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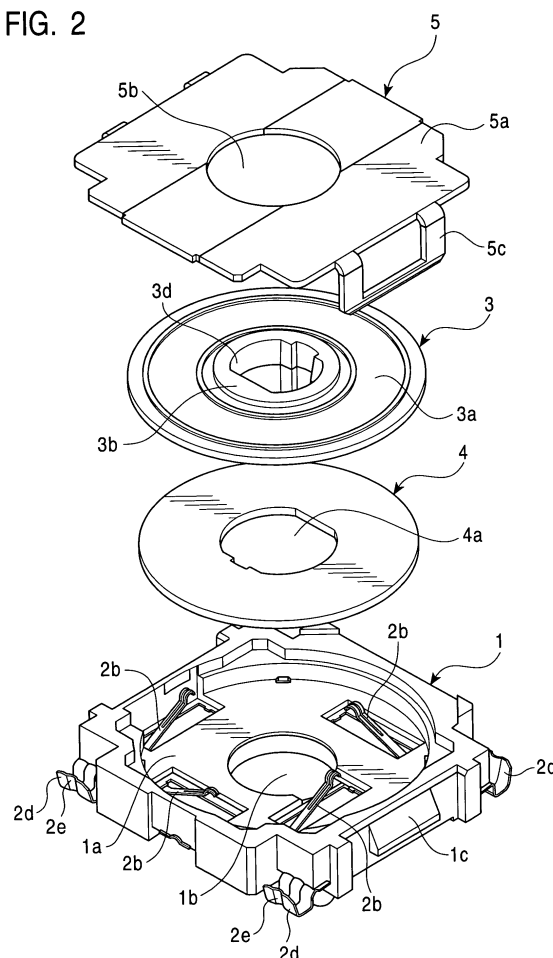
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(54) **Rotary electric component**

(57) A rotary electric component includes a housing having an accommodation portion; a terminal plate having a base, a brush, and a wide folded member; and a rotary member accommodated at the accommodation portion and having an electrically conductive pattern on which the brush slides. The base is buried in the bottom of the housing. The brush is raised from the base in the accommodation portion. The folded member is folded from the base, is in close contact with the bottom of the base at a location other than the location from where the brush is raised from the base, and is disposed under the base. The terminal plate is contained in the housing such that the brush is disposed above the folded member.

FIG. 2



Description

BACKGROUND OF THE INVENTION

1. Field of the Invention

[0001] The present invention relates to a rotary electric component, and, more particularly, to a structure of an output section and that of a contact used in, for example, a variable resistor, an encoder, or a switch.

2. Description of the Related Art

[0002] A related rotary electric component formed by insert molding is known. The insert molding is carried out using a die that comes into contact with a metal plate forming, for example, a terminal disposed below a covered contact of, for example, a bent brush (slider). (Refer to, for example, Japanese Unexamined Patent Application Publication No. 8-39603.)

[0003] Hereunder, the structure of a related rotary electric component will be described with reference to the relevant drawings.

[0004] Fig. 10 is a perspective view of the structure of a housing of the related rotary electric component. Fig. 11 is a perspective view of the main portion of the housing where one of the brushes is formed.

[0005] In Fig. 10, reference numerals 32 denote springy brushes, reference numerals 33 denote terminals disposed below and electrically connected to the respective brushes 32, and reference numeral 25 denotes the housing where the brushes 32 and the terminals 33 are insert-molded.

[0006] One of the brushes insert-molded in the housing will be described with reference to Fig. 11. The brush 32 and the terminal 33 are formed of the same materials, such as metallic plates. The brush 32 is integrally formed at a base of the terminal 33 by forming a folded member 30. The housing 25 (which is a molded product) is formed by insert molding the integrally formed brush 32 and the terminal 33.

[0007] In this case, the housing 25 is formed by injecting resin into a die. The die has a cavity for preventing the brush 32 from contacting it. Since an open side of the cavity is covered by the base of the terminal 33, the resin is prevented from flowing into the cavity.

[0008] However, since, in the related rotary electric component, the housing 25 is formed by insert molding the terminals 33 and the brushes 32 integrally formed at the bases of the terminals 33 by forming the folded members 30 and formed of the same material as the terminals 33, variations tend to occur in the folded portions. Therefore, variation occurs in the dimensions of contacts of the brushes 32, resulting in the problem that the locations of the contact portions between the brushes 32 and electrically conductive patterns including, for example, resistors cannot be set with high precision. Consequently, in particular, in a sensor requiring high

precision, variation in the contact locations is a serious problem.

SUMMARY OF THE INVENTION

[0009] Accordingly, it is an object of the present invention to provide a high-precision rotary electric component which makes it possible to set the locations of brushes with high precision and which can be used in a sensor.

[0010] To this end, according to the present invention, there is provided a rotary electric component comprising a housing having an accommodation portion; a terminal plate having a base, a brush, and a wide folded member; and a rotary member accommodated at the accommodation portion and having an electrically conductive pattern on which the brush slides. In the rotary electrical component, the base is buried in the bottom of the housing. The brush is raised from the base in the accommodation portion. The folded member is folded from the base, is in close contact with the bottom of the base at a location other than the location from where the brush is raised from the base, and is disposed under the base. The terminal plate is contained in the housing such that the brush is disposed above the folded member.

[0011] Accordingly, the brush is raised from the base of the terminal plate, and the folded member is disposed under the base so as to oppose a side of the base where the brush is raised. Therefore, it is possible to provide a high-precision rotary electric component in which the location from where the brush is raised is not affected even if a variation occurs in the folded portion.

[0012] In a first form, the entire outer peripheral edge of the folded member of the terminal plate is buried in the housing, and a surface of the folded member facing the side where the brush is raised is exposed from the housing.

[0013] Accordingly, the burying portion covers the entire periphery of the brush raised upward from the base of the terminal plate. Therefore, the brush is reliably protected.

[0014] In a second form, the terminal plate further has a slit at a folded portion between the folded member and the base.

[0015] Accordingly, the folded member is easily formed along the slit. Therefore, the folded member is reliably disposed below the base, thereby preventing resin from flowing in during insert molding.

[0016] In a third form, a folded portion between the folded member and the base of the terminal plate extends in a direction of the brush.

[0017] Accordingly, the layout of the terminal plate is simplified, and material yield is good, so that costs are reduced.

[0018] In a fourth form, the accommodation portion of the housing has a bearing holding the rotary member.

[0019] Accordingly, the electrical conductive pattern on the rotary member and the brush are easily posi-

tioned with high precision.

[0020] In a fifth form based on the fourth form, a plurality of the brushes are provided at opposing sides around the bearing of the accommodation portion, and a plurality of the folded portions are separately disposed below the respective brushes.

[0021] Accordingly, the brushes are scattered, thereby reducing radial size. In addition, since the folded members are individually disposed, the folded members are reduced in size, so that material yield of the terminal plate is good. Consequently, costs are reduced.

[0022] In a sixth form based on the fifth form, a plurality of the terminal plates are provided. The terminal plates have external connection terminals electrically connecting with the respective brushes. The external connection terminals protrude outward from different outer surfaces of the housing.

[0023] Accordingly, the electric component is easily mounted to, for example, a printed circuit board. Therefore, a predetermined output signal is easily produced.

BRIEF DESCRIPTION OF THE DRAWINGS

[0024]

Fig. 1 is a perspective view of a rotary electric component of the present invention;

Fig. 2 is an exploded perspective view of the rotary electric component of the present invention;

Fig. 3 is a side sectional view taken along line III-III of Fig. 1 of the present invention;

Fig. 4 is a side sectional view taken along line IV-IV of Fig. 1 of the present invention;

Fig. 5 is a plan view of a housing in the present invention;

Fig. 6 is a perspective view of terminal plates prior to molding the rotary electric component of the present invention;

Fig. 7 is a perspective view of the main portion of one of the terminal plates prior to bending a portion of the terminal plate in the present invention;

Fig. 8 is a perspective view of the main portion of the terminal plate after bending the portion of the terminal plate in the present invention;

Fig. 9 is a perspective view of the main portion of terminal plate in the present invention after insert molding;

Fig. 10 is a perspective view of the structure of a housing of a related rotary electric component; and

Fig. 11 is a perspective view of the main portion of the housing where a brush is formed.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0025] Hereunder, a rotary electric component of an embodiment of the present invention will be described with reference to Figs. 1 to 9.

[0026] Referring to Figs. 1 to 5, a housing 1 is formed of an insulating material (such as synthetic resin), and is rectangular in shape. The housing 1 has a cavity with an open top, and an accommodation portion 1a forming a bottom in the cavity. A bearing 1b comprising a circular through hole is formed in the center of the accommodation portion 1a, and supports a support shaft 3c of a rotary member 3 (described later). Hook-shaped engaging protrusions 1c are formed on respective outer sides of a pair of opposing side surfaces of the housing 1. The housing 1 and a cover 5 are integrally formed by engagement of the engaging protrusions 1c and respective engagers 5c of the cover 5.

[0027] A plurality of terminal plates 2 (four in the embodiment) formed of electrically conductive metallic plates are buried in and at the bottom of the accommodation portion 1a of the housing 1. Each terminal plate 2 has a flat base 2a, a brush 2b, and a folded member 2c. Each brush 2b is raised from its corresponding base 2a in the accommodation portion 1a while retaining its elasticity. Each folded member 2c is disposed below the location where its corresponding brush 2b is raised and is wider than its corresponding brush 2b. Each folded member 2c is buried in the housing 1 along with its corresponding base 2a as a result of being disposed below its corresponding base 2a so as to oppose the side where its corresponding brush 2b is raised.

[0028] The four brushes 2b are disposed so that contact portions between the respective brushes 2b and a rotary board 4 (described later) are disposed at opposing areas with the bearing 1b of the accommodation portion 1a being disposed therebetween and at equal intervals (90 degrees from each other) with respect to the center of the bearing 1b. The folded members 2c are separately disposed below the respective brushes 2b.

[0029] Accordingly, since four brushes 2b are disposed at opposing sides with the bearing 1b of the accommodation portion 1a of the housing 1 being disposed therebetween, and the separate folded members 2c are disposed below the respective brushes 2b, the brushes 2b are scattered around a periphery of the bearing 1b, so that the radial size of the rotary electric component is reduced. In addition, since the folded members 2c are separately disposed, the folded members 2c are reduced in size, resulting in good material yield of the terminal plates 2.

[0030] An external connection terminal 2d electrically connected to its corresponding brush 2b extends from the base 2a of the corresponding terminal plate 2. The external connection terminals 2d protrude outward from four different outer surfaces of the housing 1. When the external connection terminals 2d are to be mounted to a printed circuit board of, for example, an electrical device (not shown), they have shapes that allow surface mounting by soldering. The external connection terminals 2d include respective ribs 2e extending upward at the centers, and are U-shaped in cross section.

[0031] Accordingly, when the external connection ter-

minals 2d having U shapes and including the respective ribs 2e are soldered to the printed circuit board, solder flows into grooves of the ribs 2e. Therefore, the soldering surface area is increased in correspondence with the grooves of the ribs 2e, so that solder fillet heights at the grooves of the ribs 2e are increased by the principle of capillary phenomena, thereby increasing soldering strength. In addition, since the external connection terminals 2d have U shapes in cross section, the solder adheres to both sides of the U shapes and forms solder fillets. Therefore, the soldering strength is increased. Further, since the ribs 2e are disposed, the terminal strengths are increased. Still further, since the external connection terminals 2d are U-shaped in cross section, stress to the soldering portions is reduced.

[0032] Since, the external connection terminals 2d which are brought into electrical conduction with the respective brushes 2b and which protrude outward from different outer surfaces of the housing 1 are integrated to portions of the respective terminal plates 2, the electric component is easily mounted to a printed circuit board or the like, and, thus, a predetermined output signal is easily produced.

[0033] The rotary member 3 is formed of insulating material such as synthetic resin, and has a flat disc-shaped portion 3a, and a support shaft 3b and the support shaft 3c protruding vertically from the disc-shaped portion 3a. A substantially elliptical through hole 3d is formed in the center of the support shafts 3b and 3c, and receives an operation section of, for example, an electrical device (not shown). A thick substantially elliptical shank 3e is disposed at the top portion of the support shaft 3c. A plurality of protrusions 3f for positioning the rotary board 4 (described later) are disposed at the lower surface of the disc-shaped portion 3a. The support shaft 3c is inserted in the bearing 1b of the accommodation portion 1a of the housing 1 and the support shaft 3b is inserted in a through hole 5b of the cover 5 (described later), so that the rotary member 3 is supported.

[0034] The rotary board 4 is disk-shaped, is formed of a laminated plate (formed of, for example, phenol resin), and engages the support shaft 3c of the rotary member 3. A substantially elliptical fitting hole 4a is formed in the center of the rotary board 4. The fitting hole 4a is fitted to the thick substantially elliptical shank 3e at the support shaft 3c, so that the rotary board 4 corotatably engages the rotary member 3.

[0035] A plurality of electrically conductive patterns (not shown) comprising carbon resistors and silver leads are formed on the lower surface of the rotary board 4. When the rotary member 3 is rotated, the electrically conductive patterns come into sliding contact with the brushes 2b in the accommodation portion 1a of the housing 1 to output predetermined electrical signals. A rotary unit comprises the rotary member 3 and the rotary board 4.

[0036] As described above, since the bearing 1b holding the support shaft 3c of the rotary member 3 is formed

in the accommodation portion 1a of the housing 1, the brushes 2b and the electrically conductive patterns (not shown) on the rotary board 4 corotatably engaging the rotary member 3 are easily positioned with high precision, so that predetermined electrical signals are reliably produced.

[0037] The cover 5 is substantially flat and is formed of insulating material, such as synthetic resin, or a metallic plate. The cover 5 comprises an upper plate 5a and the engagers 5c. The upper plate 5a is substantially rectangular and has the circular through hole 5b in the center thereof. The engagers 5c extend downward from respective opposing sides of the upper plate 5a. The support shaft 3b of the rotary member 3 is supported at the through hole 5b, and the engagers 5c engage the hook-shaped engaging protrusions 1c at the respective outer surfaces of the housing 1, so that the housing 1 and the cover 5 are integrated.

[0038] Next, the step of insert molding and burying the terminal plates 2 in the housing 1 will be described with reference to Figs. 6 to 9.

[0039] Fig. 6 shows the hoop-shaped state of each terminal plate 2 prior to insert molding in the housing 1. In this state, the terminal plates 2 are connected and integrated to ribs 2g having outer peripheral portions forming an overall annular shape by ends of the external connection terminal 2d, extending from the corresponding base 2a, and links 2f, extending from the corresponding external connection terminal 2d. In each terminal plate 2, the brush 2b is raised from the corresponding base 2a, the folded member 2c is disposed below its corresponding base 2a, and the rib 2e is formed at its corresponding external connection terminal 2d.

[0040] In this case, the terminal plates 2 are first formed of one flat metallic plate. Portions of the metallic plate are punched out by, for example, a pressing operation, and each punched portion is raised. As a result, as shown in Fig. 7, the flat bases 2a, the brushes 2b, and portions to become the folded portions 2c are formed. The brushes 2b are raised from the respective bases 2a in the accommodation portion 1a while retaining their elasticity. The portions to become the folded members 2c are disposed continuously with the respective bases 2a at locations other than the locations where the brushes 2b are raised. Long slits 2h are formed at folded portions between the wide portions 2c and the bases 2a of the respective terminal plates 2. The folded portions where the slits 2h are formed extend in the direction of the brushes 2b of the terminal plates 2.

[0041] As shown in Fig. 8, the folded members 2c are formed along the folded portions where the slits 2h are formed, below the brushes 2b, and at sides of the respective bases 2a opposing the sides where the brushes 2b are raised; and are disposed below the bases 2a. At the same time, connected adjacent terminal plates 2 are cut into separate terminal plates 2. At this time, the terminal plates 2 are connected the annular ribs 2g by

the external connection terminals 2d and the corresponding links 2f (see Fig. 6).

[0042] From this state, the hoop-shaped terminal plates 2 are mounted to a die (not shown) and subjected to insert molding. By this, as shown in Fig. 9, the outer peripheries of the bases 2a and the folded members 2c (not the brushes 2b) are buried in resin in order to form the housing 1. In this case, the entire outer peripheral edges of the folded members 2c of the terminal plates 2 are buried in the housing 1, and the surfaces of the folded members 2c facing the sides where the brushes 2b are raised are exposed from the housing 1.

[0043] Accordingly, since the folded members 2c are easily formed along the slits 2h that are formed at the folded portions between the folded members 2c and the bases 2a of the terminal plates 2, the bases 2a are reliably disposed above the folded members 2c as a result of bringing them into close contact with each other. Therefore, the flow of resin towards the brushes 2b is prevented from occurring during the insert molding.

[0044] Since the folded portions between the folded members 2c and the bases 2a of the respective plates 2 extend in the direction of the brushes 2b, the layout of the terminal plates 2 is simplified, and material yield is good, thereby reducing costs.

[0045] Next, from this state, the annular ribs 2g remaining at the outer peripheral portion of the housing 1 are cut and removed from the respective external connection terminals 2d and the links 2f, and the external connection terminals 2d are bent into U shapes as shown in Figs. 1 and 2 to form terminal shapes for surface mounting. These operations complete the production of the housing 1.

[0046] In the step of insert molding and burying the terminal plates 2 into the housing 1, the terminals 2 are mounted to a die (not shown), and resin is injected into the die to form the housing 1. The die has cavities (not shown) for entirely disposing the brushes 2b so that the brushes 2b raised from the respective bases 2a of the terminal plates 2 do not contact the die. Since the edges defining open sides of the cavities are covered by the folded members 2c, resin is prevented from flowing into the cavities.

[0047] In the above-described embodiment of the present invention, the rotary electric component comprises terminal plates 2 having bases 2a and brushes 2b. The bases 2a are buried in and at the bottom of the housing 1. The brushes 2b are raised from the respective bases 2a and protrude in the accommodation portion 1a. The terminal plates 2 also have folded members 2c having wider widths and formed continuously with the bases 2a at locations other than the locations where the brushes 2b are raised. The folded members 2c are formed below the bases 2a so as to oppose the sides where the respective brushes 2b are raised. With the brushes 2b being disposed above the respective folded members 2c, the terminal plates 2 are buried in the housing 1. Accordingly, the brushes 2b are raised

from the respective bases 2a. Since the folded members 2c are formed, even if variations occur in the folded portions, the locations where the brushes 2b are raised are not affected. As a result, a high-precision rotary electric component is produced.

[0048] Since the entire outer peripheral edges of the folded members 2c of the terminal plates 2 are buried in the housing, and the surfaces of the folded members facing the sides where the brushes 2b are raised are exposed from the housing, the entire peripheries of the brushes 2b raised upward from the bases 2a of the respective terminal plates 2 are covered by the burying portions. Therefore, during the insert molding of the housing 1, resin is prevented from flowing towards the brushes 2b by the respective folded members 2c, so that the brushes 2b are reliably protected.

[0049] Although, in the embodiment, the housing 1 is described as comprising one portion, the present invention is not limited thereto. For example, the housing may comprise a combination of portions, such as a plate in which in each base 2a is buried and a frame having the accommodation portion 1a.

25 Claims

1. A rotary electric component comprising:

a housing having an accommodation portion;
a terminal plate having a base, a brush, and a wide folded member; and
a rotary member accommodated at the accommodation portion and having an electrically conductive pattern on which the brush slides, wherein
the base is buried in the bottom of the housing, the brush is raised from the base in the accommodation portion,
the folded member is folded from the base, is in close contact with the base at a location other than the location from where the brush is raised from the base, and is disposed under the base, and
the terminal plate is contained in the housing such that the brush is disposed above the folded member.

2. A rotary electric component according to Claim 1, wherein the entire outer peripheral edge of the folded member of the terminal plate is buried in the housing, and a surface of the folded member facing the side where the brush is raised is exposed from the housing.

3. A rotary electric component according to Claim 1 or 2, wherein the terminal plate further has a slit at a folded portion between the folded member and the base.

4. A rotary electric component according to any of Claims 1 to 3, wherein a folded portion between the folded member and the base of the terminal plate extends in a direction of the brush.

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5. A rotary electric component according to any of Claims 1 to 4, wherein the accommodation portion of the housing has a bearing holding the rotary member.

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6. A rotary electric component according to Claim 5, wherein a plurality of the brushes are provided at opposing sides around the bearing of the accommodation portion, and a plurality of the folded portions are separately disposed below the respective brushes.

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7. A rotary electric component according to Claim 6, wherein a plurality of the terminal plates are provided, the terminal plates having external connection terminals electrically connecting with the respective brushes, the external connection terminals protruding outward from different outer surfaces of the housing.

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FIG. 1

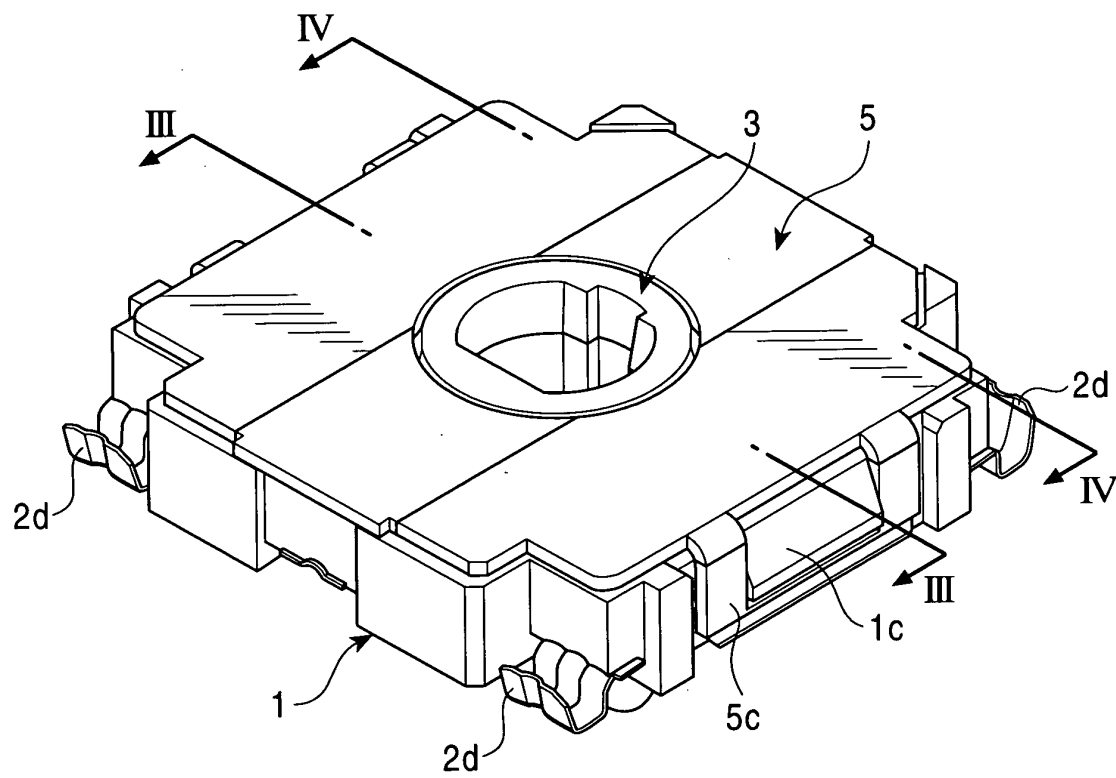


FIG. 2

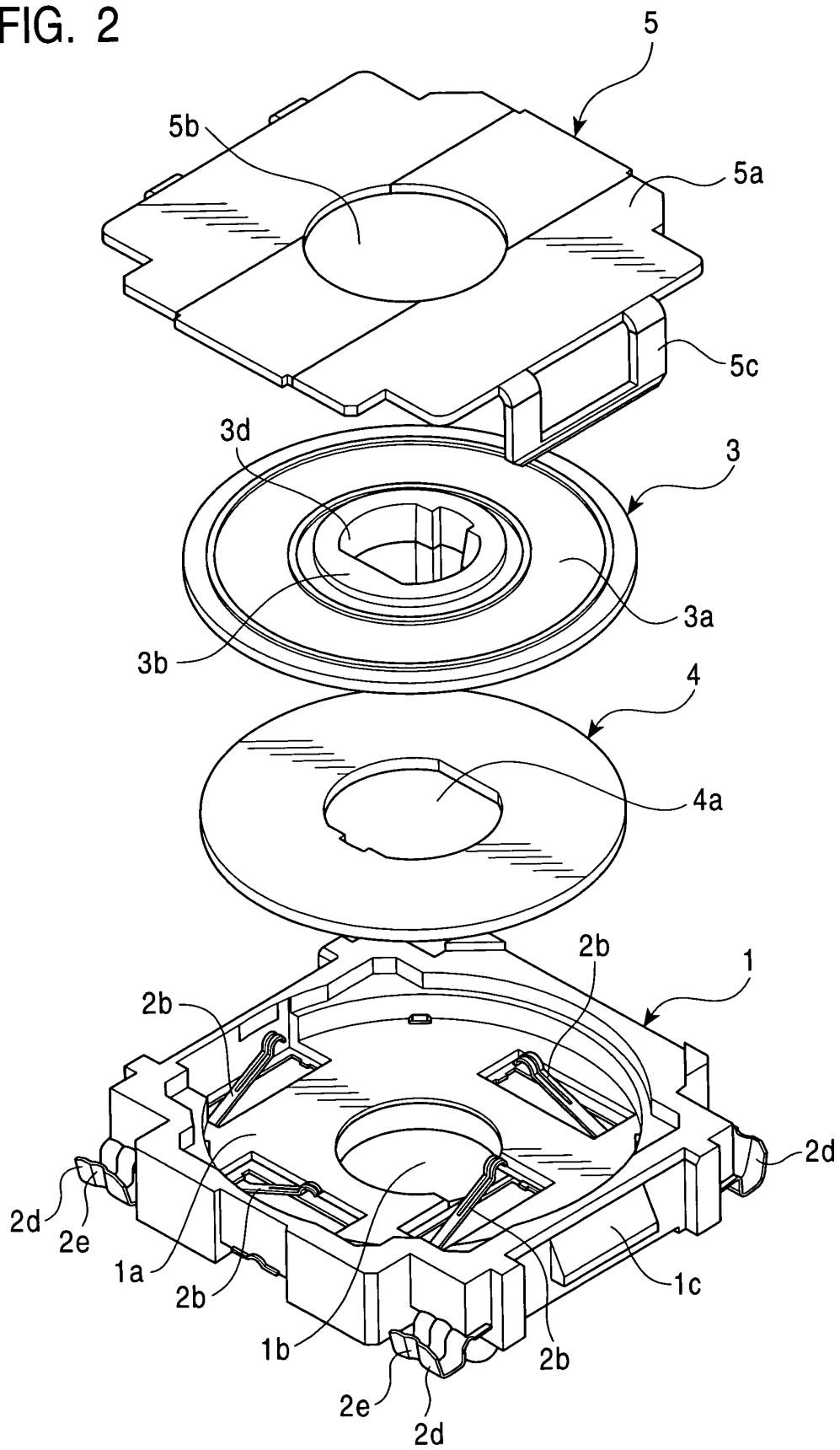


FIG. 3

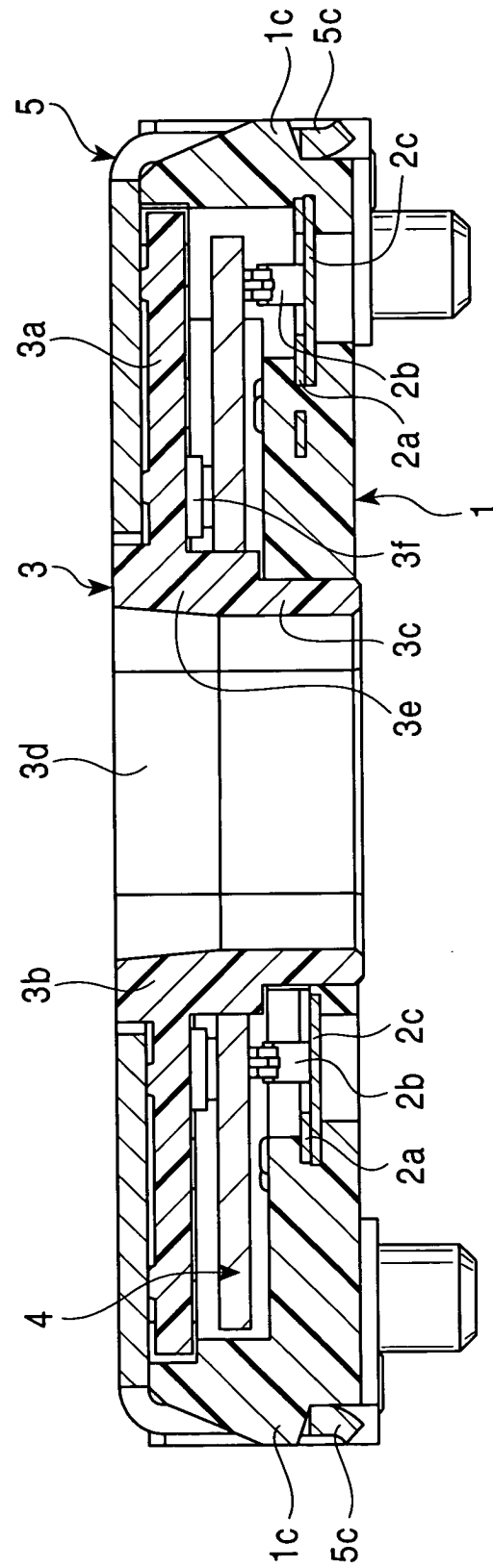


FIG. 4

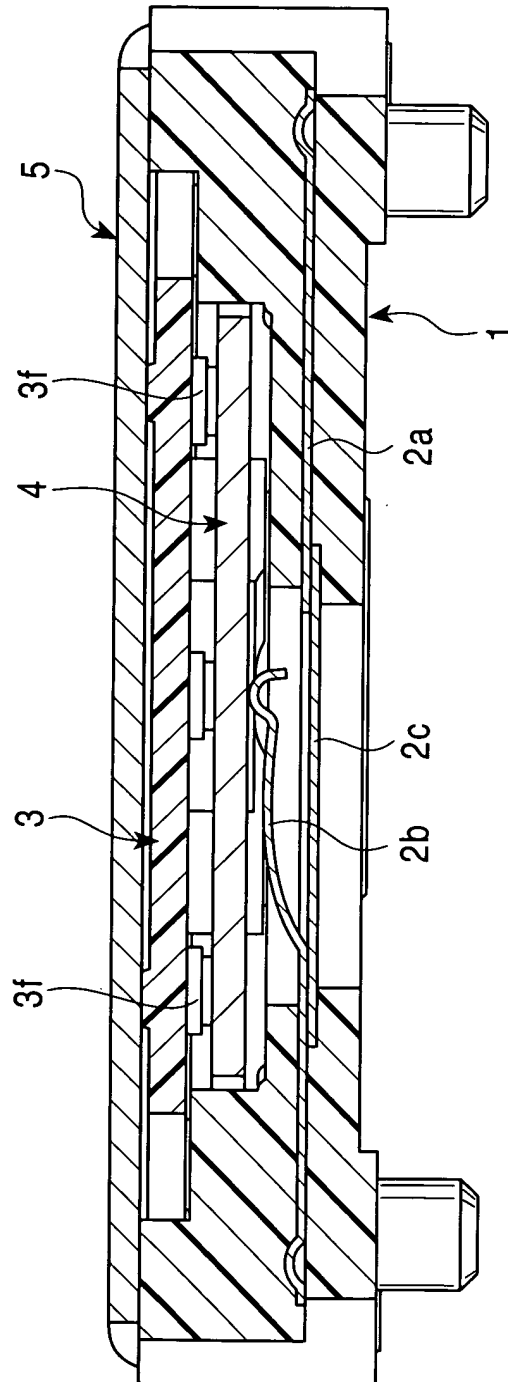


FIG. 5

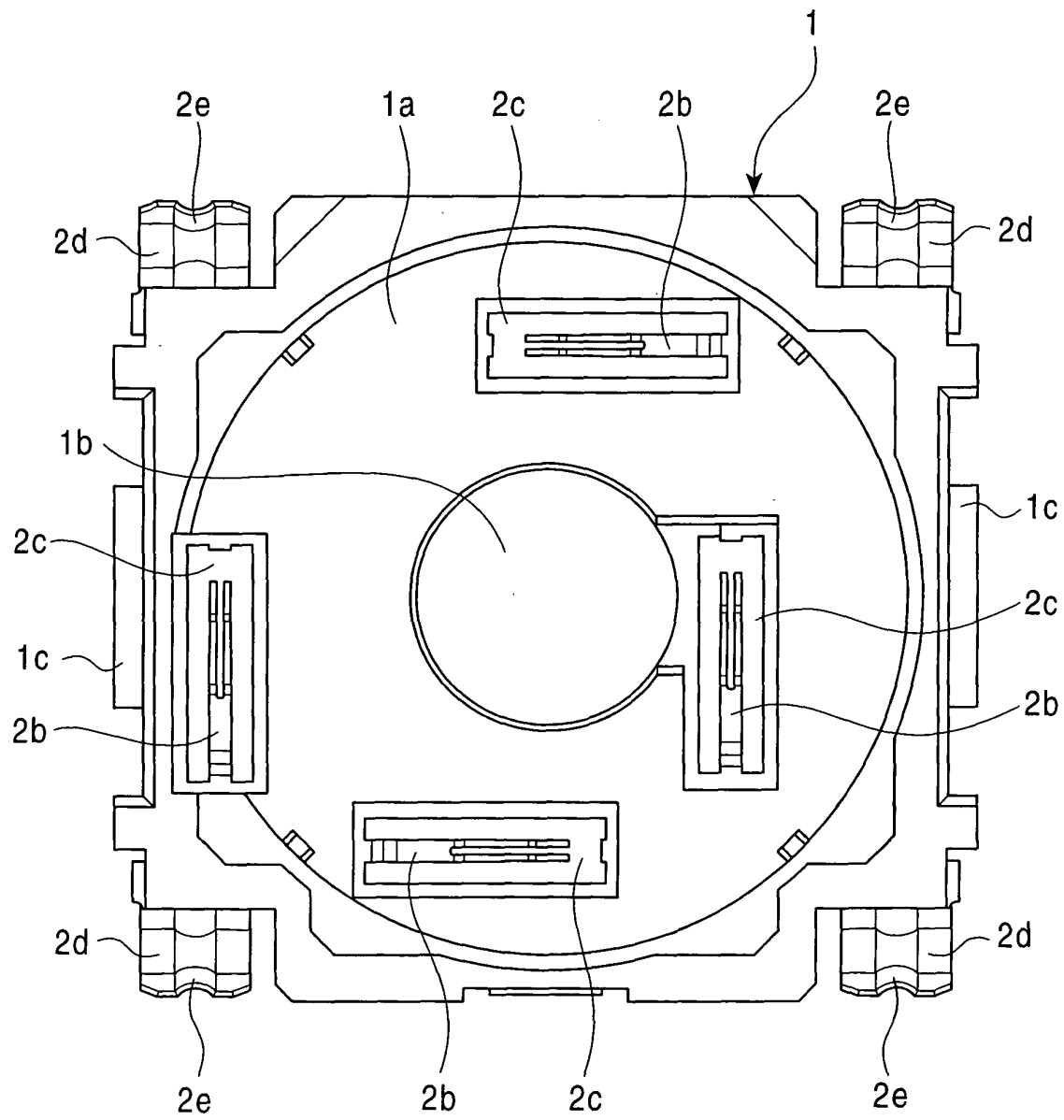


FIG. 6

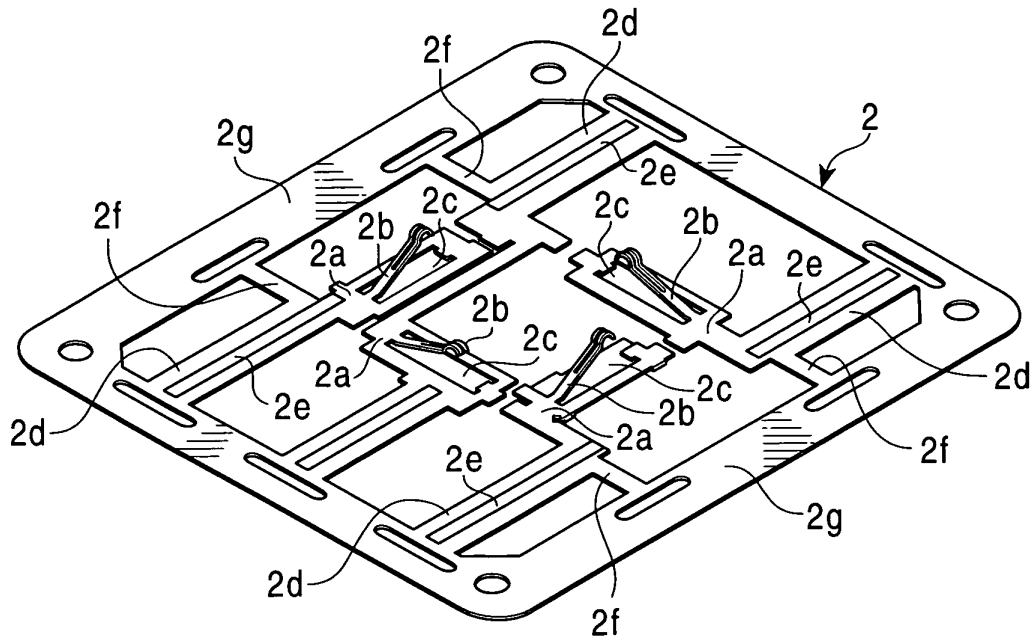


FIG. 7

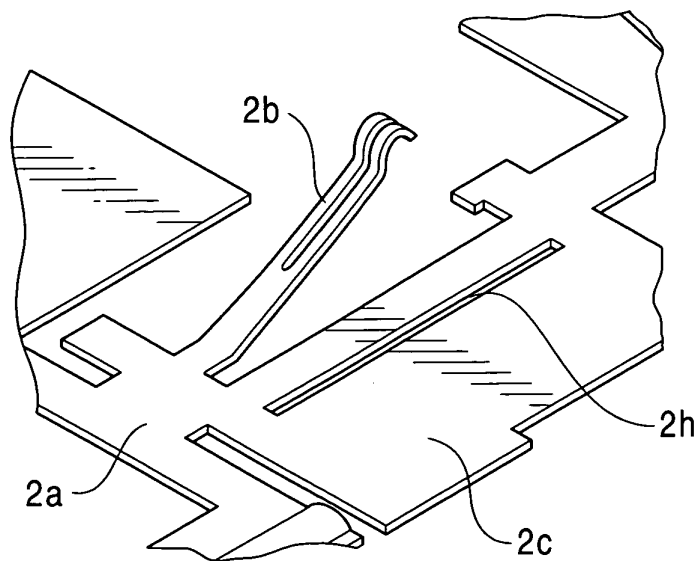


FIG. 8

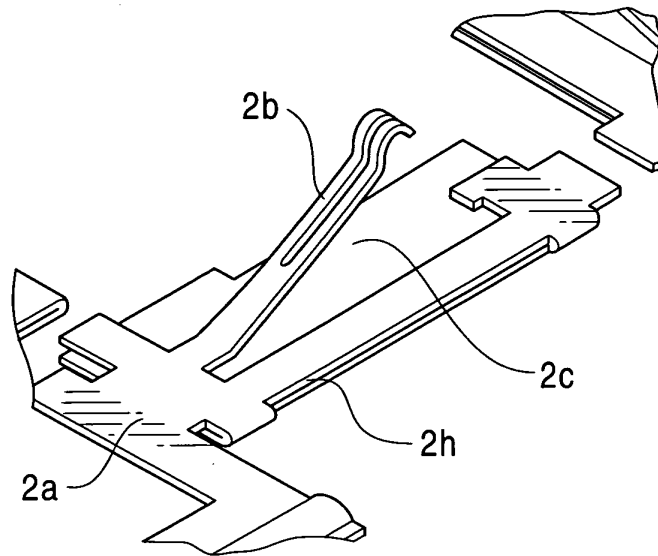


FIG. 9

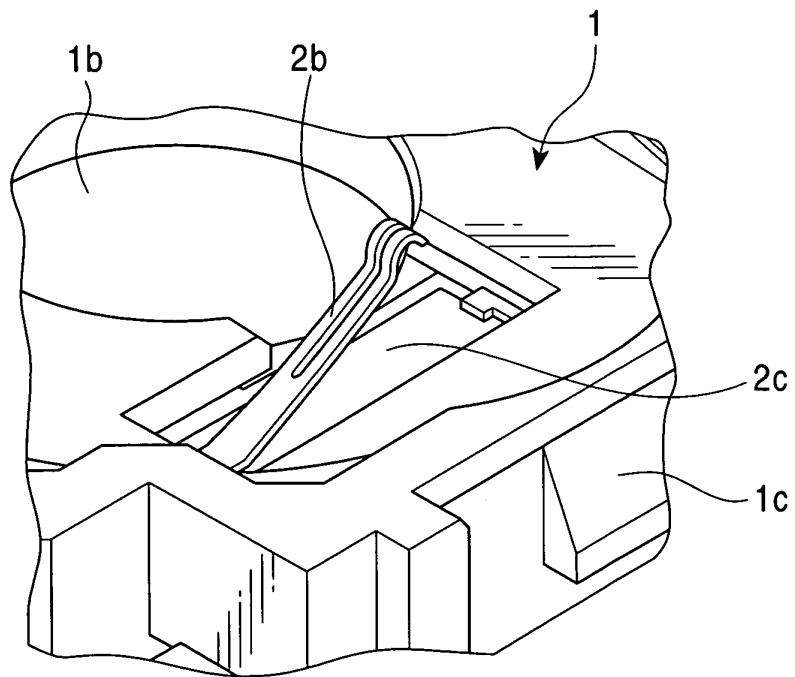


FIG. 10
PRIOR ART

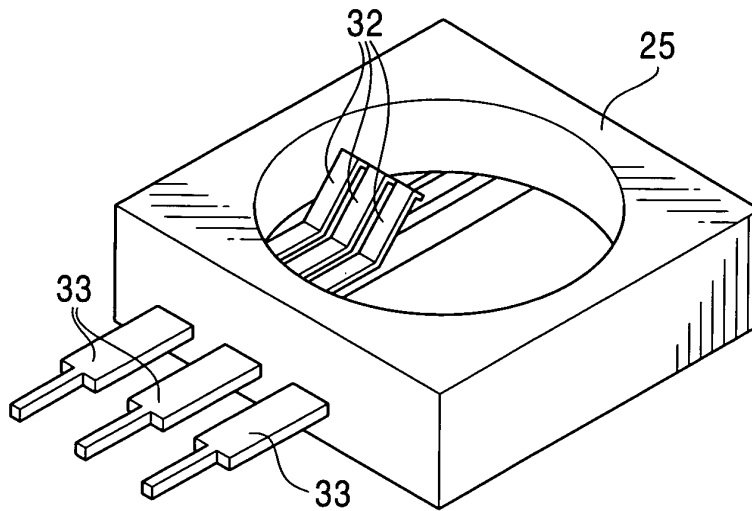
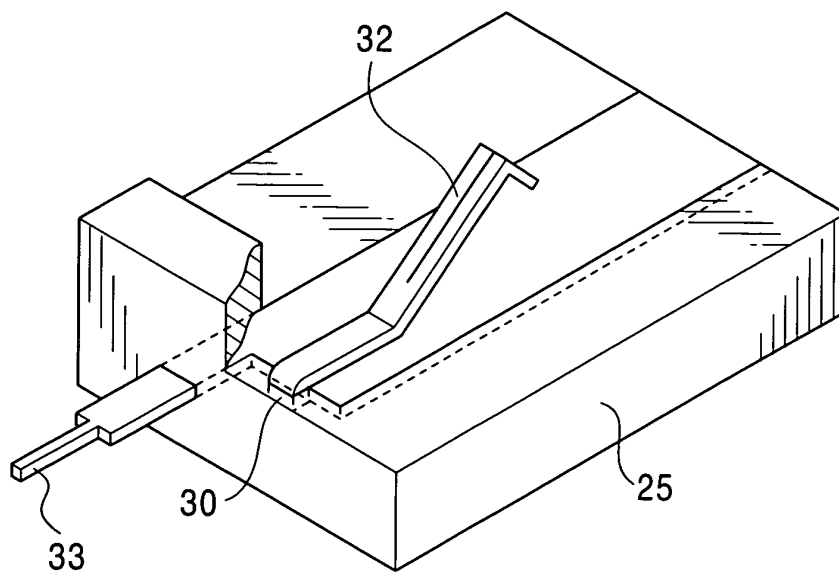


FIG. 11
PRIOR ART





European Patent
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EUROPEAN SEARCH REPORT

Application Number
EP 04 00 9958

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**ANNEX TO THE EUROPEAN SEARCH REPORT
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This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
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