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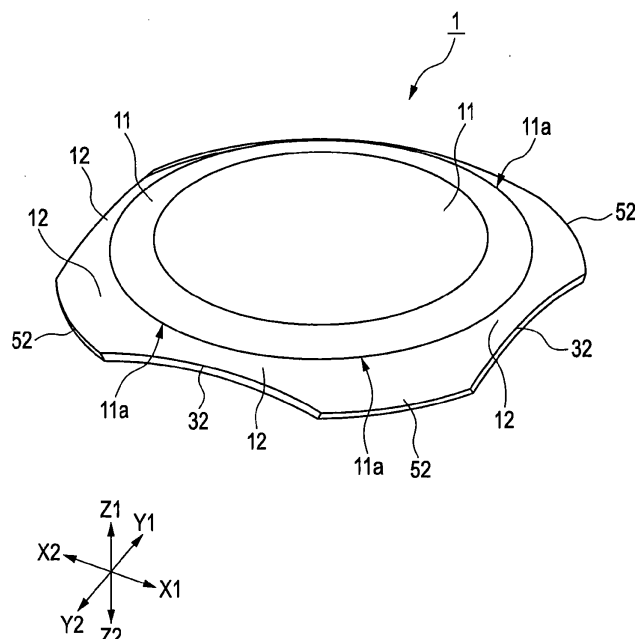
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(54) **Movable contact member and switch device using movable contact member**

(57) A movable contact member (1) includes a swelling portion (11) that swells in the shape of a dome and can operate reversely when pressed, and a skirt portion (12) that is continuously formed from an outer peripheral edge portion (11a) of the swelling portion (11). The skirt portion (12) includes cut-out portions (32) cut out at four portions thereof, portions of the skirt portion (12) except for the cut-out portions (32) form contact portions (52),

the cut-out portions (32) of the skirt portion (12) swell toward the swelling portion (11) so that portions of the skirt portion (12) except for the cut-out portions (32) form portions capable of being grounded, and a cut-out face shape (PS) of each of the cut-out portions (32) is a linear shape or a gently curved shape when the skirt portion (12) does not swell. Further, a switch device (201) is formed using the movable contact member (1).

FIG. 1



Description

CLAIM OF PRIORITY

[0001] This application claims benefit of Japanese Patent Application No. 2011-095582 filed on April 22, 2011, which is hereby incorporated by reference.

BACKGROUND OF THE INVENTION

1. Field of the Invention

[0002] The present invention relates to a movable contact member and a switch device using the movable contact member, and more particularly, to a movable contact member that operates reversely when pressed and is connected to or disconnected from a contact and a switch device using the movable contact member.

2. Description of the Related Art

[0003] In general, a movable contact member, which operates reversely when pressed and is connected to or disconnected from a contact, is used as a movable contact member used in electronic devices, such as digital cameras and mobile phones, in order to obtain an operating force or an operating feeling such as a click feeling. A movable contact member, which is formed in the shape of a dome so as to have a predetermined curvature by working a thin metal plate, has been known.

[0004] As the related art, in Japanese Unexamined Patent Application Publication No. 2000-348556, a contact spring 811 where a plurality of feet 812 protrude from the outer periphery of a dome-shaped spring 804 and a switch device 800 using the contact spring 811 are proposed as shown in Fig. 8A. Since the contact spring 811 is provided with the feet 812, the stroke of the contact spring 811 shown in Fig. 8A is larger than that of the contact spring 844 according to a preceding example shown in Fig. 8B at the time of the operation of the switch.

[0005] Further, since there is a demand for small switch devices as new electronic devices are being made small, the movable contact member has been made small. However, since the maximum outer shape of the dome has been increasingly made small as the movable contact member has been made small, there has been a problem in that a stroke at the time of the operation of a switch is not sufficiently obtained. In order to solve this problem, a movable contact member 911 shown in Fig. 9, which includes long legs 905, has been proposed in the related art (for example, see Japanese Unexamined Patent Application Publication No. 2005-332664). The stroke at the time of the operation of a switch depends on the reverse operation of a dome-shaped spring portion 904 and the legs 905. Accordingly, the longer stroke is obtained by the increase of the length of the legs 905.

[0006] However, if the legs 905 are long as in the movable contact member 911 disclosed in Japanese Unex-

amined Patent Application Publication No. 2005-332664 shown in Fig. 9, stress is concentrated on bent portions between the dome-shaped spring portion 904 and the legs 905 and the reverse operation is repeated hundreds of thousands of times. For this reason, there has been a problem in that the life of the switch is shortened due to cracks generated at borders between the spring portion 904 and the legs 905. Meanwhile, in order to lengthen the life of the switch, the feet 812 may be made extremely short as in the contact spring 811 disclosed in Japanese Unexamined Patent Application Publication No. 2000-348556 shown in Fig. 8A, or legs are not formed as in the contact spring 844 according to the preceding example shown in Fig. 8B at the time of the operation of a switch. However, as described above, there has been a problem in that the stroke is not sufficiently obtained. Further, when a contact spring having the shape of the movable contact member 911 disclosed in Japanese Unexamined Patent Application Publication No. 2005-332664 shown in Fig. 9 is used in a switch device that is generally produced in a square shape in order to increase the stroke, the maximum outer shape including the legs is larger than the maximum outer shape of the dome. For this reason, there also has been a problem in that the switch device may not be made small.

SUMMARY OF THE INVENTION

[0007] The invention provides a movable contact member of which the stroke can be increased without shortening the life of the movable contact member and which makes a switch device using the movable contact member small, and a switch device using the movable contact member.

[0008] According to a first aspect of the invention, there is provided a movable contact member that includes a swelling portion and a skirt portion. The swelling portion swells in the shape of a dome and operates reversely when pressed, and the skirt portion is continuously formed from an outer peripheral edge portion of the swelling portion. The skirt portion includes cut-out portions cut out at four portions thereof. Portions of the skirt portion except for the cut-out portions form contact portions. The cut-out portions of the skirt portion swell toward the swelling portion so that portions of the skirt portion except for the cut-out portions form portions to be grounded. A cut-out face shape of each of the cut-out portions is a linear shape or a gently curved shape when the skirt portion does not swell.

[0009] Further, according to a second aspect of the invention, in the movable contact member, among the four cut-out face shapes, the cut-out face shapes facing each other may be disposed at positions parallel to each other and the cut-out face shapes adjacent to each other may be disposed at positions orthogonal to each other.

[0010] Furthermore, according to a third aspect of the invention, in the movable contact member, the skirt portion may be continuously formed from the outer periph-

eral edge portion of the swelling portion so as to substantially correspond to a tangential direction of a tangent extending in a radial direction of the dome at the outer peripheral edge portion of the swelling portion.

[0011] Moreover, according to a fourth aspect of the invention, in the movable contact member, the skirt portion and the cut-out portions may be formed by performing plastic working accompanied by swelling after a flat plate material is cut along the outer shapes of the skirt portion and the cut-out portions.

[0012] Further, according to a fifth aspect of the invention, there is provided a switch device that includes the movable contact member according to any one of the first to fourth aspects, a switch base, a central stationary contact, and peripheral stationary contacts. The switch base includes a receiving portion in which the movable contact member is received. The central stationary contact is provided in the receiving portion and connected to or disconnected from the swelling portion. The peripheral stationary contacts are provided in the receiving portion and come into electrical contact with at least one of the contact portions.

[0013] According to the first aspect of the invention, in the movable contact member, the skirt portion includes the cut-out portions cut out at four portions thereof and the skirt portion is continuously formed from the outer peripheral edge portion of the swelling portion. Accordingly, it is possible to reduce the concentration of stress on the cut-out portions or the outer peripheral edge portion at the time of the reverse operation of the movable contact member as compared to a case where cut-out portions are formed at a part of a swelling portion or a case where legs are formed at a swelling portion (Japanese Unexamined Patent Application Publication No. 2005-332664). Therefore, it is possible to suppress cracks generated at the movable contact member and to lengthen the life of the movable contact member. In addition, since the skirt portion supports the swelling portion, it is possible to increase the stroke of the movable contact member by the skirt portion as compared to a case where legs are not formed or a case where legs are extremely short (Japanese Unexamined Patent Application Publication No. 2000-348556). Accordingly, it is possible to provide the movable contact member of which the stroke is increased without the shortening of the life of the movable contact member.

[0014] According to the second aspect of the invention, in the movable contact member, among the four cut-out face shapes, the cut-out face shapes facing each other are disposed at positions parallel to each other and the cut-out face shapes adjacent to each other are disposed at positions orthogonal to each other in plan view. Accordingly, a cut-out outer shape where the cut-out face shapes extend and are connected to each other is a quadrangular shape (substantially square shape). For this reason, it is possible to distribute stress, which is generated at the cut-out portions or the outer peripheral edge portion, with a good balance at the time of the re-

verse operation of the movable contact member. Accordingly, it is possible to further suppress cracks generated at the movable contact member and to further lengthen the life of the movable contact member.

[0015] According to the third aspect of the invention, in the movable contact member, the skirt portion is continuously formed from the outer peripheral edge portion of the swelling portion so as to substantially correspond to the tangential direction of a tangent extending in the radial direction of the dome. Accordingly, as compared to a case where the swelling portion and the skirt portion are connected to each other with inflection points, fullcrums at the time of the reversing of the swelling portion are not formed at the inflection points when the movable contact member operates reversely. Therefore, stress is not concentrated on the outer peripheral edge portion of the swelling portion. As a result, it is possible to further suppress the generation of cracks of the movable contact member caused by the concentration of stress, and to further lengthen the life of the movable contact member.

[0016] According to the fourth aspect of the invention, in the movable contact member, plastic working (drawing) accompanied by swelling is performed after a flat plate material is cut (shaping) along the outer shapes of the skirt portion and the cut-out portions. Accordingly, it is possible to suppress the generation of cracks of the swelling portion or the generation of strain, deformation, or the like of the swelling portion, which is caused by cutting, as compared to a case where the shaping (cutting) of the skirt portion and the cut-out portions is performed after the drawing of the swelling portion.

[0017] According to the fifth aspect of the invention, the switch device is a switch device using the movable contact member according to any one of the first to fourth aspects. Accordingly, a switch device of which the stroke is long and which can be made small is obtained. Further, since the life of the movable contact member is lengthened, it is also possible to lengthen the life of the switch device.

BRIEF DESCRIPTION OF THE DRAWINGS

[0018]

Fig. 1 is a perspective view of a movable contact member according to a first embodiment of the invention;

Fig. 2 is a view showing the movable contact member according to the first embodiment of the invention, Fig. 2A is a top view, and Fig. 2B is a side view;

Fig. 3 is a view showing the movable contact member according to the first embodiment of the invention, Fig. 3A is a cross-sectional view taken along a line III-III shown in Fig. 2A, and Fig. 3B is an enlarged cross-sectional view of a portion P shown in Fig. 3A; Fig. 4 is a perspective view of a switch device according to a second embodiment of the invention; Fig. 5 is an exploded perspective view of the switch

device according to the second embodiment of the invention;

Fig. 6 is a view showing the switch device according to the second embodiment of the invention, Fig. 6A is a top view of a switch base, and Fig. 6B is a plan view showing that the movable contact member is placed on the switch base;

Fig. 7 is a view showing a modification of the movable contact member according to the first embodiment of the invention, Fig. 7A is an enlarged cross-sectional view of a first modification of the enlarged cross-sectional view of the movable contact member shown in Fig. 3B, and Fig. 7B is an enlarged cross-sectional view of a second modification of the enlarged cross-sectional view shown in Fig. 3B;

Fig. 8A is a top view of a switch device disclosed in Japanese Unexamined Patent Application Publication No. 2000-348556, and Fig. 8B is a top view of a switch device that shows a contact spring according to a preceding example disclosed in Japanese Unexamined Patent Application Publication No. 2000-348556; and

Fig. 9 is a perspective view of a movable contact member disclosed in Japanese Unexamined Patent Application Publication No. 2005-332664.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0019] Embodiments of the invention will be described in detail below with reference to accompanying drawings.

[First embodiment]

[0020] Fig. 1 is a perspective view of a movable contact member 1 according to a first embodiment of the invention. Fig. 2 is a view showing the movable contact member 1 according to the first embodiment of the invention, Fig. 2A is a top view, and Fig. 2B is a side view. Fig. 3 is a view showing the movable contact member 1 according to the first embodiment of the invention, Fig. 3A is a cross-sectional view taken along a line III-III shown in Fig. 2A, and Fig. 3B is an enlarged cross-sectional view of a portion P shown in Fig. 3A.

[0021] As shown in Fig. 1, the movable contact member 1 is formed of a conductive metal plate. The movable contact member 1 includes a swelling portion 11 that operates reversely when pressed, and a skirt portion 12 that is continuously formed from an outer peripheral edge portion 11a of the swelling portion 11. Accordingly, since the skirt portion 12 is formed so as to continue to an outer peripheral edge portion 11a of the swelling portion 11, the skirt portion 12 supports the swelling portion 11.

[0022] As shown in Fig. 2, the swelling portion 11 swells upward (in a Z1 direction shown in Fig. 1) in the shape of a dome and is formed so as to be curved at a predetermined curvature in an area that corresponds to a circle having a predetermined diameter $\phi 1$ of the dome. Further, the swelling portion 11 is formed so as to be

curved at a predetermined curvature even in an area between the circle having the predetermined diameter $\phi 1$ and the circle having the maximum diameter $\phi 2$ of the dome.

[0023] Further, the skirt portion 12, which is formed so as to continue to the outer peripheral edge portion 11a of the swelling portion 11, is formed so as to be inclined at a predetermined angle. In this case, as shown in Figs. 2A, 2B, and 3B, the skirt portion 12 is continuously formed from the outer peripheral edge portion 11a of the swelling portion 11 so as to substantially correspond to a tangential direction SD of a tangent extending in a radial direction DD of the dome at the outer peripheral edge portion 11a of the swelling portion 11. That is, since the skirt portion 12 is smoothly connected to the swelling portion 11, bent portions are not formed on the border between the skirt portion 12 and the swelling portion 11 and fulcrums at the time of the reversing of the swelling portion are not formed on the border.

[0024] Furthermore, as shown in Figs. 1 to 3B, the skirt portion 12 includes cut-out portions 32 cut out at four portions facing each other with the swelling portion 11 interposed therebetween, and portions of the skirt portion 12 except for the cut-out portions 32 form contact portions 52. Moreover, the cut-out portions 32 of the skirt portion 12 swell toward the swelling portion 11 (see Fig. 2B) so that portions of the skirt portion 12 except for the cut-out portions 32 form portions capable of being grounded. Further, connecting portions 42 between the cut-out portions 32 and the contact portions 52 of the skirt portion 12 are bent and connected. Furthermore, the maximum outer shape MS of the contact portions 52 of the skirt portion 12 in plan view is a circular shape having a diameter $\phi 3$. Meanwhile, the shape of each of the contact portions 52 of the skirt portion 12 is an arc shape but may be a linear shape.

[0025] As shown in Fig. 2A, a cut-out face shape PS of each of the cut-out portions 32 in plan view is a linear shape. In particular, among the cut-out face shapes PS formed at all sides of the skirt portion, the cut-out face shapes PS facing each other are disposed at positions parallel to each other and the cut-out face shapes PS adjacent to each other are disposed at positions orthogonal to each other. Accordingly, a cut-out outer shape OS where the cut-out face shapes PS extend and are connected to each other is a quadrangular shape (substantially square shape). Moreover, a distance DS between a pair of cut-out portions 32 is larger than the maximum diameter $\phi 2$ of the dome of the swelling portion 11. The cut-out face shape PS of the first embodiment of the invention has been a substantially linear shape, but may be a gently curved shape.

[0026] In the movable contact member 1 according to the first embodiment of the invention having the above-mentioned structure, the four cut-out portions 32 are formed only at the skirt portion 12 so that the entire swelling portion 11 remains, and the skirt portion 12 is continuously formed from the peripheral edge portion 11a of

the swelling portion 11. Accordingly, it is possible to reduce the concentration of stress on the cut-out portions 32 or the outer peripheral edge portion 11a at the time of the reverse operation of the movable contact member 1 as compared to a case where cut-out portions are formed at a part of a swelling portion or a case where legs are formed at a swelling portion (Japanese Unexamined Patent Application Publication No. 2005-332664). Therefore, it is possible to suppress cracks generated at the movable contact member 1 and to lengthen the life of the movable contact member 1. In addition, since the skirt portion 12 supports the swelling portion 11, it is possible to increase the stroke of the movable contact member 1 by the skirt portion 12 as compared to a case where legs are not formed or a case where legs are extremely short (Japanese Unexamined Patent Application Publication No. 2000-348556).

[0027] Further, since the cut-out outer shape OS where the cut-out face shapes PS extend and are connected to each other is a quadrangular shape (substantially square shape) in the movable contact member 1 according to the first embodiment of the invention, it is possible to distribute stress, which is generated at the cut-out portions 32 or the outer peripheral edge portion 11a, with a good balance at the time of the reverse operation of the movable contact member 1. Accordingly, it is possible to further suppress cracks generated at the movable contact member 1 and to further lengthen the life of the movable contact member 1. In addition, as compared to a case where long legs are formed at a swelling portion (Japanese Unexamined Patent Application Publication No. 2005-332664), it is possible to make the maximum outer shape (cut-out outer shape OS) of the movable contact member 1 small and to make the movable contact member 1 compact without shortening the stroke of the movable contact member 1.

[0028] The cut-out outer shape OS has been formed so that the cut-out portions 32 are disposed at the portion of the skirt portion 12 larger than the diameter $\phi 2$ of the dome of the swelling portion 11 and smaller than the diameter $\phi 3$ of the maximum outer shape MS of the skirt portion 12. However, it is preferable that the cut-out portions 32 be disposed near the middle between the diameter $\phi 2$ of the dome and the diameter $\phi 3$ of the maximum outer shape MS. For example, when the cut-out portions 32 are disposed near the diameter $\phi 2$ of the dome of the swelling portion 11, stress is apt to be concentrated due to the cut-out portions 32. For this reason, there is a concern that the life of the movable contact member 1 may be shortened. For example, when the cut-out portions 32 are disposed near the diameter $\phi 3$ of the maximum outer shape MS, the grounded portions of the contact portions 52 of the skirt portion 12 become narrow. For this reason, there is a concern that the contact portions 52 may not be uniformly grounded or a concern that the abrasion of a corresponding contact (for example, a stationary contact) may increase.

[0029] Further, in the movable contact member 1 ac-

cording to the first embodiment of the invention, the skirt portion 12 is continuously formed from the outer peripheral edge portion 11a of the swelling portion 11 so as to substantially correspond to the tangential direction SD of a tangent extending in the radial direction DD of the dome. Accordingly, as compared to a case where the swelling portion 11 and the skirt portion 12 are connected to each other with inflection points, fulcrums at the time of the reversing of the swelling portion are not formed at the inflection points when the movable contact member 1 operates reversely. Therefore, stress is not concentrated on the outer peripheral edge portion 11a of the swelling portion 11. As a result, it is possible to further suppress the generation of cracks of the movable contact member 1 caused by the concentration of stress, and to further lengthen the life of the movable contact member 1.

[0030] A method of manufacturing the movable contact member 1 is a method of performing the shaping and drawing of a flat plate material, which is made of a metal material, by a press die. However, in the method, plastic working (drawing) accompanied by swelling is performed after the flat plate material is cut (shaping) along the outer shapes of the skirt portion 12 and the cut-out portions 32 at the beginning. Accordingly, it is possible to suppress the generation of cracks of the swelling portion 11 or the generation of the strain, deformation, or the like of the swelling portion 11, which is caused by cutting, as compared to a case where the shaping (cutting) of the skirt portion 12 and the cut-out portions 32 is performed after the drawing of the swelling portion 11.

[0031] Moreover, when the skirt portion 12 does not swell, that is, when the skirt portion 12 has been subjected to shaping and is not yet subjected to drawing, the cut-out face shape PS of each of the cut-out portions 32 is a linear shape or a gently curved shape but it is preferable that the cut-out face shape PS of the cut-out portion 32 be a shape slightly bulging outward. Since the middle portion of the cut-out face shape PS of the cut-out portion 32 is curved toward the swelling portion 11 by the subsequent drawing, the reason why the cut-out face shape PS of each of the cut-out portions 32 is set to a shape slightly bulging outward is to make the cut-out outer shape OS after drawing be a quadrangular shape (substantially square shape). Accordingly, it is possible to distribute stress, which is generated at the cut-out portions 32 or the outer peripheral edge portion 11a, with a good balance at the time of the reverse operation of the movable contact member 1. Therefore, it is possible to further suppress cracks generated at the movable contact member 1 and to further lengthen the life of the movable contact member 1.

[0032] As described above, in the movable contact member 1 according to the first embodiment of the invention, the skirt portion 12 includes the cut-out portions 32 cut out at four portions thereof and the skirt portion 12 is formed so as to continue to the peripheral edge portion 11a of the swelling portion 11. Accordingly, it is possible to reduce the concentration of stress on the cut-

out portions 32 or the outer peripheral edge portion 11a at the time of the reverse operation of the movable contact member 1 as compared to a case where cut-out portions are formed at a part of a swelling portion or a case where legs are formed at a swelling portion (Japanese Unexamined Patent Application Publication No. 2005-332664). Therefore, it is possible to suppress cracks generated at the movable contact member 1 and to lengthen the life of the movable contact member 1. In addition, since the skirt portion 12 supports the swelling portion 11, it is possible to increase the stroke of the movable contact member 1 by the skirt portion 12 as compared to a case where legs are not formed or a case where legs are extremely short (Japanese Unexamined Patent Application Publication No. 2000-348556). Accordingly, it is possible to provide the movable contact member 1 of which the stroke is increased without the shortening of the life of the movable contact member 1.

[0033] Further, in plan view, among the cut-out face shapes PS formed at all sides of the skirt portion, the cut-out face shapes PS facing each other are disposed at positions parallel to each other and the cut-out face shapes PS adjacent to each other are disposed at positions orthogonal to each other. Accordingly, a cut-out outer shape OS where the cut-out face shapes PS extend and are connected to each other is a quadrangular shape (substantially square shape). For this reason, it is possible to distribute stress, which is generated at the cut-out portions 32 or the outer peripheral edge portion 11a, with a good balance at the time of the reverse operation of the movable contact member 1. Therefore, it is possible to further suppress cracks generated at the movable contact member 1 and to further lengthen the life of the movable contact member 1.

[0034] Furthermore, the skirt portion 12 is continuously formed from the outer peripheral edge portion 11a of the swelling portion 11 so as to substantially correspond to the tangential direction SD of a tangent extending in the radial direction DD of the dome. Accordingly, as compared to a case where the swelling portion 11 and the skirt portion 12 are connected to each other with inflection points, fulcrums at the time of the reversing of the swelling portion are not formed at the inflection points when the movable contact member 1 operates reversely. As a result, stress is not concentrated on the outer peripheral edge portion 11a of the swelling portion 11. Accordingly, it is possible to further suppress the generation of cracks of the movable contact member 1 caused by the concentration of stress, and to further lengthen the life of the movable contact member 1.

[0035] Moreover, plastic working (drawing) accompanied by swelling is performed after the flat plate material is cut (shaping) along the outer shapes of the skirt portion 12 and the cut-out portions 32. Accordingly, it is possible to suppress the generation of cracks of the swelling portion 11 or the generation of the strain, deformation, or the like of the swelling portion 11, which is caused by cutting, as compared to a case where the shaping (cut-

ting) of the skirt portion 12 and the cut-out portions 32 is performed after the drawing of the swelling portion 11.

[Second embodiment]

[0036] Fig. 4 is a perspective view of a switch device 201 according to a second embodiment of the invention. Fig. 5 is an exploded perspective view of the switch device 201 according to the second embodiment of the invention. Fig. 6 is a view showing the switch device 201 according to the second embodiment of the invention, Fig. 6A is a top view of a switch base 4, and Fig. 6B is a plan view showing that the movable contact member 1 is placed on the switch base 4. Further, the same components as the components of the first embodiment will be denoted by the same reference numerals, and the detailed description thereof will be omitted.

[0037] As shown in Figs. 4 to 6, the switch device 201 according to the second embodiment of the invention includes the movable contact member 1 according to the first embodiment of the invention, a switch base 4 including a receiving portion 14 in which the movable contact member 1 is received, a central stationary contact 3 that is connected to or disconnected from the swelling portion 11 of the movable contact member 1, and peripheral stationary contacts 5 that come into electrical contact with at least one of the contact portions 52 of the movable contact member 1. In addition, the switch device 201 includes an operating member 6 that causes the movable contact member 1 to operate reversely by a pressing operation, and a cover 9 that is mounted on the switch base 4 covering the receiving portion 14 of the switch base 4.

[0038] The switch base 4 is made of an insulating material such as a synthetic resin, and is formed in the shape of a box which includes the concave receiving portion 14 therein and of which the outer shape is a quadrangular shape and the upper surface is opened as shown in Figs. 4 to 6. The movable contact member 1 is placed in the receiving portion 14 as shown in Fig. 6B so as to be received in the receiving portion 14. Further, since the shape of the receiving portion 14 is a quadrangular shape so as to correspond to the outer shape of the movable contact member 1, it is possible to make the switch base 4 small as compared to a case where the movable contact member 911 disclosed in Japanese Unexamined Patent Application Publication No. 2005-332664 is used. Accordingly, it is possible to produce the switch device 201 with a small size.

[0039] As shown in Fig. 6A, the central stationary contact 3 made of a conductive metal material is disposed at the center of the inner bottom surface of the receiving portion 14 so that the upper surface of the central stationary contact 3 is exposed to the outside. Accordingly, when the movable contact member 1 operates reversely by a pressing operation, the central stationary contact 3 comes into electrical contact with the back side (the side corresponding to the Z2 side shown in Fig. 5) of the swell-

ing portion 11 of the movable contact member 1. Moreover, likewise, the peripheral stationary contacts 5 made of a conductive metal material are disposed at four corner positions on the inner bottom surface of the receiving portion 14 so that the upper surfaces of the peripheral stationary contacts 5 are exposed to the outside. When the movable contact member 1 is placed so as to be received in the receiving portion 14, the peripheral stationary contacts 5 come into electrical contact with at least one of the contact portions 52 of the movable contact member 1. The disposition of the central stationary contact 3 and the peripheral stationary contacts 5 into the receiving portion 14 of the switch base 4 is simultaneously performed by insert molding when the switch base 4 is formed.

[0040] Further, as shown in Figs. 4 to 6, connection terminals 3a led out of the central stationary contact 3 and connection terminals 5c led out of the peripheral stationary contacts 5 are formed at two sides, which face each other, of the bottom wall of the switch base 4, so as to protrude outward for the purpose of the connection to a circuit board of a device or the like.

[0041] The operating member 6 is made of, for example, a synthetic resin material, includes a convex operating portion 6s to be pressed as shown in Figs. 4 and 5, and is disposed on the upper side (Z1 side) of the movable contact member 1. When the operating portion 6s is pressed, the swelling portion 11 of the movable contact member 1 disposed on the lower side (Z2 side) is pushed. Accordingly, it is possible to make the movable contact member 1 be reversely operated.

[0042] The cover 9 is produced using, for example, a metal plate, and is formed in the shape of a substantially square plate in top view. Further, a large operation opening portion 9k through which the operating portion 6s of the operating member 6 is exposed to the outside is formed at the center of the cover 9 as shown in Figs. 4 and 5. Furthermore, L-shaped locking pawls 19 are formed at the four corners of the cover 9. The locking pawls 19 are engaged with positioning protrusions 4t formed on the switch base 4, so that the cover 9 is positioned on the switch base 4 from front to back and from side to side. Meanwhile, the cover 9 has been produced by performing the pressing (shaping, punching, and the like) of a metal plate. However, the cover 9 is not limited to a metal material and may be produced by injection molding with a synthetic resin material.

[0043] Since the switch device 201 according to the second embodiment of the invention having the above-mentioned structure is formed using the movable contact member 1 according to the first embodiment of the invention, a switch device 201 of which the stroke is long and which can be produced with a small size is obtained. Further, since the life of the movable contact member 1 is lengthened, it is also possible to lengthen the life of the switch device 201.

[0044] Meanwhile, the invention is not limited to the above-mentioned embodiments, and may be modified,

for example, as described below. These embodiments also pertain to the scope of the invention.

[0045] Fig. 7 is a view showing a modification of the movable contact member 1 according to the first embodiment of the invention, Fig. 7A is an enlarged cross-sectional view of a first modification of the enlarged cross-sectional view of the movable contact member 1 shown in Fig. 3B, and Fig. 7B is an enlarged cross-sectional view of a second modification of the enlarged cross-sectional view shown in Fig. 3B.

<First modification >

[0046] In the above-mentioned embodiments, the grounded portions of the contact portions 52 of the movable contact member 1 have been formed linearly and inclined. However, grounded portions of contact portions C62 may be curved as shown in Fig. 7A. For this reason, it is possible to reduce the abrasion of peripheral stationary contacts 5 and the contact portions C62 that is caused by the repetition of the reverse operation of a movable contact member C11. Accordingly, it is possible to further lengthen the life of the switch device.

<Second modification>

[0047] In the above-mentioned embodiments, the skirt portion 12 of the movable contact member 1 where the contact portions 52 have been formed linearly and inclined. However, bent portions KK, which are folded upward, may be formed at the skirt portion C22 as shown in Fig. 7B. Accordingly, it is possible to increase the stroke of a movable contact member C21.

<Third modification>

[0048] Several small convex protrusions may be formed on the back side (the side coming into contact with the central stationary contact 3) of the swelling portion 11 of the movable contact member 1 according to the above-mentioned embodiment. For this reason, it is possible to reliably make the movable contact member and the central stationary contact 3 come into contact with each other without affecting the reverse operation of the movable contact member, and to reduce contact failures caused by abrasion powder. Accordingly, the life of the movable contact member and the switch device using the movable contact member is lengthened.

<Fourth modification>

[0049] In the above-mentioned embodiments, the connecting portions 42 (see Fig. 2B) between the cut-out portions 32 and the contact portions 52 of the skirt portion 12 have been bent and connected. However, it is more preferable that the connecting portions 42 be moderately connected. Accordingly, stress applied to the connecting portions is reduced, so that it is possible to lengthen the

life of the movable contact member 1.

<Fifth modification>

[0050] A film made of a synthetic resin having flexibility may be disposed between the movable contact member 1 and the operating member 6 of the second embodiment so as to cover the receiving portion 14. It is possible to prevent dust from escaping from the receiving portion 14 of the movable contact member 1, to prevent dust from entering the receiving portion 14, or to prevent static electricity by the film.

<Sixth modification>

[0051] In the second embodiment, the operating member 6 has been used to make the movable contact member 1 operate reversely. However, the movable contact member 1 may be directly pushed by a finger without the operating member 6.

[0052] The invention is not limited to the above-mentioned embodiments, and may have various modifications without departing from the scope of the invention.

[0053] It should be understood by those skilled in the art that various modifications, combinations, sub-combinations and alterations may occur depending on design requirements and other factors insofar as they are within the scope of the appended claims or the equivalents thereof.

Claims

1. A movable contact member comprising:

a swelling portion (11) that swells in the shape of a dome and operates reversely when pressed; and
a skirt portion (12 or C22) that is continuously formed from an outer peripheral edge portion (11a) of the swelling portion,

wherein the skirt portion includes cut-out portions (32) cut out at four portions thereof, portions of the skirt portion except for the cut-out portions form contact portions (52 or C62), the cut-out portions of the skirt portion swell toward the swelling portion so that portions of the skirt portion except for the cut-out portions form portions to be grounded, and
a cut-out face shape (PS) of each of the cut-out portions is a linear shape or a gently curved shape when the skirt portion does not swell.

2. The movable contact member according to claim 1, wherein among the four cut-out face shapes, the cut-out face shapes facing each other are disposed at positions parallel to each other and the cut-out face

shapes adjacent to each other are disposed at positions orthogonal to each other.

3. The movable contact member according to claim 1 or 2, wherein the skirt portion is continuously formed from the outer peripheral edge portion of the swelling portion so as to substantially correspond to a tangential direction (SD) of a tangent extending in a radial direction (DD) of the dome at the outer peripheral edge portion of the swelling portion.

4. The movable contact member according to claim 3, wherein the skirt portion and the cut-out portions are formed by performing plastic working accompanied by swelling after a flat plate material is cut along the outer shapes of the skirt portion and the cut-out portions.

5. A switch device comprising:

the movable contact member (1, C11, or C21) according to any one of claims 1 to 4;
a switch base (4) including a receiving portion (14) in which the movable contact member is received;
a central stationary contact (3) that is provided in the receiving portion and connected to or disconnected from the swelling portion; and
peripheral stationary contacts (5) that are provided in the receiving portion and come into electrical contact with at least one of the contact portions.

FIG. 1

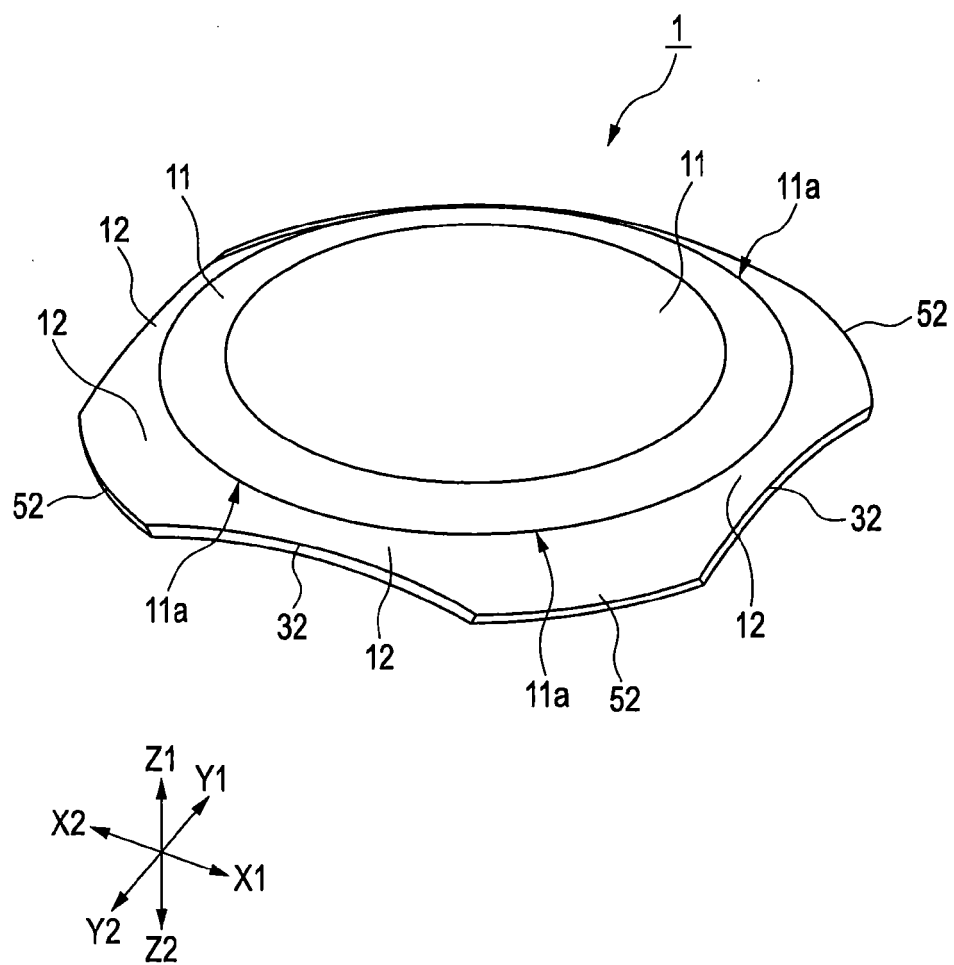


FIG. 2A

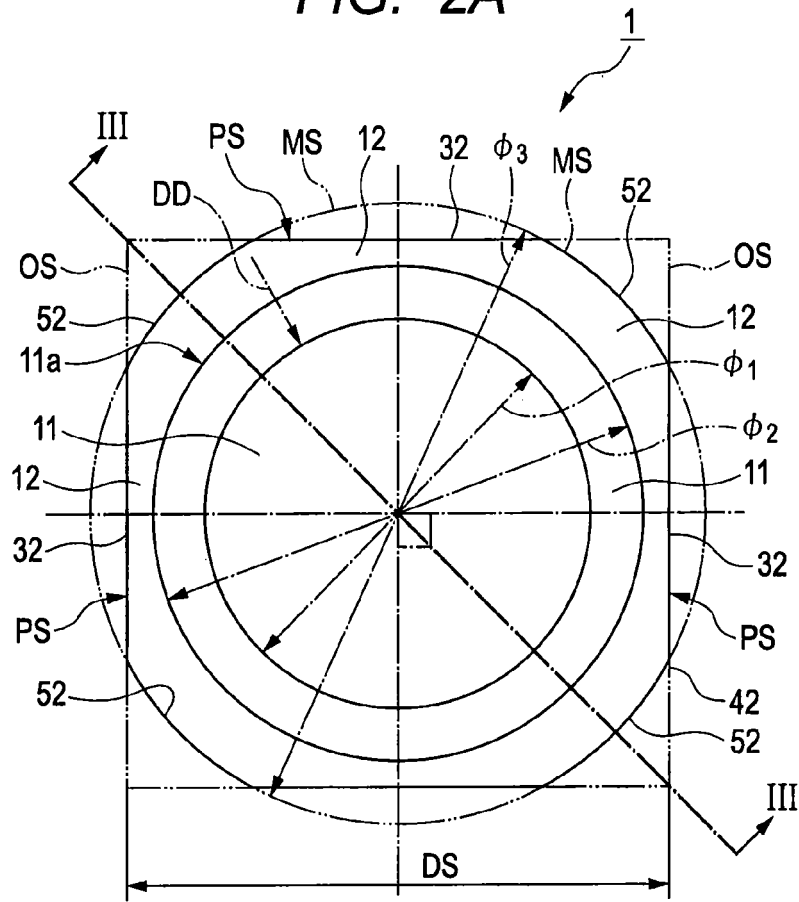


FIG. 2B

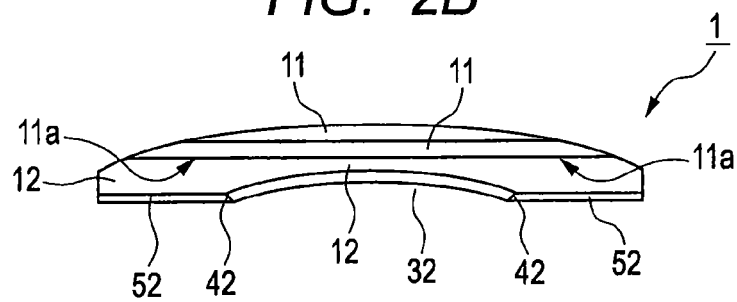


FIG. 3A

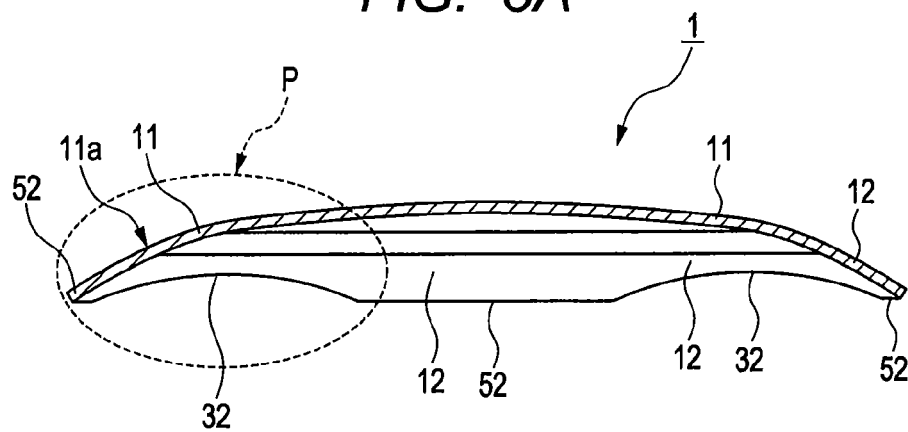


FIG. 3B

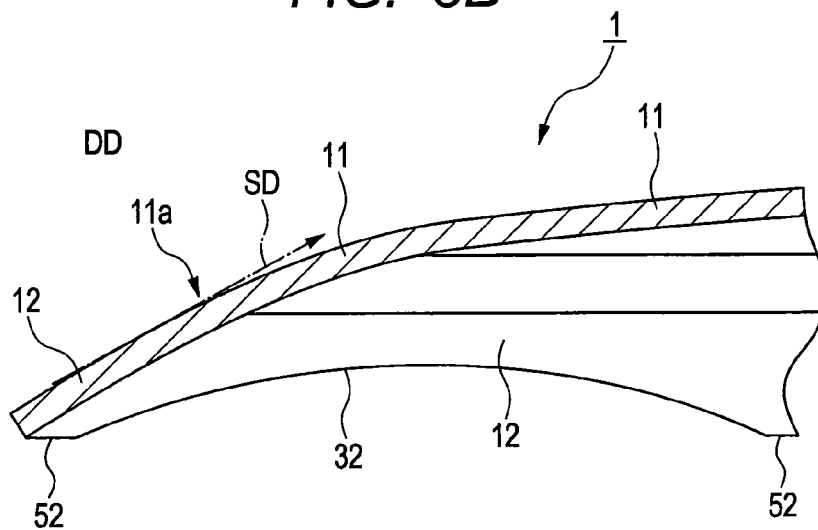


FIG. 4

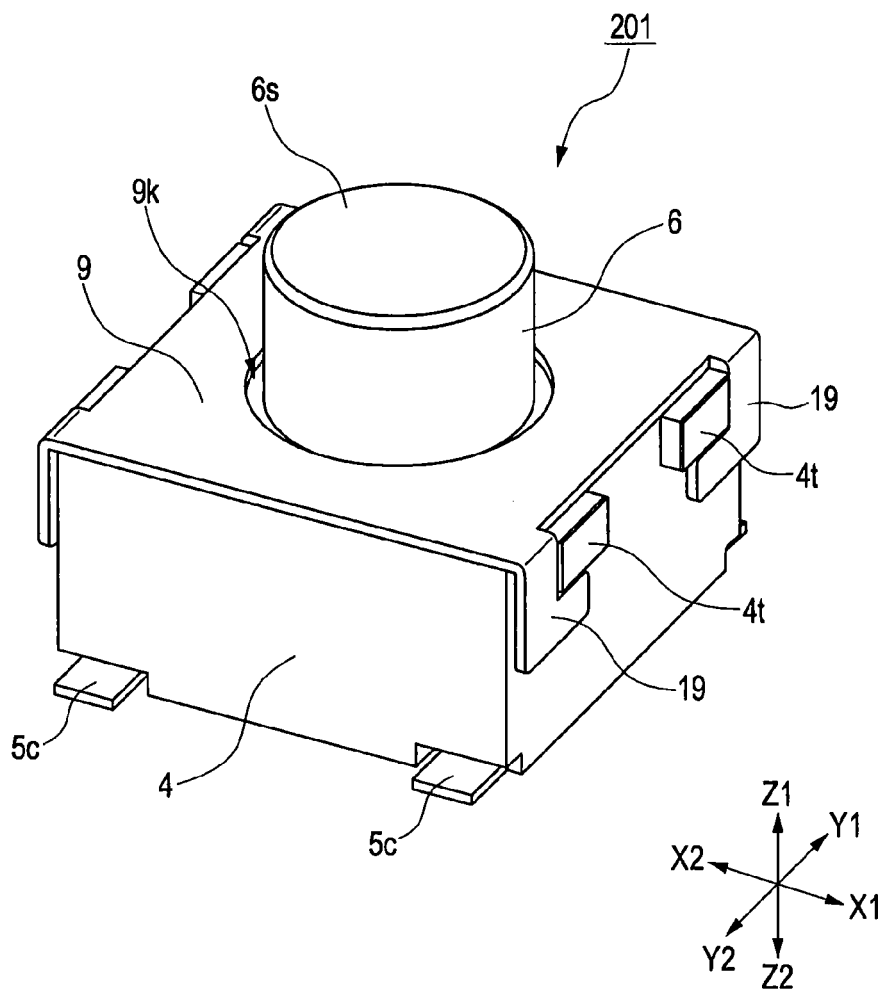


FIG. 5

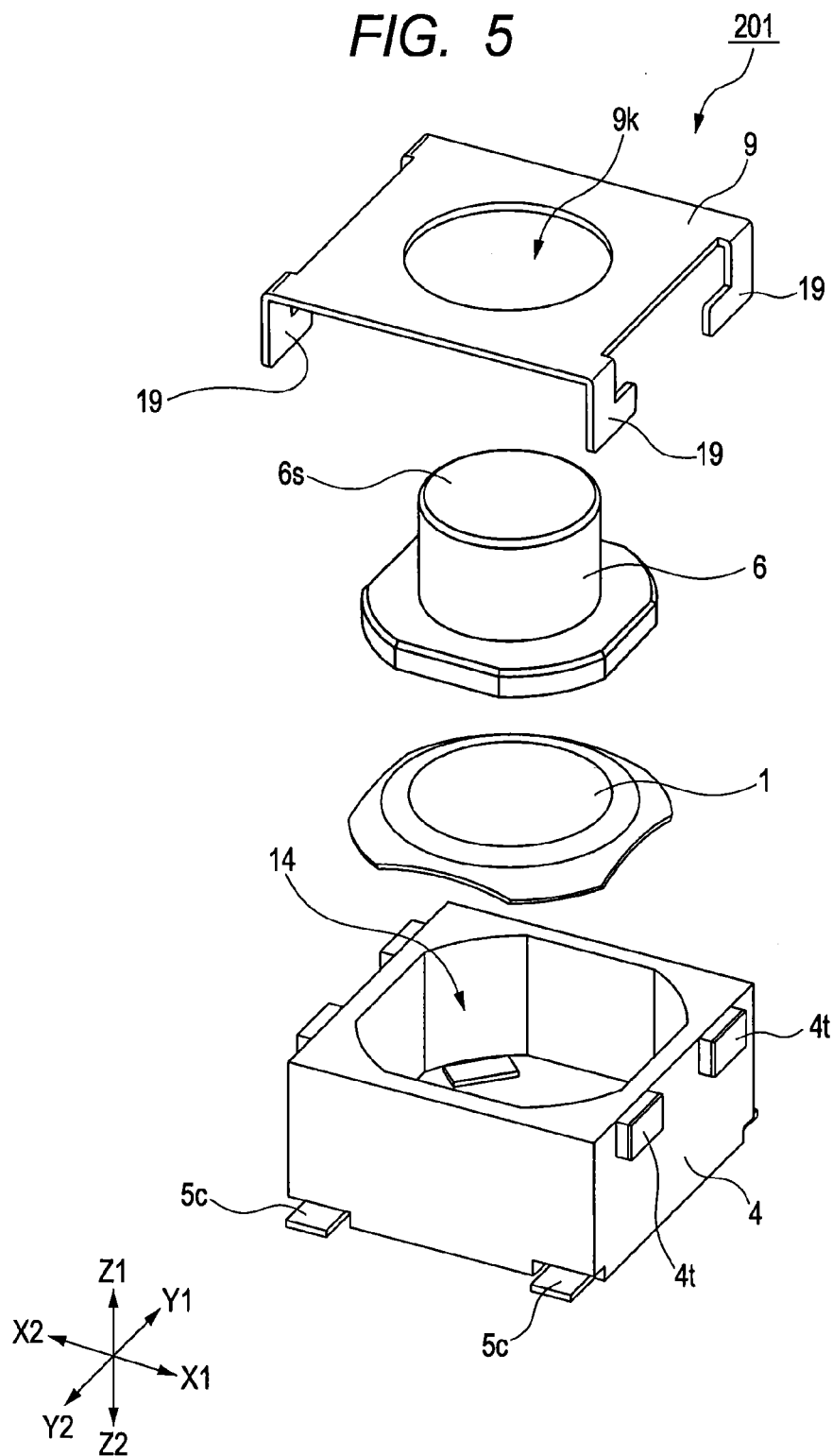


FIG. 6A

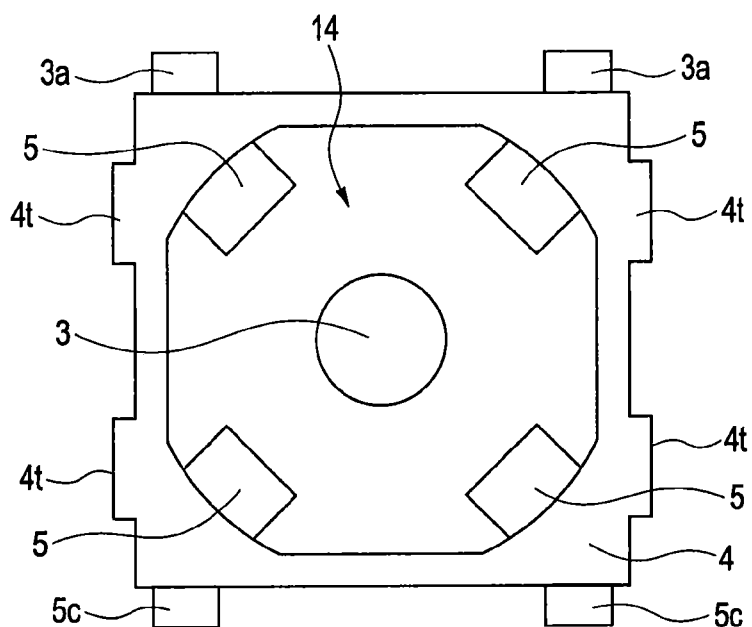


FIG. 6B

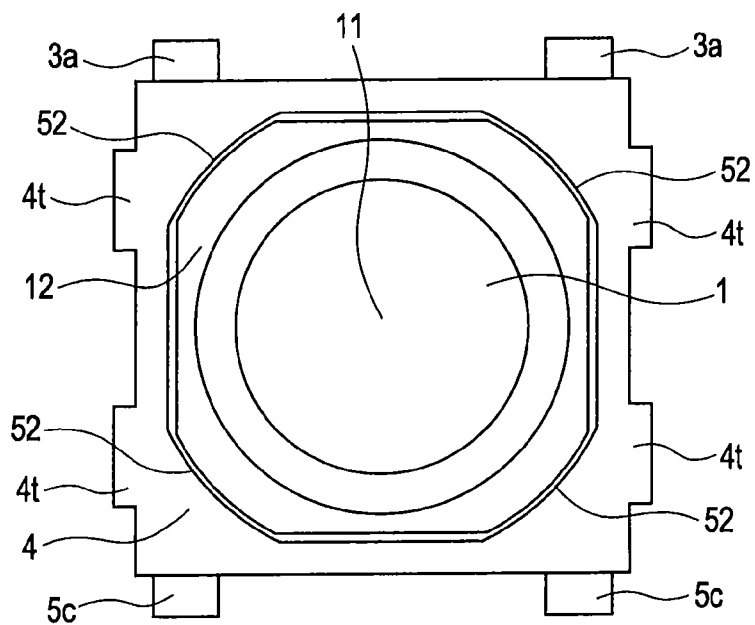


FIG. 7A

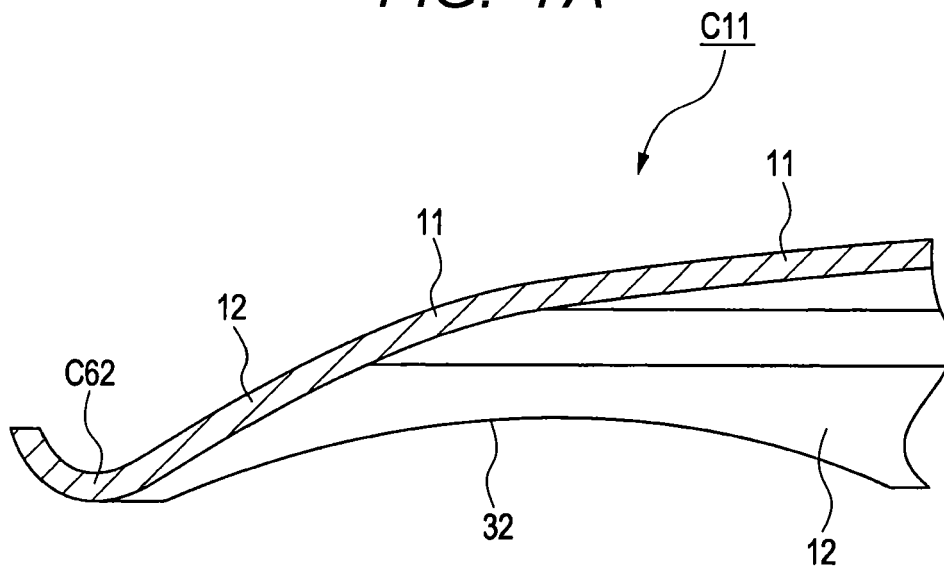


FIG. 7B

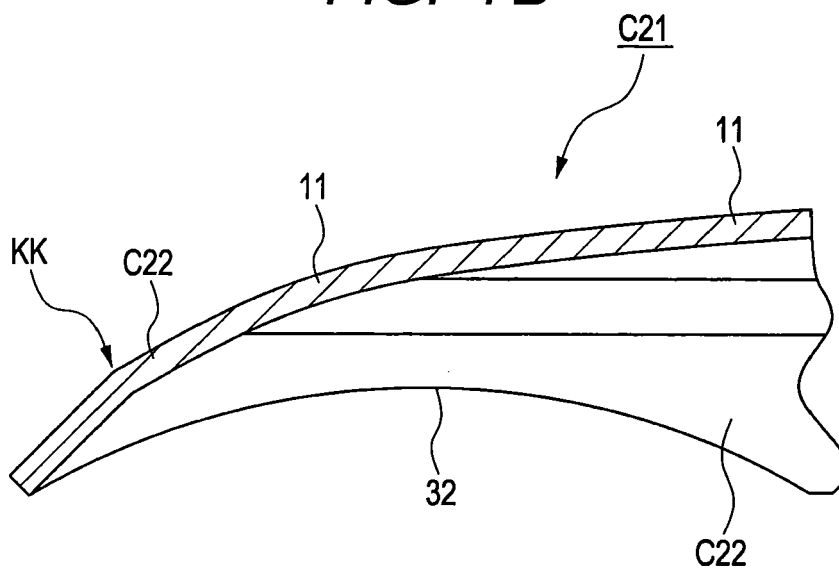


FIG. 8A

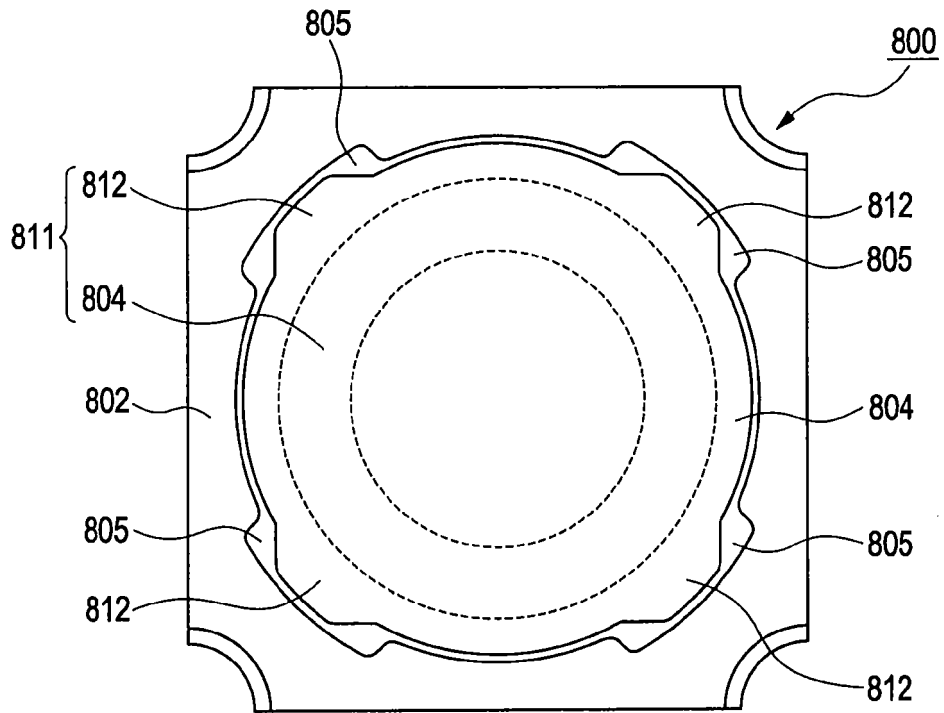


FIG. 8B

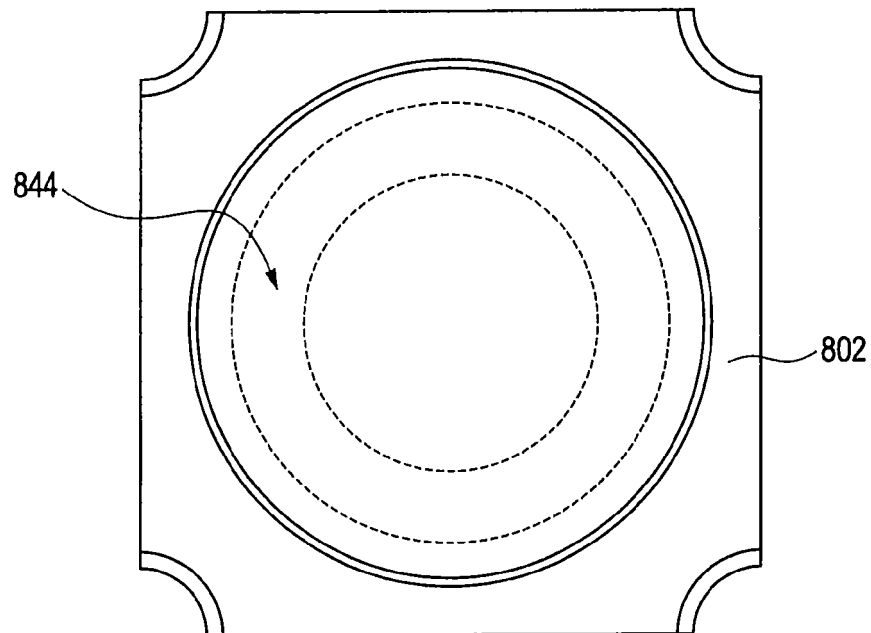
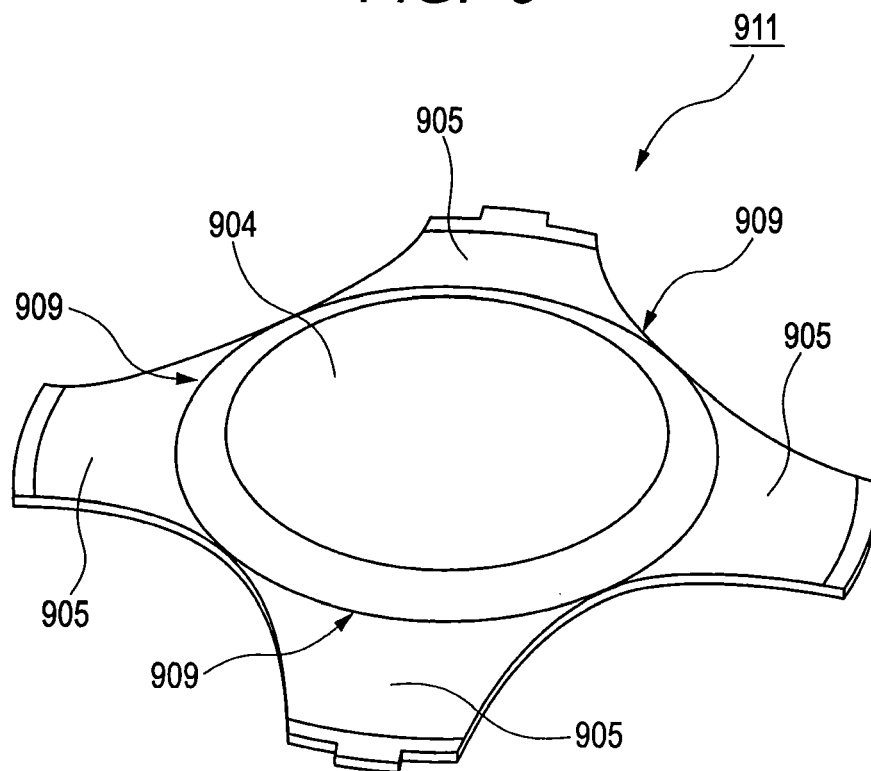


FIG. 9





EUROPEAN SEARCH REPORT

Application Number
EP 12 15 7047

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Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
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			H01H
The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 14 August 2012	Examiner Nieto, José Miguel
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
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