of the electrical connection of the grounding terminal and the electromagnetic wave shielding layer by the electrically conductive material is housed in the recess. According to the configuration, the place of the electrical connection of the grounding terminal and the electromagnetic wave shielding layer does not protrude from the plate-like body. Therefore, the switch unit is not bulky, and the installation space for the switch unit can be reduced.

[0017] The method of electrically connecting an electromagnetic wave shielding member with a grounding terminal in a switch unit according to the invention relates to a method of electrically connecting an electromagnetic wave shielding member with a grounding terminal in a switch unit in which a lead is embedded into an electrically insulative plate-like body comprising a switch portion having: a stationary electrode; and a movable electrode serving as a counter electrode for the stationary electrode, the lead being continuous to the stationary electrode, and an electromagnetic wave shielding member is overlaid on the plate-like body. As the electromagnetic wave shielding member, used is an electrically conductive and flexible sheet member configured by a laminated member consisting of a base layer formed by a polyethylene terephtalate film, and an electromagnetic wave shielding layer formed by an aluminum thin film. An elastic grounding terminal which protrudes from a wall face of a recess formed in the plate-like body to an outside of the recess via an inside of the recess is passed through an opening formed in the sheet member. The sheet member is overlaid on the plate-like body. The grounding terminal is then pressed into the recess to cause the grounding terminal to press an opening edge portion of the opening of the sheet member into the recess. Thereafter, a pressing force applied on the grounding terminal is released, whereby the grounding terminal is opposed in the opening edge portion of the opening of the sheet member inside the recess to the electromagnetic wave shielding layer, with using plasticity of the electromagnetic wave shielding layer and springback of the grounding terminal. Next, an electrically conductive coating composition is charged into a place where the grounding terminal and the electromagnetic wave shielding layer are opposed to each other, whereby the grounding terminal and the electromagnetic wave shielding layer are electrically connected with each other via the electrically conductive coating composition. According to this method, in the case where the dust resistance is ensured by using an electrically conductive and flexible sheet member as the electromagnetic wave shielding member, a conductive portion of the sheet member can be electrically connected surely and easily with the grounding terminal. Moreover, the switch unit of the invention can be easily produced.

Brief Description of the Drawings

[0018]

Fig. 1 is a plan view of a switch unit of an embodiment of the invention;

Fig. 2 is a plan view of a plate-like body which is used in the switch unit of Fig. 1;

Fig. 3 is a plan view of an electromagnetic wave shielding member;

Fig. 4 is a diagram showing a lamination structure of the electromagnetic wave shielding member;

Fig. 5A is an enlarged section view of a portion along the line V-V of Fig. 1;

Fig. 5B is an enlarged section view showing a mod-

ification of a portion along the line V-V of Fig. 1;
Fig. 6 is an enlarged section view of a portion along the line VI-VI of Fig. 1;
Figs. 7A to 7C are views illustrating a method of electrically connecting an electromagnetic wave shielding member with a grounding terminal;
Fig. 8 is an partially omitted external view of a portable telephone in which a switch unit is used; and
Fig. 9 is a plan view of a conventional switch unit.

Detailed Description of the Preferred Embodiments

[0019] A switch unit U of the embodiment is a switch unit which is to be used in a mobile communication apparatus such as a portable telephone that has been described with reference to Fig. 8. It is assumed that the switch unit is used in the same manner as the conventional one that has been described with reference to the figure.

[0020] As shown in Fig. 1, the switch unit U is formed into a flat slender plate piece-like shape. A slender electromagnetic wave shielding member 50 is bonded to a slender plate-like body 20 so as to cover a substantially whole of the surface of the body. Switch portions 30 are placed respectively in the lateral sides of the plate-like body 20 which is formed by a synthetic resin molded product that is electrically insulative. A grounding terminal 40 protrudes in one end portion of the body. The grounding terminal 40 and the electromagnetic wave shielding member 50 are electrically connected with each other.

[0021] As shown in Fig. 2 or 5A, circular recesses 21 are formed in the lateral sides of the plate-like body 20, respectively, and two stationary electrodes or a center electrode 31 and a peripheral electrode 32 are exposed in the bottom face of each of the circular recesses 21 so as to be flush with each other. Leads 33 and 34 which are respectively continuous to the center electrode 31 and the peripheral electrode 32 are embedded into the plate-like body 20. Contact pieces 35 are respectively continuous to the lead 33 of the center electrode 31 and the grounding terminal 40, and protrude from the plate-like body 20. The contact pieces 35 are bent in the root portion in a folded manner to be placed in the rear side of the plate-like body 20.

[0022] As shown in Fig. 5A, a movable electrode 36 which is configured by a snap plate having a circular dome-like shape is housed in each of the circular recesses 21 of the plate-like body 20 in a substantially rattle-free condition. A peripheral edge portion 36a of the movable electrode 36 overlaps with the peripheral electrode 32 to be always contacted therewith. By contrast, a center portion (top portion) of the movable electrode 36 is opposed to the center electrode 31 via a gap, and faces an opening 21a of the recess 21. Each of the switch portions 30 is formed by the two stationary electrodes or the center electrode 31 and the peripheral electrode 32, and the movable electrode 36 configured by the snap plate.

[0023] The electromagnetic wave shielding member 50 is formed by an electrically conductive and flexible sheet member. In the embodiment, a laminated member having a structure shown in Fig. 4 is used as the sheet member forming the electromagnetic wave shielding member 50. Specifically, the sheet member forming the electromagnetic wave shielding member 50 is configured by a laminated member having two layers of a base layer 51 formed by a polyethylene terephtalate film, and an electromagnetic wave shielding layer 52 formed by an aluminum thin film, and an adhesive layer 53 is held by the base layer 51. In the electromagnetic wave shielding member 50, an opening 54 is opened through which the grounding terminal 40 disposed on the plate-like body 20 is to be passed. The electromagnetic wave shielding member 50 configured by the sheet member is overlappingly bonded to the plate-like body 20 via the adhesive layer 53. The grounding terminal 40 is passed through the opening 54 of the electromagnetic wave shielding member 50, so that, as shown in Fig. 6, the grounding terminal 40 and the electromagnetic wave shielding member 50 are electrically connected with each other via an electrically conductive material 60 formed by an electrically conductive coating composition. More specifically, in the electromagnetic wave shielding member 50 which is bonded to the plate-like body 20 via the adhesive layer 53, the electromagnetic wave shielding layer 52 is positioned in the outermost layer. The electromagnetic wave shielding layer 52 which is opposed in the opening edge portion of the opening 54 to the grounding terminal 40 is electrically connected with the grounding terminal 40 via the conductive material 60.

[0024] In the embodiment, as shown in Fig. 6, the grounding terminal 40 protrudes from a wall face of a recess (an opening in the illustrated example) 23 formed in the plate-like body 20, and the place where the grounding terminal 40 and the electromagnetic wave shielding member 50 are electrically connected with each other by the electrically conductive material 60 is housed in the recess 23. Therefore, the electrical connection of the electromagnetic wave shielding layer 52 with the grounding terminal 40 can be performed simply by pouring the electrically conductive coating composition which is fluid in a softened state between the grounding terminal 40 and the electromagnetic wave shielding layer 52, and then allowing them to stand to harden the coating composition. Consequently, it is not necessary to use extra components such as a spring, nor to conduct a cumbersome work such as caulking. Moreover, the place of the electrical connection of the grounding terminal 40 and the electromagnetic wave shielding layer 52 does not protrude from the plate-like body 20. Therefore, the switch unit U is not bulky, and the installation space for the switch unit can be reduced.

[0025] In the thus configured switch unit U, when the movable electrode 36 of the switch portion 30 is pressed

to perform an operation of inversion from the initial shape, the center electrode 31 and the peripheral electrode 32 are shortcircuited by the movable electrode 36, and, when the movable electrode 36 performs an operation of returning to the initial shape from the inverted shape, the short circuit between the center electrode 31 and the peripheral electrode 32 is cancelled. When the switch unit U is incorporated inside the case 1 of the portable telephone and the operation member 5 of the switch unit U is placed in the opening 6 opened in a side face of the case 1 as shown in Fig. 8, the ON/OFF modes of the switch portion 30 of the switch unit are controlled by pressingly operating the operation member 5. At this time, the operation of pressing the operation member 5 is converted into the inversion operation of the movable electrode 36 via the flexural deformation of the electromagnetic wave shielding member 50 configured by the flexible sheet member, and the returning operation of the movable electrode 36 is converted into the returning operation of the operation member 5 via the flexural deformation of the electromagnetic wave shielding member 50 configured by the sheet member. Therefore, a situation in which an operation sense of the operation member 5 due to the inversion operation of the snap plate (the movable electrode 36) used in the switch portion 30 is impaired by the electromagnetic wave shielding member 50 hardly occurs, and a satisfactory operation sense is obtained.

[0026] The leads 33 and 34 embedded into the plate-like body 20, and the switch portions 30 are electromagnetic-wave shielded by the electromagnetic-wave shielding function of the electromagnetic wave shielding member 50 which is overlappingly bonded to the plate-like body 20, and which is electrically conductive.

[0027] Since the electromagnetic wave shielding member 50 covers the switch portions 30, there is no possibility that dust enters from the outside into the switch portions 30 and the switching performance and operability of the switch portions 30 themselves are impaired.

[0028] Since the sheet member forming the electromagnetic wave shielding member 50 has the base layer 51 formed by a polyethylene terephtalate film, the electromagnetic wave shielding member 50 is provided with excellent durability which is exerted by the polyethylene terephtalate film. As a result, a damage in which the electromagnetic wave shielding layer 52 formed by an aluminum thin film is broken hardly occurs, and the initial electromagnetic wave shielding function is maintained for a long term.

[0029] In the embodiment, as shown in Fig. 5A, the recesses 21 of the plate-like body 20 are covered simply by the electromagnetic wave shielding member 50 which is bonded to the plate-like body 20, and which is flexible. In place of the configuration, as shown in Fig. 5B, a configuration may be employed in which an annular flexible portion 55 having a valley-like shape which is pressed into the opening 21a of each of the recesses 21 in an outer peripheral portion of the opening 21a is shaped in the electromagnetic wave shielding member 50, and a circular part 56 of the electromagnetic wave shielding member 50 which is surrounded by the flexible portion 56 is closely contacted with the surface of the snap plate which forms the movable electrode 36. According to the configuration, the flexible portion 55 of the electromagnetic wave shielding member 50 follows the inversion operation of the movable electrode 36 formed by a snap plate, without producing resistance, or without generating tension in the sheet member. Consequently, there is no room for occurring a situation in which an operation sense of the operation member 5 due to the inversion operation of the movable electrode 36 is impaired by tension generated in the electromagnetic wave shielding member 50 configured by the sheet member, and a satisfactory operation sense is obtained.

[0030] Next, a method of electrically connecting the electromagnetic wave shielding member 50 with the grounding terminal 40 in the switch unit U will be described with reference to Figs. 6 and 7A to 7C.

[0031] In an initial stage, the grounding terminal 40 configured by an elastic spring piece protrudes from the wall face of the recess 23 of the plate-like body 20 to the outside of the recess 23 via the inside of the recess 23. While, as shown in Fig. 7A, the grounding terminal 40 is passed through the opening 54 formed in the electromagnetic wave shielding member 50 configured by the sheet member, the electromagnetic wave shielding member 50 is positioned on the plate-like body 20 and overlaid thereon, and the electromagnetic wave shielding member 50 is then bonded to the plate-like body 20 via the adhesive layer 53.

[0032] Next, as shown in Fig. 7B, a work of pressing the grounding terminal 40 into the recess 23 as indicated by the arrow d is conducted by using a jig 70. As a result of the work, also a peripheral edge portion 54a of the opening 54 of the electromagnetic wave shielding member 50 is pressed into the recess 23 by the grounding terminal 40. Thereafter, the pressing force on the grounding terminal 40 is released. Since the electromagnetic wave shielding layer 52 of the electromagnetic wave shielding member 50 is formed by an aluminum thin film and the grounding terminal 40 is configured by an elastic spring piece, the peripheral edge portion 54a of the opening 54 of the electromagnetic wave shielding member 50 is then caused to remain in the pressed position by the plasticity of the electromagnetic wave shielding layer 52 as shown in Fig. 7C, and the grounding terminal 40 is slightly returned by springback of the terminal to be opposed to the electromagnetic wave shielding member 50 via a gap inside the recess 23. Then, the electrically conductive coating composition is poured and charged into a place where the grounding terminal 40 is opposed to the electromagnetic wave shielding layer 52 of the electromagnetic wave shielding member 50, whereby the electromagnetic wave shielding layer 52 and the grounding terminal 40 are electri-

cally connected with each other via the electrically conductive coating composition (the electrically conductive material 60) as shown in Fig. 6.

[0033] According to the method, the electrical connection of the electromagnetic wave shielding member 50 and the grounding terminal 40 can be performed quickly and correctly.

Claims

1. A switch unit in which an electrically insulative plate-like body which is formed by a synthetic resin molded product comprises a stationary electrode of a switch portion, and a movable electrode serving as a counter electrode for said stationary electrode; said movable electrode is housed in a recess formed in said plate-like body, and faces an opening of said recess; said movable electrode is configured by a snap plate which, when said snap plate is pressed by an operation member, performs an operation of inversion from an initial shape, and, when a pressing force by said operation member is released, returns from an inverted shape to the initial shape; a lead which is continuous to said stationary electrode is embedded into said plate-like body; and an electromagnetic wave shielding member is overlaid on said plate-like body, wherein

   said electromagnetic wave shielding member is formed by an electrically conductive and flexible sheet member, said opening of said recess is closed by said sheet member, and a conductive portion of said sheet member and a grounding terminal formed on said plate-like body are electrically connected with each other via an electrically conductive material which is fluid in a softened state, and in which, when hardened, the fluidity is lowered.

2. A switch unit according to claim 1, wherein said sheet member is configured by a laminated member consisting of a base layer formed by a polyethylene terephtalate film, and an electromagnetic wave shielding layer formed by an aluminum thin film.

3. A switch unit according to claim 1, wherein said sheet member is configured by a laminated member having two layers of a base layer formed by a polyethylene terephtalate film, and an electromagnetic wave shielding layer formed by an aluminum thin film, and said base layer is bonded to said plate-like body via an adhesive layer.

4. A switch unit according to any one of claims 1 to 3, wherein an annular flexible portion having a shape which is pressed into said opening of said recess in an outer peripheral portion of said opening is shaped in said sheet member, and a part of said sheet member which is surrounded by said flexible portion is closely contacted with a surface of said snap plate.

5. A switch unit according to claim 2 or 3, wherein said grounding terminal which protrudes from said plate-like body is passed through an opening formed in said sheet member configured by said laminated member in which an outermost layer is formed by said electromagnetic wave shielding layer, and said grounding terminal and said electromagnetic wave shielding layer which is opposed to said grounding terminal in an opening edge portion of said opening are electrically connected with each other via an electrically conductive material.

6. A switch unit according to any one of claims 1 to 3, wherein an annular flexible portion having a shape which is pressed into said opening of said recess in an outer peripheral portion of said opening is shaped in said sheet member, a part of said sheet member which is surrounded by said flexible portion is closely contacted with a surface of said snap plate,

   said grounding terminal which protrudes from said plate-like body is passed through an opening formed in said sheet member configured by said laminated member in which an outermost layer is formed by said electromagnetic wave shielding layer, and said grounding terminal and said electromagnetic wave shielding layer which is opposed to said grounding terminal in an opening edge portion of said opening are electrically connected with each other via an electrically conductive material.

7. A switch unit according to claim 2 or 3, wherein said grounding terminal which protrudes from said plate-like body is passed through an opening formed in said sheet member configured by said laminated member in which an outermost layer is formed by said electromagnetic wave shielding layer, said grounding terminal and said electromagnetic wave shielding layer which is opposed to said grounding terminal in an opening edge portion of said opening are electrically connected with each other via an electrically conductive material, and

   said electrically conductive material is an electrically conductive coating composition.

8. A switch unit according to any one of claims 1 to 3, wherein an annular flexible portion having a shape which is pressed into said opening of said recess in an outer peripheral portion of said opening is shaped in said sheet member, a part of said sheet member which is surrounded by said flexible portion is closely contacted with a surface of said snap plate,

   said grounding terminal which protrudes from said plate-like body is passed through an opening

formed in said sheet member configured by said laminated member in which an outermost layer is formed by said electromagnetic wave shielding layer, said grounding terminal and said electromagnetic wave shielding layer which is opposed to said grounding terminal in an opening edge portion of said opening are electrically connected with each other via an electrically conductive material, and

said electrically conductive material is an electrically conductive coating composition.

9. A switch unit according to claim 2 or 3, wherein said grounding terminal protrudes from a wall face of a recess formed in said plate-like body, into said recess, and a place of the electrical connection of said grounding terminal and said electromagnetic wave shielding layer by said electrically conductive material is housed in said recess.

10. A switch unit according to any one of claims 1 to 3, wherein an annular flexible portion having a shape which is pressed into said opening of said recess in an outer peripheral portion of said opening is shaped in said sheet member, a part of said sheet member which is surrounded by said flexible portion is closely contacted with a surface of said snap plate, and

said grounding terminal protrudes from a wall face of a recess formed in said plate-like body, into said recess, and a place of the electrical connection of said grounding terminal and said electromagnetic wave shielding layer by said electrically conductive material is housed in said recess.

11. A switch unit according to any one of claims 1 to 3, wherein an annular flexible portion having a shape which is pressed into said opening of said recess in an outer peripheral portion of said opening is shaped in said sheet member, a part of said sheet member which is surrounded by said flexible portion is closely contacted with a surface of said snap plate,

said grounding terminal which protrudes from said plate-like body is passed through an opening formed in said sheet member configured by said laminated member in which an outermost layer is formed by said electromagnetic wave shielding layer, said grounding terminal and said electromagnetic wave shielding layer which is opposed to said grounding terminal in an opening edge portion of said opening are electrically connected with each other via an electrically conductive material,

said grounding terminal protrudes from a wall face of a recess formed in said plate-like body, into said recess, and a place of the electrical connection of said grounding terminal and said electromagnetic wave shielding layer by said electrically conductive material is housed in said recess.

12. A switch unit according to any one of claims 1 to 3, wherein an annular flexible portion having a shape which is pressed into said opening of said recess in an outer peripheral portion of said opening is shaped in said sheet member, a part of said sheet member which is surrounded by said flexible portion is closely contacted with a surface of said snap plate,

said grounding terminal which protrudes from said plate-like body is passed through an opening formed in said sheet member configured by said laminated member in which an outermost layer is formed by said electromagnetic wave shielding layer, said grounding terminal and said electromagnetic wave shielding layer which is opposed to said grounding terminal in an opening edge portion of said opening are electrically connected with each other via an electrically conductive material,

said electrically conductive material is an electrically conductive coating composition,

said grounding terminal protrudes from a wall face of a recess formed in said plate-like body, into said recess, and a place of the electrical connection of said grounding terminal and said electromagnetic wave shielding layer by said electrically conductive material is housed in said recess.

13. A method of electrically connecting an electromagnetic wave shielding member with a grounding terminal in a switch unit in which a lead is embedded into an electrically insulative plate-like body comprising a switch portion having: a stationary electrode; and a movable electrode serving as a counter electrode for said stationary electrode, said lead being continuous to said stationary electrode, and an electromagnetic wave shielding member is overlaid on said plate-like body, wherein

an electrically conductive and flexible sheet member configured by a laminated member consisting of a base layer formed by a polyethylene terephtalate film, and an electromagnetic wave shielding layer formed by an aluminum thin film is used as said electromagnetic wave shielding member,

an elastic grounding terminal which protrudes from a wall face of a recess formed in said plate-like body to an outside of said recess via an inside of said recess is passed through an opening formed in said sheet member, said sheet member is overlaid on said plate-like body,

said grounding terminal is then pressed into said recess to cause said grounding terminal to press an opening edge portion of said opening of said sheet member into said recess, a pressing force applied on said grounding terminal is then released, whereby said grounding terminal is opposed in said opening edge portion of said opening of said sheet member inside said recess to said

electromagnetic wave shielding layer, with using plasticity of said electromagnetic wave shielding layer and springback of said grounding terminal, and

an electrically conductive coating composition is then charged into a place where said grounding terminal and said electromagnetic wave shielding layer are opposed to each other, whereby said grounding terminal and said electromagnetic wave shielding layer are electrically connected with each other via said electrically conductive coating composition.

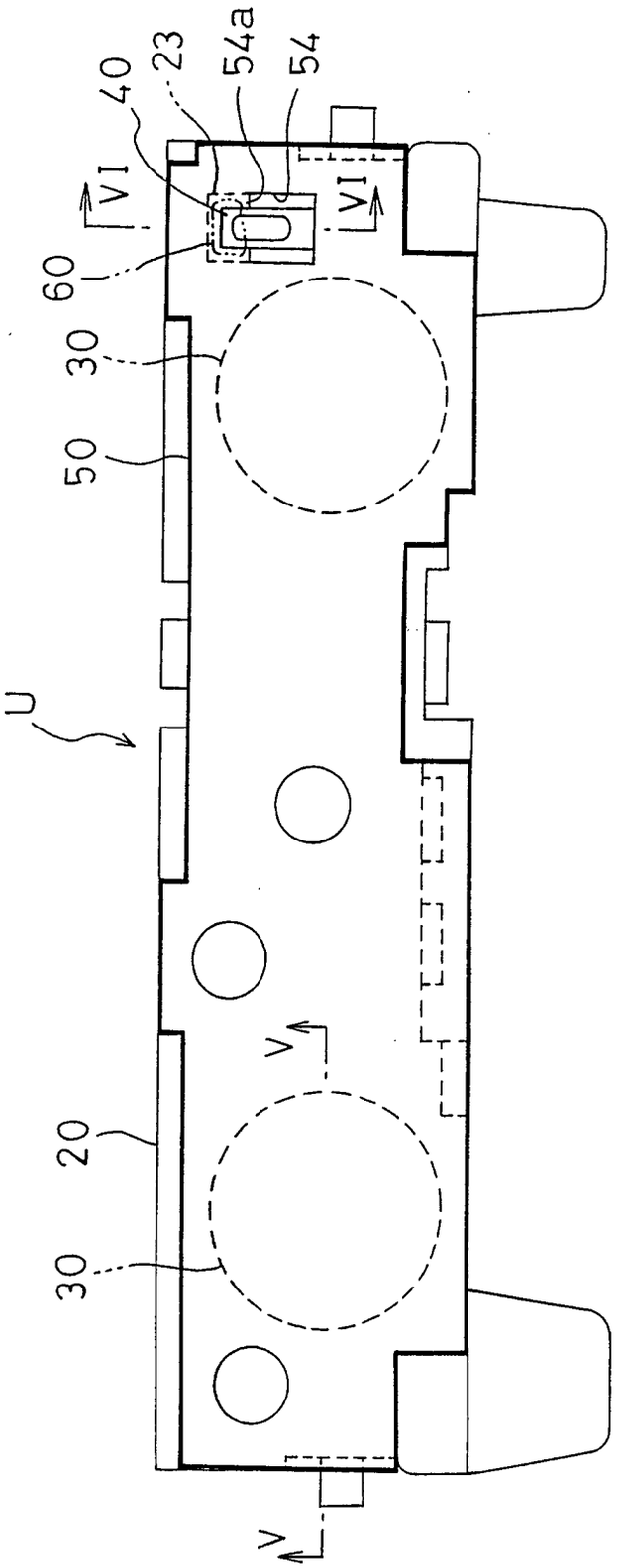


Fig. 1

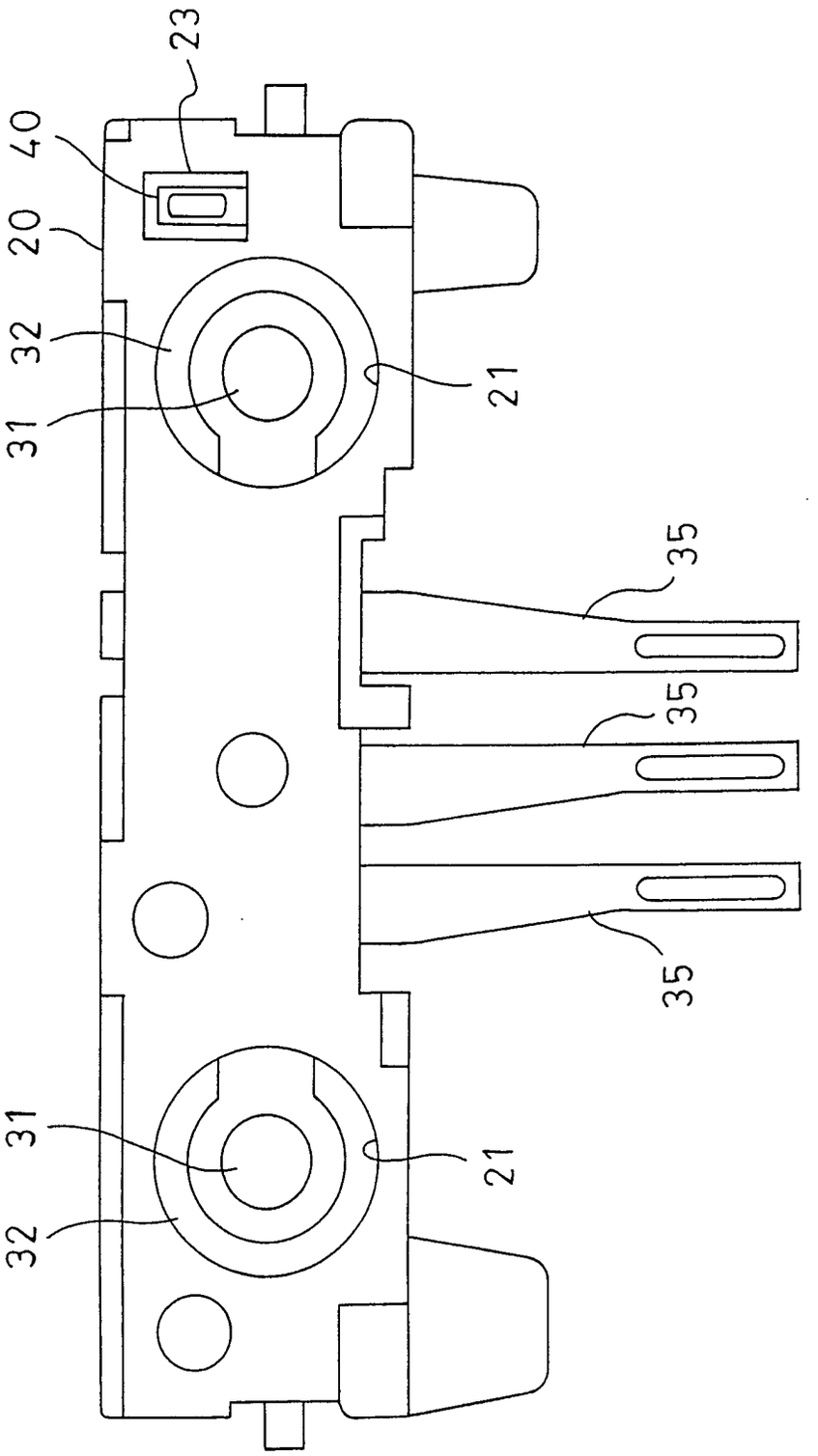


Fig. 2

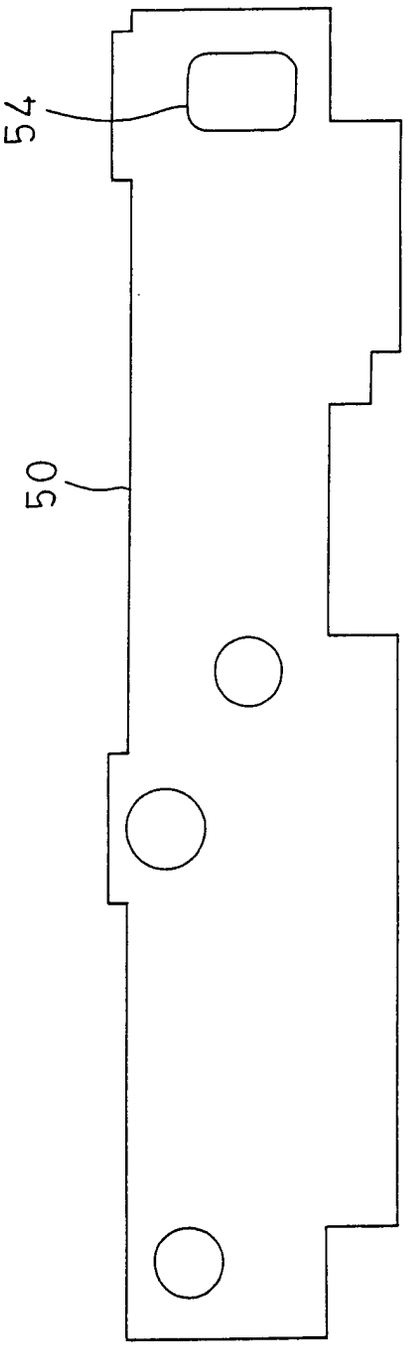
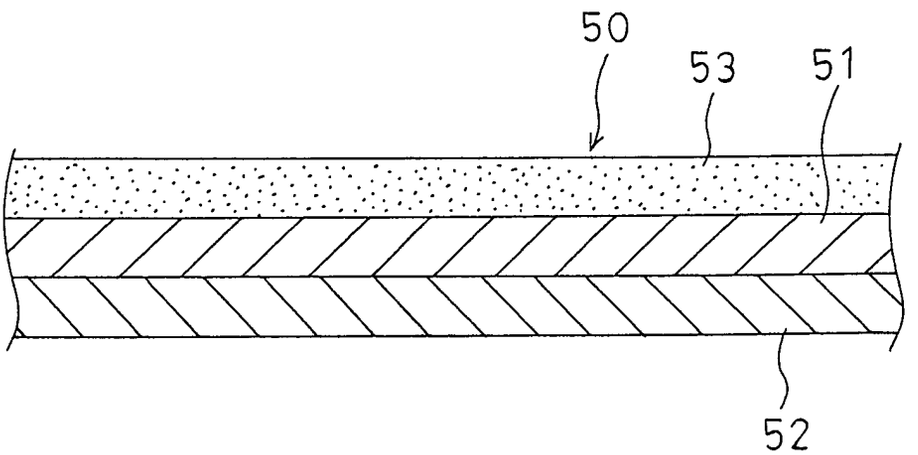


Fig. 3

Fig. 4



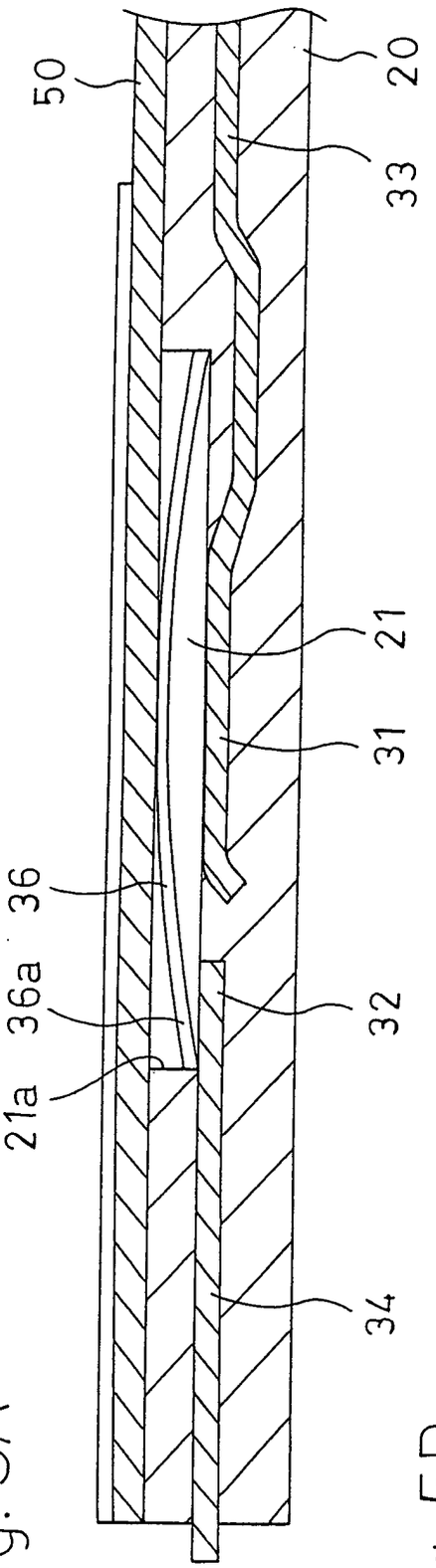


Fig. 5A

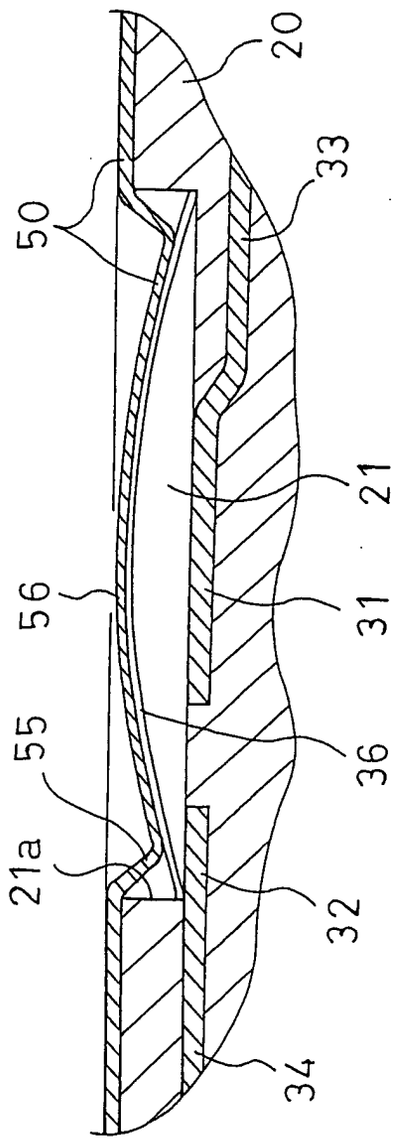


Fig. 5B

Fig. 6

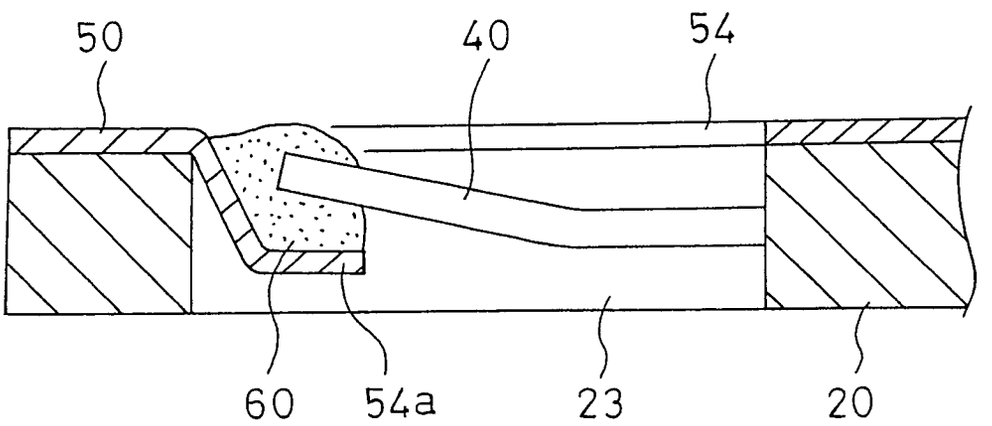


Fig. 7A

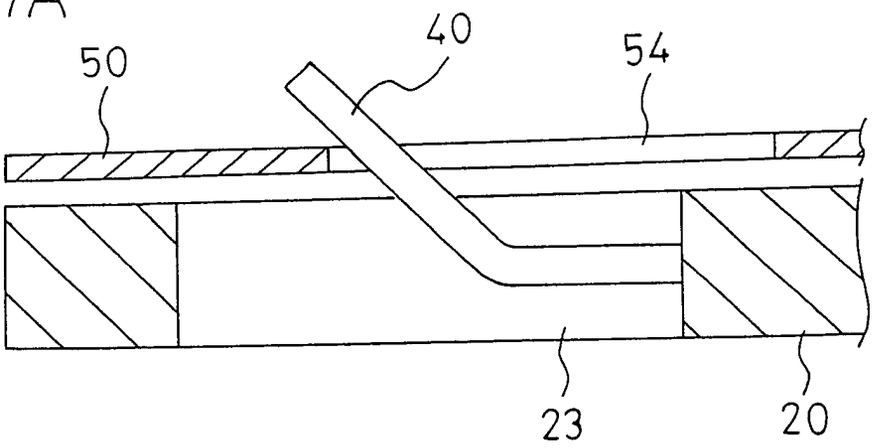


Fig. 7B

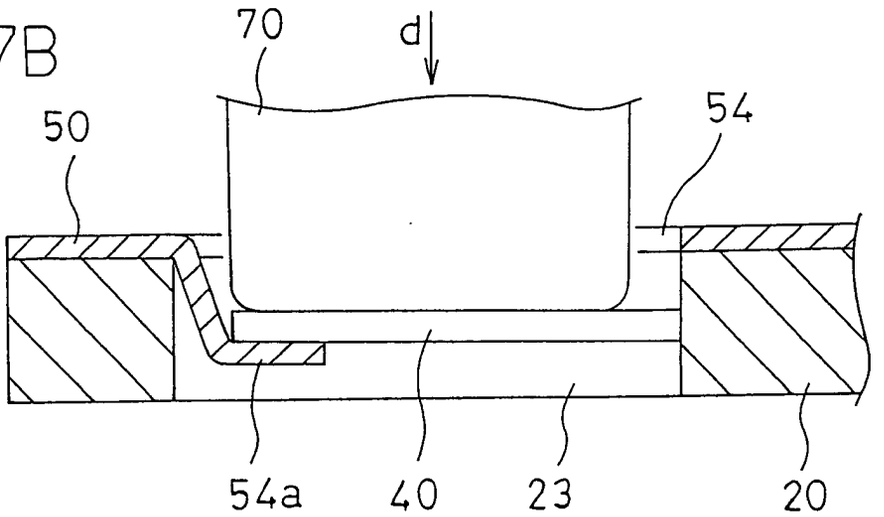


Fig. 7C

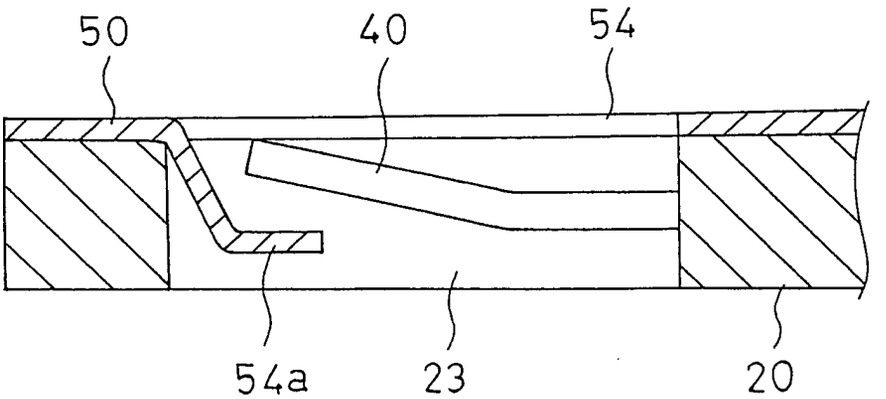
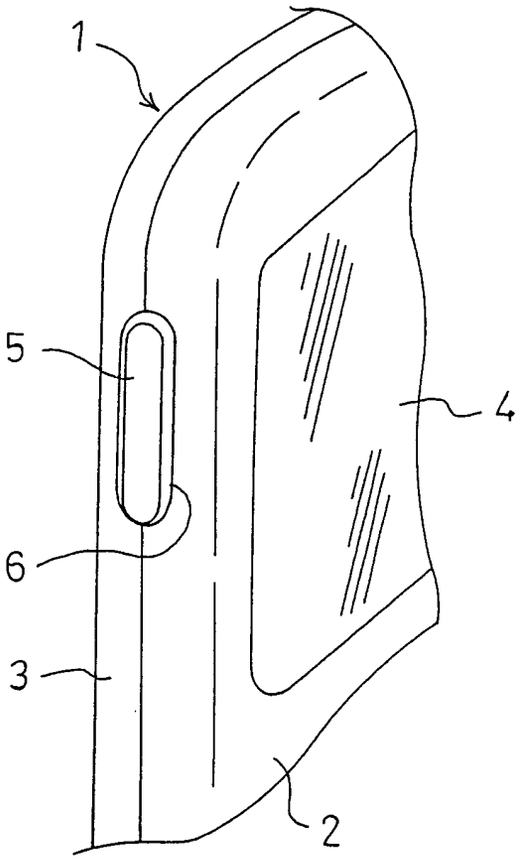


Fig. 8



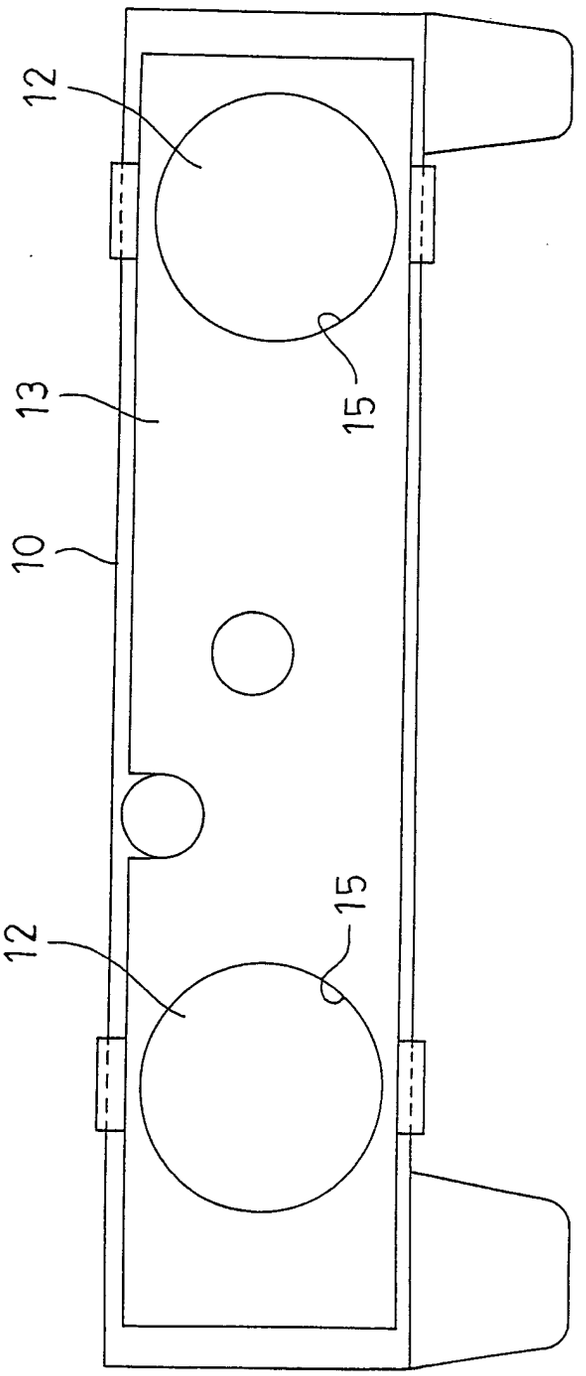


Fig. 9

European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 03 00 0276

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)
Y	EP 1 137 026 A (MATSUSHITA ELECTRIC IND CO LTD) 26 September 2001 (2001-09-26) * page 2, column 2, line 24 - page 4, column 5, line 24; figures 1,2,4 *	1-4	H01H13/70
Y	EP 1 039 493 A (SEIKO PRECISION KK) 27 September 2000 (2000-09-27) * page 2, column 2, line 34 - page 3, column 4, line 25; figures 1-3 *	1-4	
A		5,9	
A	PATENT ABSTRACTS OF JAPAN vol. 1999, no. 12, 29 October 1999 (1999-10-29) & JP 11 195343 A (MITSUMI ELECTRIC CO LTD), 21 July 1999 (1999-07-21) * abstract *	1-5,9	
A	US 6 339 200 B1 (SHI LEI ET AL) 15 January 2002 (2002-01-15) * page 6, column 3, line 39 - column 4, line 23; figure 4 *	5	TECHNICAL FIELDS SEARCHED (Int.Cl.7)
A	US 4 539 445 A (JABBEN GARY D) 3 September 1985 (1985-09-03) * page 9, column 7, line 27 - line 33; figure 2 *	5	H01H
A	US 4 681 987 A (SUWA KANAME) 21 July 1987 (1987-07-21) * page 11, column 3, line 12 - line 68; figures 1,3,5 *	5,9	
A	US 4 843 197 A (KOJIMA HISANAO ET AL) 27 June 1989 (1989-06-27) * page 24, column 9, line 15 - line 23; figure 13 *	9	

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
MUNICH	28 March 2003	Pirvulescu, M

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28-03-2003

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
EP 1137026 A	26-09-2001	JP 2001266700 A	28-09-2001
		EP 1137026 A2	26-09-2001
		US 2001022269 A1	20-09-2001
EP 1039493 A	27-09-2000	JP 11232956 A	27-08-1999
		US 6198060 B1	06-03-2001
		EP 1039493 A1	27-09-2000
JP 11195343 A	21-07-1999	NONE	
US 6339200 B1	15-01-2002	JP 2000182798 A	30-06-2000
		CN 1257326 A ,B	21-06-2000
US 4539445 A	03-09-1985	US 4461934 A	24-07-1984
US 4681987 A	21-07-1987	JP 1725843 C	19-01-1993
		JP 4014451 B	12-03-1992
		JP 59127329 A	23-07-1984
		JP 59205657 A	21-11-1984
		JP 1781673 C	13-08-1993
		JP 4073308 B	20-11-1992
		JP 59211286 A	30-11-1984
US 4843197 A	27-06-1989	JP 63116321 A	20-05-1988
		JP 63116322 A	20-05-1988
		DE 3736892 A1	11-05-1988

EPO FORM P0459

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