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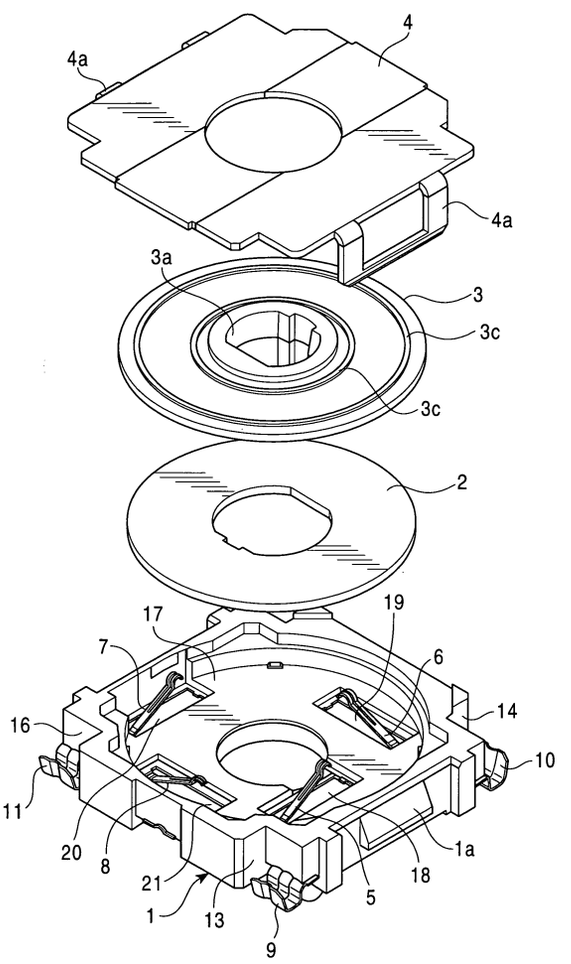
(54) Rotary electric component

(57) Four electrically independent sliders are separately embedded by insert molding near four different corners of a housing that is substantially square in plan view. The sliders extend to be spaced from one another in the circumferential direction of a rotary substrate that is accommodated in a circular recess of the housing. Two of the sliders are in sliding contact with a resistor pattern provided on the rotary substrate, and the remaining two sliders are respectively in sliding contact with electrodes patterns.

FIG. 3



EP 1 473 746 A1

Description

BACKGROUND OF THE INVENTION

1. Field of the Invention

[0001] The present invention relates to rotary electric components such as variable resistors and rotary encoders, and more particularly, to a rotary electric component including a housing in which a plurality of sliders are embedded, and a conductive pattern on which the sliders relatively slide.

2. Description of the Related Art

[0002] This type of rotary electric component is disclosed in, for example, Japanese Unexamined Patent Application Publication No. 64-7602. FIGS. 12A and 12B are a top view and a sectional view, respectively, of a housing of the disclosed rotary electric component. The rotary electric component shown in FIGS. 12A and 12B is a variable resistor in which a plurality of elastic contact members, that is, sliders 51 are embedded in a substantially square housing 50 by insert molding.

[0003] Although not shown, the variable resistor includes a rotary plate, that is, a rotary substrate having a conductive pattern on which the sliders 51 relatively slide, for example, a resistor element serving as a resistor pattern, and two conductive layers serving as electrode patterns. As shown in FIGS. 12A and 12B, legs 52 of the sliders 51 are bent at roots 53, and leading ends 54 thereof protrude toward the rotary substrate. A projection 55 regulates the rotation of the rotary substrate.

[0004] In the known variable resistor having such a configuration, a resistance between a terminal connected to sliders 51 in sliding contact with the resistor pattern and a terminal connected to sliders 51 in sliding contact with the electrode pattern is changed by rotating the rotary substrate.

[0005] The roots 53 of the sliders 51 are collectively embedded in a specific circumferential direction of a circular recess, in which the rotary substrate is accommodated, between the two adjoining corners of the housing 50. For this reason, the sliders 51 in sliding contact with the electrode pattern provided on the inner side of the rotary substrate, the slider 51 in sliding contact with the electrode pattern provided on the outer side of the rotary substrate, and the slider 51 in sliding contact with the resistor pattern provided between the above two electrode patterns are different in shape.

[0006] That is, the sliders 51 in sliding contact with the electrode pattern provided on the inner side of the rotary substrate extend almost along the radial direction of the circular recess, and the slider 51 in sliding contact with the electrode pattern provided on the outer side of the rotary substrate extends in the circumferential direction of the circular recess. The slider 51 in sliding contact with the resistor pattern between the above two electrode patterns extends almost along the circumferential direction of the circular recess.

[0007] In the above-described known variable resistor, the roots 53 of the sliders 51 are collectively embedded in the region between the two corners of the housing 50 in the specific circumferential direction of the circular recess. Therefore, the length of the housing 50 is larger than the sum of the diameter of the circular recess and the length of the region in which the roots 53 of the sliders 51 are embedded. Consequently, the outer size of the housing 50 is increased, and size reduction of the variable resistor is difficult.

[0008] In this case, it is possible to embed the roots 53 of the sliders 51 in the bottom wall of the circular recess of the housing 50. However, the diameter of the circular recess must be increased for such embedding. That is, the sliders 51 in sliding contact with the electrode pattern on the inner side of the rotary substrate must be sufficiently long in order to ensure a spring characteristic, and the diameter of the circular recess must be thereby increased. Therefore, in such a structure, the outer size of the housing 50 is increased from a standpoint different from the above.

[0009] Furthermore, since the sliders 51 are different in shape, the spring characteristics thereof are also prone to vary. That is, it is difficult to ensure equivalent spring characteristics among the sliders 51. Moreover, since the contact portions between the sliders 51 and the two electrode patterns and the resistor pattern on the rotary substrate are almost positioned on a straight line, it is difficult to hold the surface of the rotary substrate having the patterns parallel to the bottom wall of the circular recess. From the above, the patterns on the rotary substrate or the sliders 51 are prone to be unevenly worn by the rotation of the rotary substrate. This reduces durability.

SUMMARY OF THE INVENTION

[0010] The present invention has been made in view of the above-described actual circumstances of the known art, and an object of the present invention is to provide a rotary electric component having a housing of smaller outer size.

[0011] In order to achieve the above object, according to an aspect, the present invention provides a rotary electric component including a housing, at least three sliders electrically independent from one another, and separately embedded in the housing, and a rotary substrate having a conductive pattern on which the sliders slide, wherein the sliders are spaced from one another in the circumferential direction of the rotary substrate.

[0012] In the present invention, the sliders are separately embedded in the housing so as to be spaced from one another in the circumferential direction of the rotary substrate, and therefore, the lengths of the sliders can be made long. This reduces the total area of the regions

in which the sliders are in contact with the conductive pattern, and reduces the outer size of the housing. Since the sliders can be made long, a sufficient strength can be ensured. Since the sliders are spaced from one another in the circumferential direction of the rotary substrate, the contact portions between the surface of the rotary substrate having the pattern and the sliders can be distributed in the circumferential direction of the rotary substrate. Moreover, the sliders may be formed in the same shape.

[0013] Preferably, the housing has at least three corners outside a region in which the rotary substrate rotates, and the sliders are embedded in areas near the respective corners of the housing. This structure allows the areas near the corners of the housing, which were dead space before, to be effectively utilized as areas in which the sliders are embedded.

[0014] Preferably, the housing has a circular recess that accommodates the rotary substrate, and each of the areas near the respective corners of the housing includes a part of a bottom wall of the circular recess. Since the regions in which the sliders are embedded include a part of the bottom wall of the circular recess, the sliders can be stably held in the housing even when the areas near the corners that define dead spaces outside an overlapping portion between the housing and the rotary substrate are reduced. This can further reduce the size of the housing. Even when the regions in which the sliders are embedded thus protrude in the circular recess, since the sliders can be extended in the circumferential direction of the rotary substrate, they can ensure a sufficient length to obtain a predetermined spring characteristic.

[0015] Preferably, closing plates are provided integrally with the respective sliders to close spaces provided in the housing. In this case, the closing plates can prevent resin from adhering to the respective sliders during insert molding. In particular, since the closing plates can be formed simultaneously with the formation of the respective sliders, the number of parts necessary for insert molding can be reduced.

[0016] Preferably, terminals are provided integrally with the respective sliders. Since the terminals can be formed simultaneously with the formation of the respective sliders, and the number of parts is not increased.

[0017] Preferably, the planar shape of the housing is substantially square, the corners have cutouts, and the terminals are exposed from spaces defined by the cutouts. In this case, the shape of the entire component including the housing and the terminals can be made square in plan view. That is, the terminals do not protrude outward from the entire square component. This makes it possible to easily perform chucking when mounting the housing, that is, the rotary electric component, onto a printed board.

[0018] Preferably, the conductive pattern includes an arc-shaped resistor pattern and a pair of ring-shaped electrode patterns connected to both ends of the resistor pattern, the sliders include four sliders that are electrically independent from one another, two of the sliders are in sliding contact with the electrode patterns, and the remaining two sliders are disposed on the opposite sides of the rotating center of the rotary substrate so as to be in sliding contact with the resistor pattern. This achieves a small variable resistor having no dead zone.

[0019] In the present invention, the sliders are spaced from one another in the circumferential direction of the rotary substrate. Therefore, the sliders can be made long, and the outer size of the housing can be reduced. This can reduce the size of the entire component. Since the sliders can be made long, a sufficient strength can be ensured and durability is improved.

[0020] The contact portions between the surface of the rotary substrate having the pattern and the sliders can be distributed in the circumferential direction of the rotary substrate. Therefore, the pattern provided on the rotary substrate, or the sliders can be prevented from being worn unevenly. This also improves durability.

[0021] The sliders may have the same shape. In this case, variations in spring characteristics among the sliders are reduced, the above-described uneven wear is further reduced, and higher durability is ensured.

[0022] Further objects, features, and advantages of the present invention will become apparent from the following description of the preferred embodiments with reference to the attached drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

[0023]

FIG. 1 is a general perspective view of a rotary electric component according to a first embodiment of the present invention;

FIG. 2 is a plan view of a housing provided in the rotary electric component shown in FIG. 1;

FIG. 3 is an exploded perspective view of the rotary electric component shown in FIG. 1;

FIG. 4 is an exploded rear perspective view of the rotary electric component shown in FIG. 1;

FIG. 5 is an enlarged sectional view taken along line V-V in FIG. 1;

FIG. 6 is an enlarged sectional view taken along line IV-IV in FIG. 1;

FIG. 7 is a plan view of a rotary substrate provided in the rotary electric component shown in FIG. 1;

FIG. 8 is a perspective view showing sliders and terminals embedded in the housing shown in FIG. 2;

FIG. 9 is a plan view of a plate member before the sliders and the terminals shown in FIG. 2 are produced;

FIG. 10 is a plan view showing the positional relationship between a conductive pattern provided on the rotary substrate shown in FIG. 1 and the sliders embedded in the housing;

FIG. 11 is a plan view of the principal part of another

embodiment of the present invention, showing the positional relationship between a conductive pattern provided on a rotary substrate and sliders embedded in a housing; and

FIGS. 12A and 12B are a top view and a sectional view, respectively, of a housing provided in a known rotary electric component.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0024] Rotary electric components according to preferred embodiments of the present invention will be described below with reference to the attached drawings.

[0025] FIGS. 1 to 6 show a rotary electric component according to a first embodiment of the present invention. In the first embodiment, the rotary electric component is a variable resistor used as, for example, a position sensor. As particularly shown in FIG. 3, the variable resistor includes a housing 1 that forms a base member, a rotary substrate 2 opposing the housing 1, a rotary member 3 for transmitting a rotational force to the rotary substrate 2, and a cover member 4 for covering the housing 1 and the rotary member 3. A shaft hole 3a through which an operating shaft (not shown) extends is provided at the center of the rotary member 3.

[0026] For example, the housing 1 is substantially square in plan view, as shown in FIG. 2. At least three electrically independent sliders, for example, four sliders 5, 6, 7, and 8 are fixed near the corners of the housing 1. The housing 1 has a circular recess 17 in which the rotary substrate 2 shown in FIG. 3 is held rotatably. The sliders 5, 6, 7, and 8 are separately embedded in the housing 1 so that they are spaced from one another in the circumferential direction of the rotary substrate 2 held in the circular recess 17.

[0027] Two of the four sliders 5 to 8, that is, the sliders 5 and 7 are in sliding contact with a pair of electrode patterns provided on the rotary substrate 2 which will be described later, and the remaining two sliders 6 and 8 are in sliding contact with a resistor pattern provided on the rotary substrate 2 which will be described later. The sliders 6 and 8 are arranged with the rotation center of the rotary substrate 2 therebetween.

[0028] The sliders 5 to 8 linearly extend in the same shape, and are embedded in the housing 1 by insert molding. Roots of the embedded sliders 5 to 8 are partly disposed inside a bottom wall of the circular recess 17. That is, portions of the bottom wall of the circular recess 17 are included in the regions near the corners of the housing 1 in which the sliders 5 to 8 are embedded.

[0029] As shown in FIG. 8, terminals 9 to 12 are formed integrally with the respective sliders 5 to 8. That is, the slider 5 and the terminal 9, the slider 6 and the terminal 10, the slider 7 and the terminal 11, and the slider 8 and the terminal 12 are integrally formed.

[0030] As also shown in FIG. 8, closing plates 18 to 21 are formed integrally with the respective sliders 5 to 8. The closing plates 18 to 21 close spaces formed in the housing 1 during insert molding, and prevent resin from adhering to the sliders 5 to 8. That is, the slider 5 and the closing plate 18, the slider 6 and the closing plate 19, the slider 7 and the closing plate 20, and the slider 8 and the closing plate 21 are integrally formed.

[0031] As shown in FIG. 2, cutouts 13 to 16 are provided at the four corners of the housing 1, and the above-described terminals 9 to 12 are exposed from the spaces defined by the cutouts 13 to 16. That is, the terminal 9 integrally formed with the slider 5 is exposed from the cutout 13, the terminal 10 integrally formed with the slider 6 is exposed from the cutout 14, the terminal 12 integrally formed with the slider 8 is exposed from the cutout 15, and the terminal 11 integrally formed with the slider 7 is exposed from the cutout 16. The terminals 9 to 12 exposed from the cutouts 13 to 16 are arranged inside the outline of the rotary electric component, including the housing 1, that is square in plan view. That is, the terminals 9 to 12 are arranged so as not to protrude outward from the square outline.

[0032] As shown in FIGS. 2 and 3, a pair of engaging projections 1a are provided on both sides of the housing 1. The engaging projections 1a are fitted in a pair of engaging pieces 4a provided on both sides of the cover member 4 shown in FIG. 3.

[0033] The sliders 5 to 8, the terminals 9 to 12, and the closing plates 18 to 21 are made from one plate member shown in FIG. 9. The plate member shown in FIG. 9 is a metal plate formed by cutting so as to include slider materials 5a, 6a, 7a, and 8a, terminal materials 9a, 10a, 11a, 12a, and closing-plate materials 18a, 19a, 20a, and 21a.

[0034] The plate member is bent downward along reference bending lines 27, 28, 29, and 30, and is cut at cutting portions 22, 23, 24, 25, and 26 during insert molding of the housing. The slider materials 5a, 6a, 7a, and 8a are bent to have elasticity. Consequently, the sliders 5 to 8, the terminals 9 to 12, and the closing plates 18 to 21 are formed, as shown in FIG. 8. That is, the sliders 5 to 8, the terminals 9 to 12, and the closing plates 18 to 21 are embedded in the housing 1 in the form shown in FIG. 8 by insert molding.

[0035] A conductive pattern shown in FIG. 7 is provided on the surface of the rotary substrate 2 opposing the terminals 5 to 8. The conductive pattern includes an electrode pattern 31 on which the slider 5 slides, a resistor pattern 32 on which the sliders 6 and 8 relatively slide, and an electrode pattern 33 on which the slider 7 slides. That is, the rotary substrate 2 is held at four contact portions with the four sliders 5 to 8 with the two electrode patterns 31 and 33 and the resistor pattern 32 therebetween. For example, the four contact portions are spaced at intervals of approximately 90° in the circumferential direction of the rotary substrate 2.

[0036] As shown in FIG. 3, two annular projections 3c are provided centered on the shaft hole 3a on the upper surface of the rotary member 3 so that they are in sliding

contact with the cover member 4. A plurality of projections 3b are provided around the shaft hole 3a on the lower surface of the rotary member 3 so that they are in contact with the rotary substrate 2, as shown in FIG. 4.

[0037] In the variable resistor of the first embodiment having the above-described configuration, the rotary member 3 is rotated by the rotation of the operating shaft (not shown) fitted in the shaft hole 3a shown in FIG. 1, the rotary substrate 2 corotates with the rotary member 3. With the rotation, as shown in FIG. 10, the slider 5 embedded in the housing 1 relatively slides on the electrode pattern 31, the sliders 6 and 8 relatively slide on the resistor pattern 32, and the slider 7 relatively slides on the electrode pattern 33. Signals in accordance with changes in resistance are output through the terminal 9 and the terminals 10 and 12, and the terminal 11 and the terminals 10 and 12, so that the rotating position of the operating shaft is detected.

[0038] Since the sliders 6 and 8 are arranged so that at least one of them is constantly in contact with the resistor pattern 32 provided through 180° or more on the rotary substrate 2, the rotating position of the rotary member 3 can be detected, regardless of the rotating angle of the rotary member 3. That is, whether the rotating angle is less than or equal to 360°, or exceeds 360°, the rotating position of the rotary member 3 can be endlessly and reliably detected through the terminal 10 or the terminal 12 without forming a dead zone.

[0039] In the first embodiment, since the sliders 5 to 8 are separately embedded in the housing 1 so that they are spaced from one another in the circumferential direction of the rotary substrate 2, the sliders 5 to 8 can be made long. Consequently, the total area of the regions in which the sliders 5 to 8 are in contact with the conductive pattern, namely, the electrode patterns 31 and 33 and the resistor pattern 32 can be reduced, and the outer size of the housing 1 can be thereby reduced. As a result, the size of the entire component can be reduced. Furthermore, since the sliders 5 to 8 can be made long, a sufficient strength is ensured, and durability is increased.

[0040] The portions of the housing 1 separate from an overlapping planar portion between the housing 1 that is substantially square in plan view and the rotary substrate 2, that is, the areas near the corners of the housing 1 outside the circular recess 17 shown in FIG. 2, which were dead spaces before, can be effectively used as portions in which the sliders 5 to 8 are embedded. Therefore, the outer size of the housing 1 can be limited to a size such as to accommodate the rotary substrate 2, that is, a small size that allows the circular recess 17 to be formed. This also contributes to size reduction of the entire component.

[0041] In particular, since the portions having the sliders 5 to 8 embedded therein include a part of the bottom wall of the circular recess 17, even when the areas near the corners of the housing 1 that define dead spaces are reduced, the sliders 5 to 8 can be stably held in the housing 1. This can minimize the outer size of the housing 1.

[0042] Even when the portions having the sliders 5 to 8 embedded therein protrude into the circular recess 17, as described above, since the sliders 5 to 8 extend in the chord direction of the rotary substrate 2, they can ensure a sufficient length to obtain a predetermined spring characteristic without increasing the diameter of the circular recess 17 more than necessary.

[0043] The sliders 5 to 8 extend from the adjacencies of the different corners of the housing 1 in the chord direction of the circular rotary substrate 2, and are arranged in almost the same manner. Therefore, the sliders 5 to 8 can have the same shape, and have equivalent spring characteristics, as described above. Furthermore, since the four sliders 5 to 8 having the same shape are spaced from one another in the circumferential direction of the rotary substrate 2, that is, they are arranged near the different corners of the housing 1, the contact portions thereof with the electrode patterns 31 and 33 and the resistor pattern 32 on the rotary substrate 2 can be substantially equally spaced in the circumferential direction of the rotary substrate 2, as described above. Therefore, the rotary substrate 2 does not tilt, but can be held in a predetermined plane parallel to the bottom wall of the circular recess 17 during rotation. This prevents uneven wear between the sliders 5 to 8 and the electrode patterns 31 and 33 and the resistor pattern 32 on the rotary substrate 2, and ensures high durability.

[0044] In the first embodiment, the closing plates 18 to 21 shown in FIG. 2 can prevent resin from adhering to the respective sliders 5 to 8 during insert molding. Therefore, it is unnecessary to form closing plates for preventing resin adhesion to the sliders 5 to 8, separately from the sliders 5 to 8. That is, since the closing plates 18 to 21 can be integrally formed simultaneously with the formation of the respective sliders 5 to 8, as described above, the number of parts necessary for insert molding can be reduced, and the production cost can be reduced. Similarly, the terminals 9 to 12 can be integrally formed simultaneously with the formation of the respective sliders 5 to 8, and therefore, the number of parts is not increased. Consequently, the production cost can be reduced.

[0045] Since the terminals 9 to 12 are disposed in the cutouts 13 to 16 provided at the corners of the housing 1, the outline of the plane including the housing 1 and the terminals 9 to 12 can be made square. That is, the terminals 9 to 12 can be arranged so as not to protrude outward from the square outline. This allows chucking to be easily and reliably performed when mounting the housing 1, that is, the rotary electric component, onto a printed board, and enhances the mounting efficiency.

[0046] Since the sliders 5 to 8 are disposed along the different sides of the housing 1, the closing plates 18 to 21 can be easily placed therebeneath. Furthermore, since the terminals 9 to 12 are arranged at the different

corners of the housing 1, the width thereof can be increased, and the fixing strength after mounting can be increased.

[0047] Since the annular projections 3c in sliding contact with the cover member 4 are provided on the upper surface of the rotary member 3, the rotary member 3 can be maintained in line contact with the cover member 4 during rotation. This achieves a smooth rotation of the rotary member 3, and improves the reliability of the component.

[0048] Since a plurality of projections 3b in contact with the rotary substrate 2 are provided on the lower surface of the rotary member 3, the rotary substrate 2 can be prevented from being bent by the pressure of contact with the sliders 5 to 8. This makes it possible to maintain a flat planar shape of the rotary substrate 2 for a long period and to ensure a high signal-output performance. This also contributes to a more reliable component.

[0049] Since a pair of engaging pieces 4a of the cover member 4 are fitted on a pair of engaging projections 1a of the housing 1, the cover member 4 can be easily mounted on the housing 1.

[0050] FIG. 11 is a plan view showing the principal part of a rotary encoder serving as a rotary electric component according to a second embodiment of the present invention, more particularly, showing the positional relationship between a conductive pattern provided on a rotary substrate and sliders embedded in a housing.

[0051] The rotary encoder shown in FIG. 11 is utilized as a rotation-angle sensor, and includes only three sliders 5, 6, and 7. A conductive pattern provided on a rotary substrate 2 includes an innermost common pattern 34, a first conductive pattern 35 on the outer side of the common pattern 34, and a second conductive pattern 36 on the outer side of the first conductive pattern 35. Other structures are the same as those in the above-described first embodiment shown in FIGS. 1 to 10.

[0052] In the second embodiment having such a configuration, when the rotary substrate 2 rotates, the slider 5 relatively slides on the common pattern 34, the slider 6 relatively and intermittently slides on the first conductive pattern 35, and the slider 7 relatively and intermittently slides on the second conductive pattern 36. Signals corresponding to the rotation angles of the rotary substrate 2 are thereby output through terminals 9 and 10, and terminals 9 and 11.

[0053] In the second embodiment, the sliders 5, 6, and 7 are arranged in a manner similar to that in the above first embodiment shown in FIGS. 1 to 10, and therefore, operational advantages equivalent to those in the first embodiment can be provided.

[0054] While the cutouts 13 to 16 are provided at the corners of the housing 1 and the terminals 9 to 12 are arranged in the spaces defined by the cutouts 13 to 16 in the above embodiments, the cutouts 13 to 16 may be omitted, for example, in a condition that there is no need to take chucking during mounting into account. That is, the housing 1 may be shaped like a complete square in plan view, and the terminals 13 to 16 may protrude outward from appropriate positions, for example, the side faces, of the housing 1.

[0055] While the housing 1 is substantially square, that is, substantially rectangular in the above embodiments, it may be shaped like other polygons, such as a triangle, a hexagon, and an octagon, a circle, and an ellipse.

[0056] While the present invention has been described with reference to what are presently considered to be the preferred embodiments, it is to be understood that the invention is not limited to the disclosed embodiments. On the contrary, the invention is intended to cover various modifications and equivalent arrangements included within the spirit and scope of the appended claims. The scope of the following claims is to be accorded the broadest interpretation so as to encompass all such modifications and equivalent structures and functions.

Claims

1. A rotary electric component comprising:

a housing;
at least three sliders electrically independent from one another, and separately embedded in the housing; and
a rotary substrate having a conductive pattern on which the sliders slide,

wherein the sliders are spaced from one another in the circumferential direction of the rotary substrate.

2. A rotary electric component according to claim 1, wherein the housing has at least three corners outside a region in which the rotary substrate rotates, and the sliders are embedded in areas near the respective corners of the housing.

3. A rotary electric component according to claim 1 or 2, wherein the housing has a circular recess that accommodates the rotary substrate, and each of the areas includes a part of a bottom wall of the circular recess.

4. A rotary electric component according to any of claims 1 to 3, wherein closing plates are provided integrally with the respective sliders to close spaces provided in the housing.

5. A rotary electric component according to any of claims 1 to 4, wherein terminals are provided integrally with the respective sliders.

6. A rotary electric component according to claim 5, wherein the planar shape of the housing is substantially square, the corners have cutouts, and the terminals are exposed from spaces defined by the cutouts.

7. A rotary electric component according to any of claims 1 to 6, wherein the conductive pattern includes an arc-shaped resistor pattern and a pair of ring-shaped electrode patterns connected to both ends of the resistor pattern,

wherein said at least three sliders comprise four sliders, two of the sliders are in sliding contact with the electrode patterns, and the remaining two sliders are disposed on the opposite sides of the rotating center of the rotary substrate so as to be in sliding contact with the resistor pattern.

FIG. 1

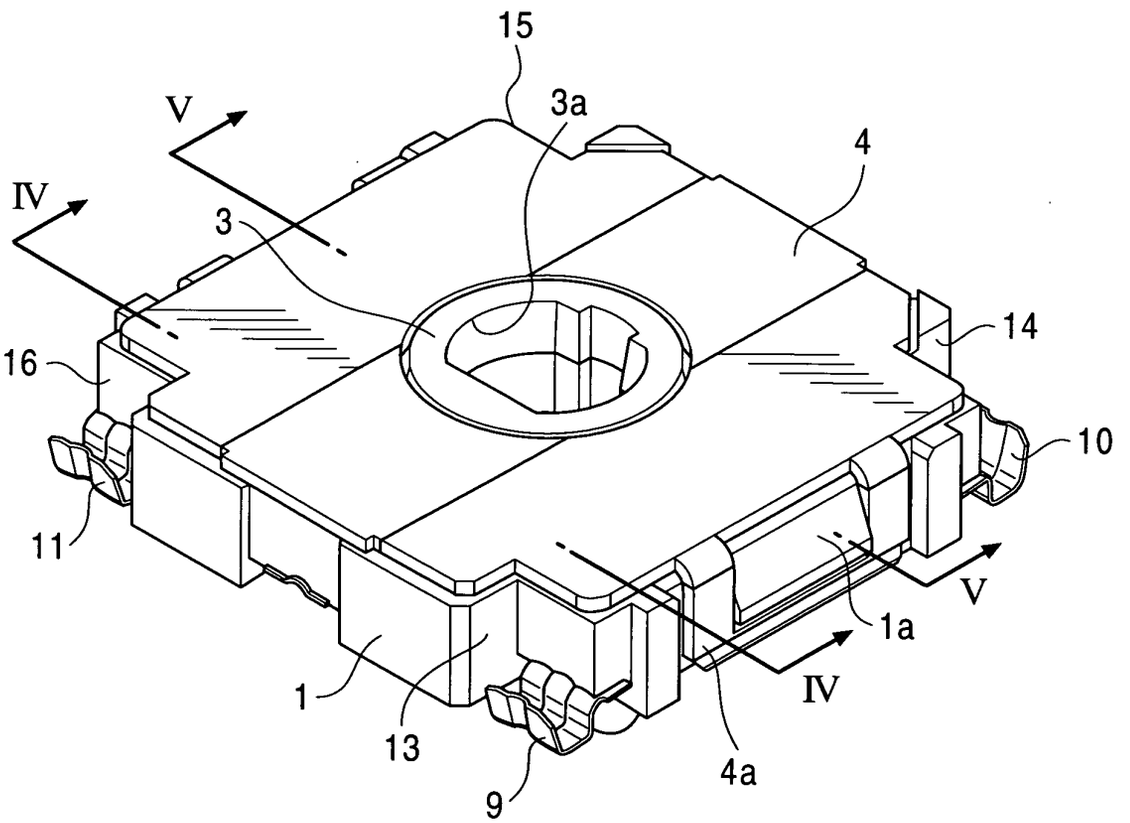


FIG. 2

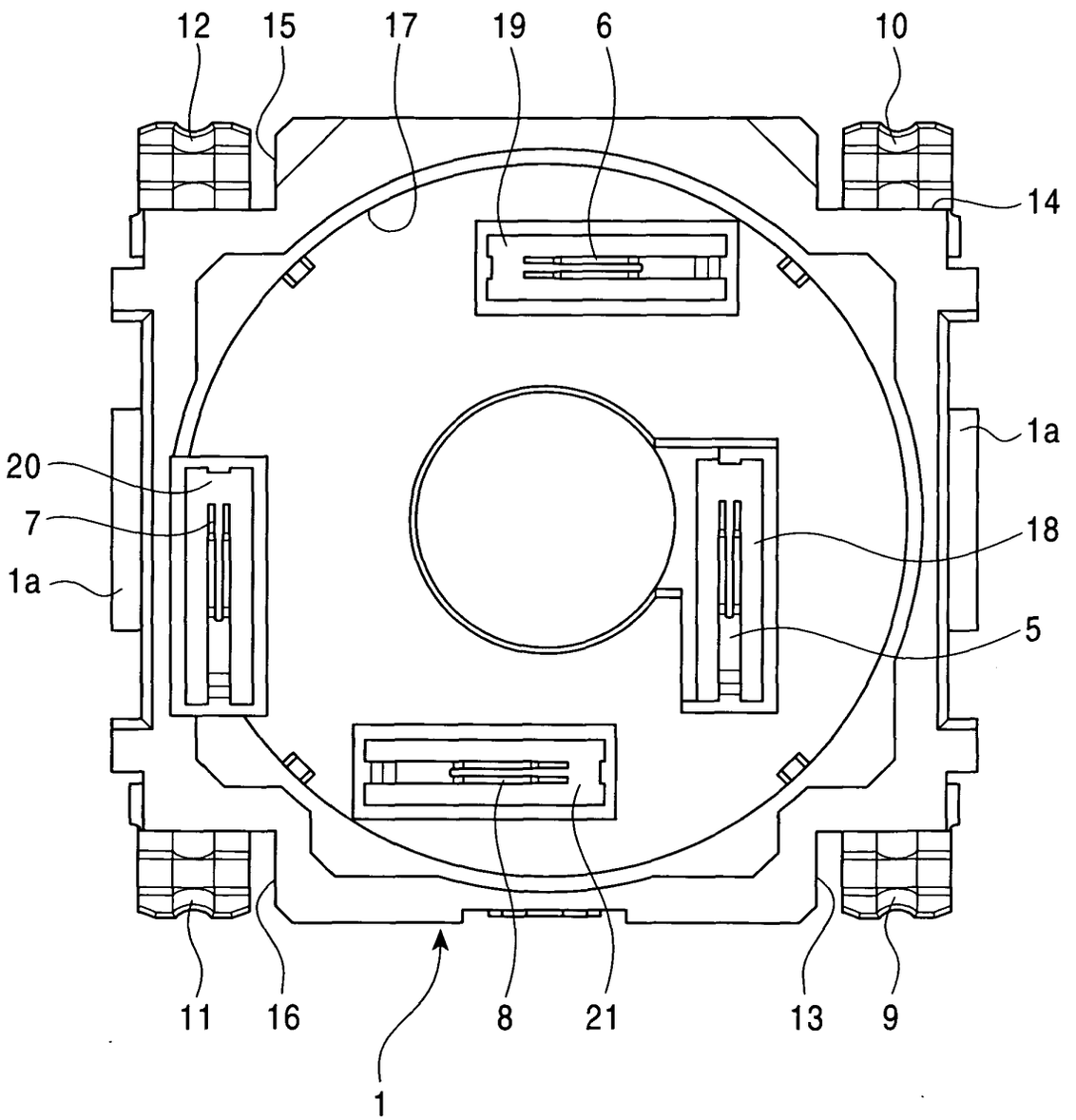


FIG. 3

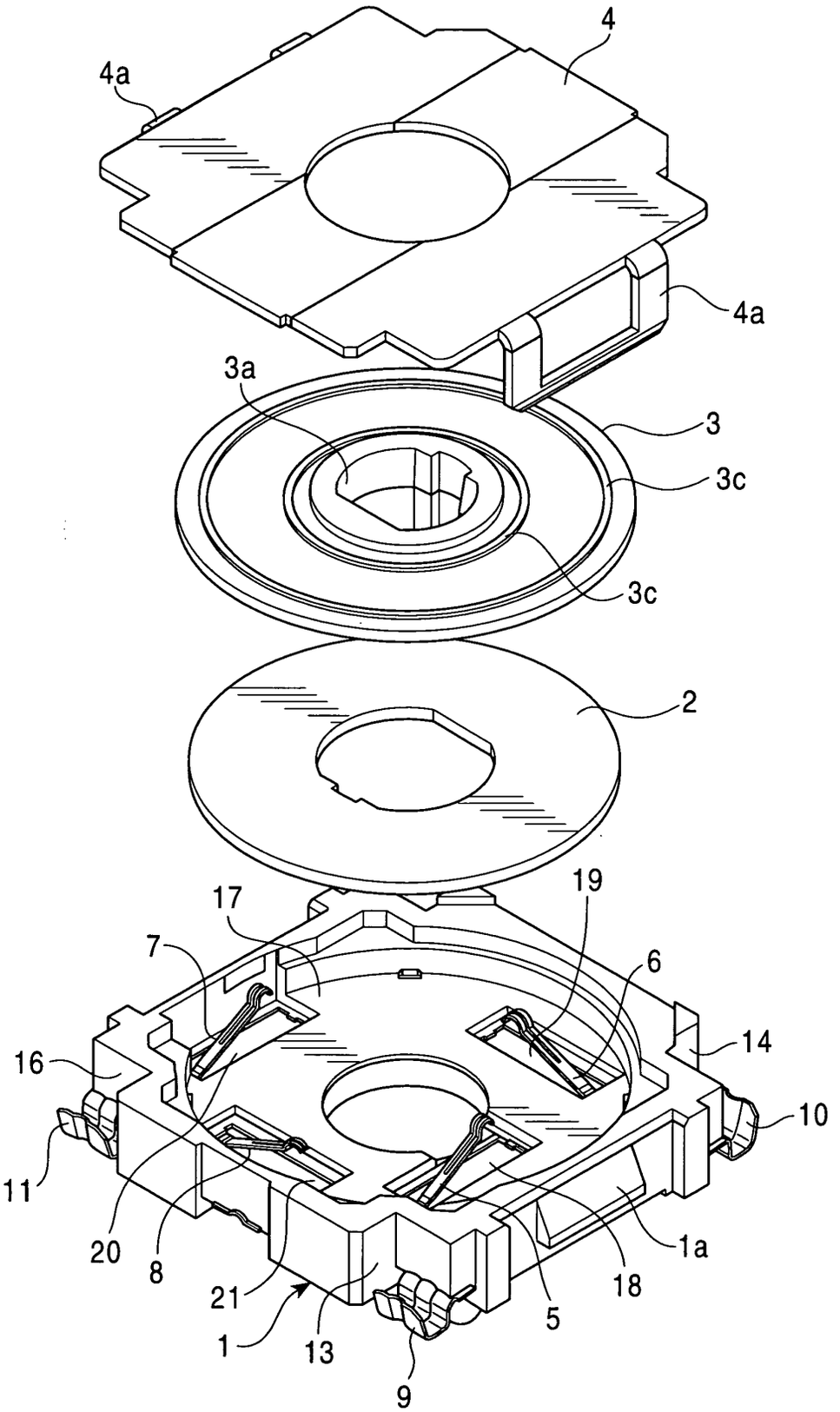


FIG. 4

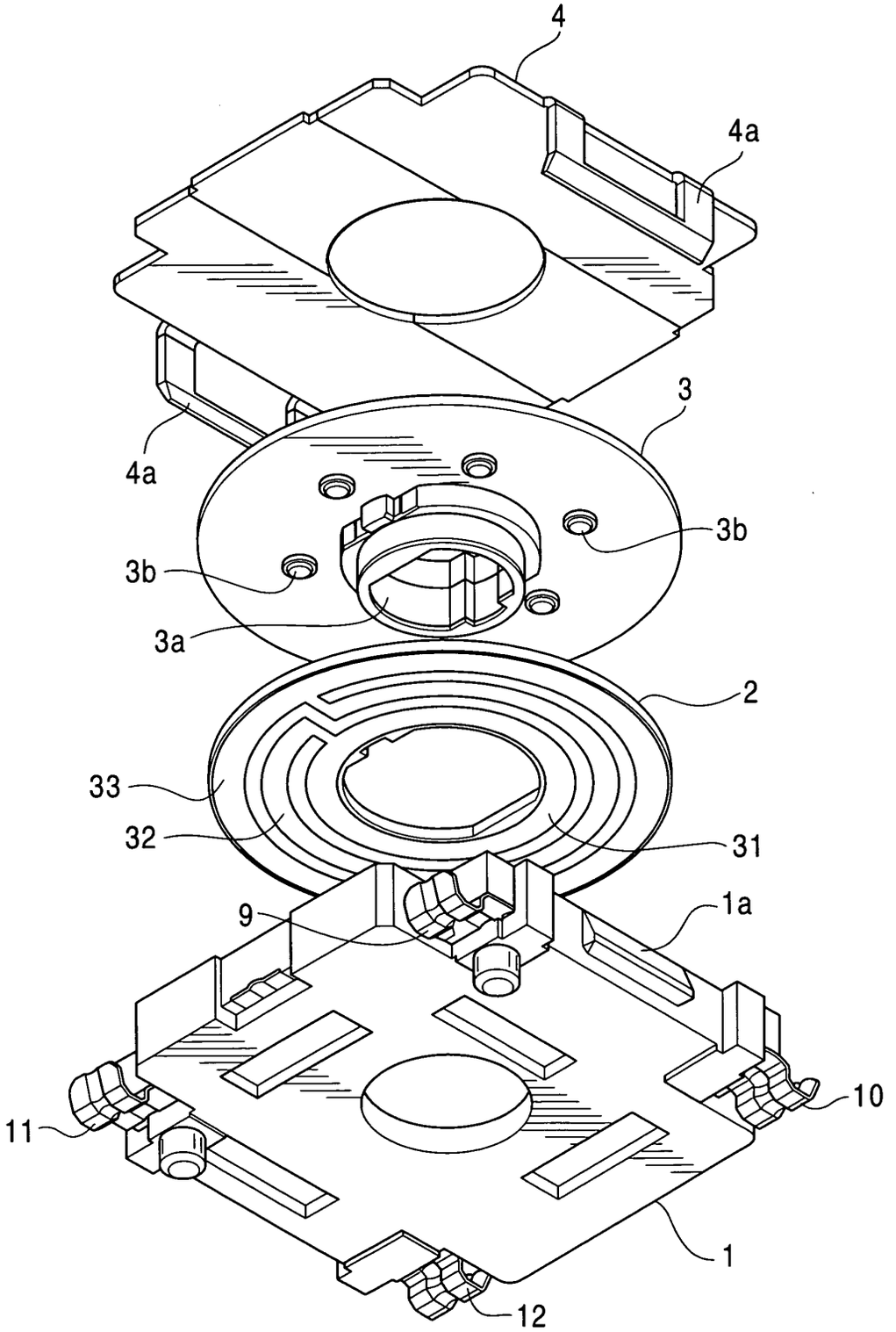


FIG. 5

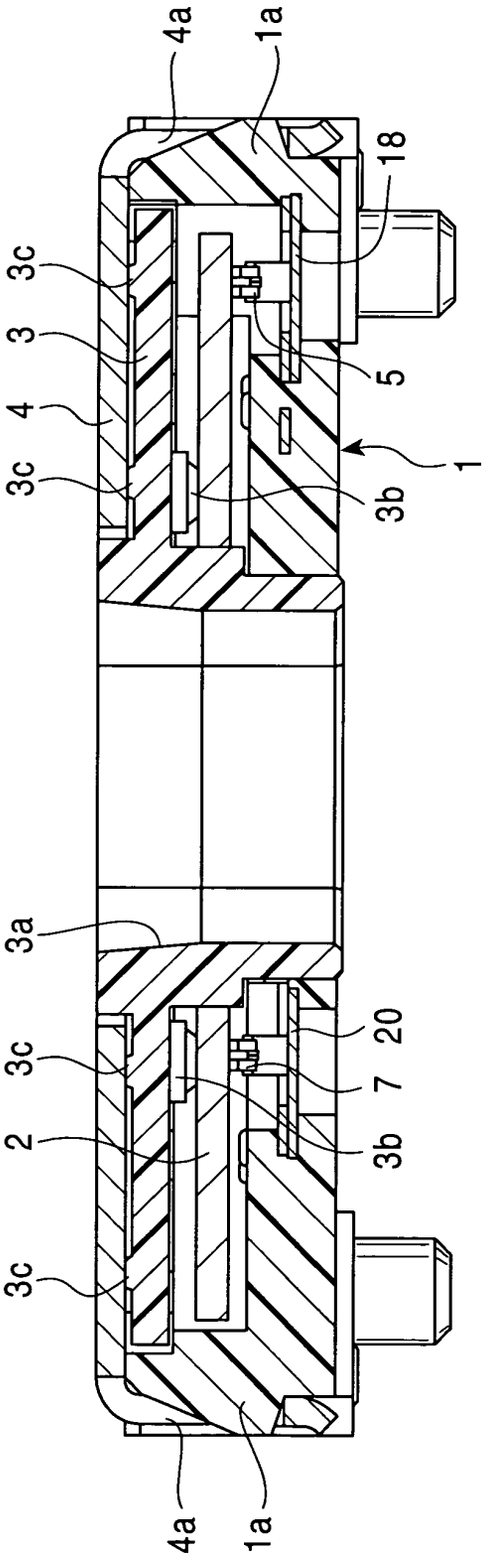


FIG. 6

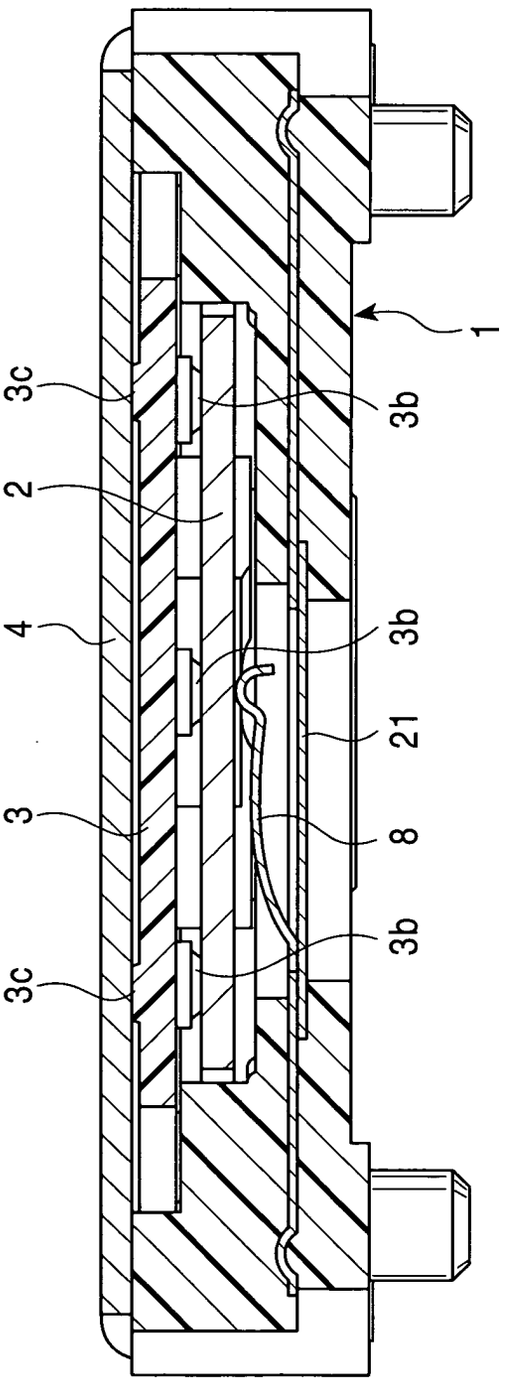


FIG. 7

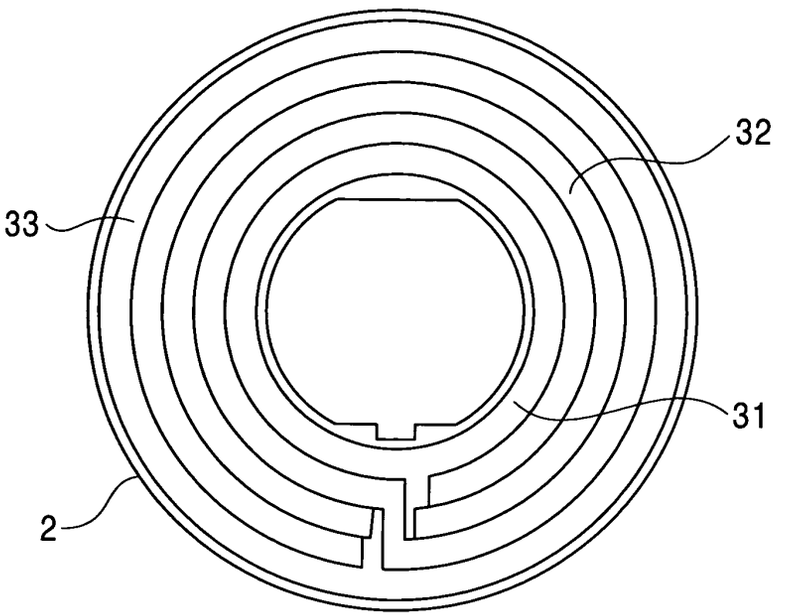


FIG. 8

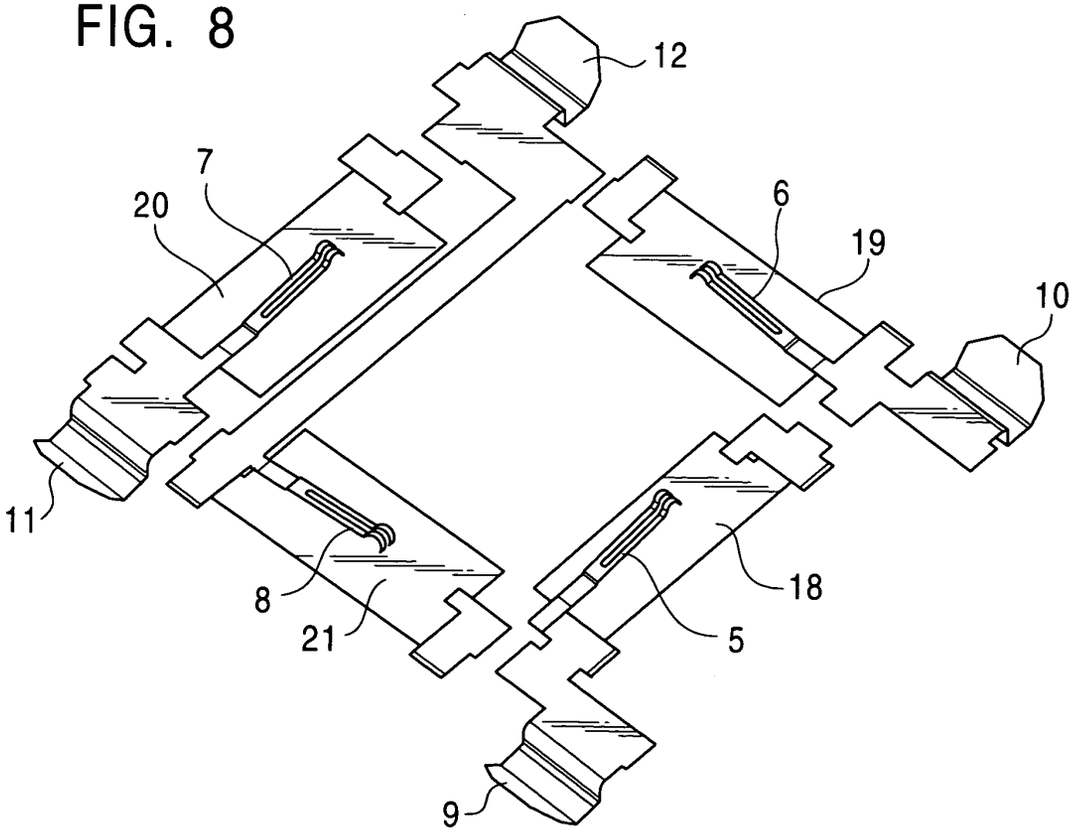


FIG. 9

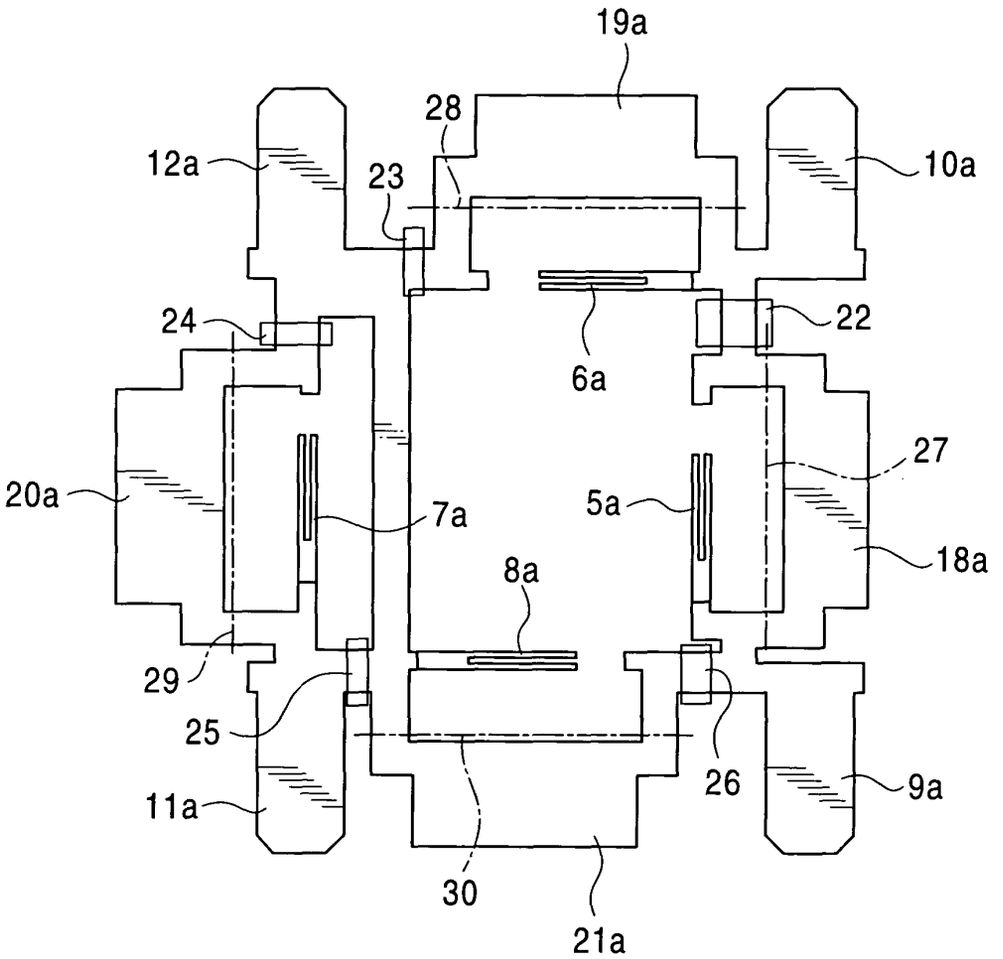


FIG. 10

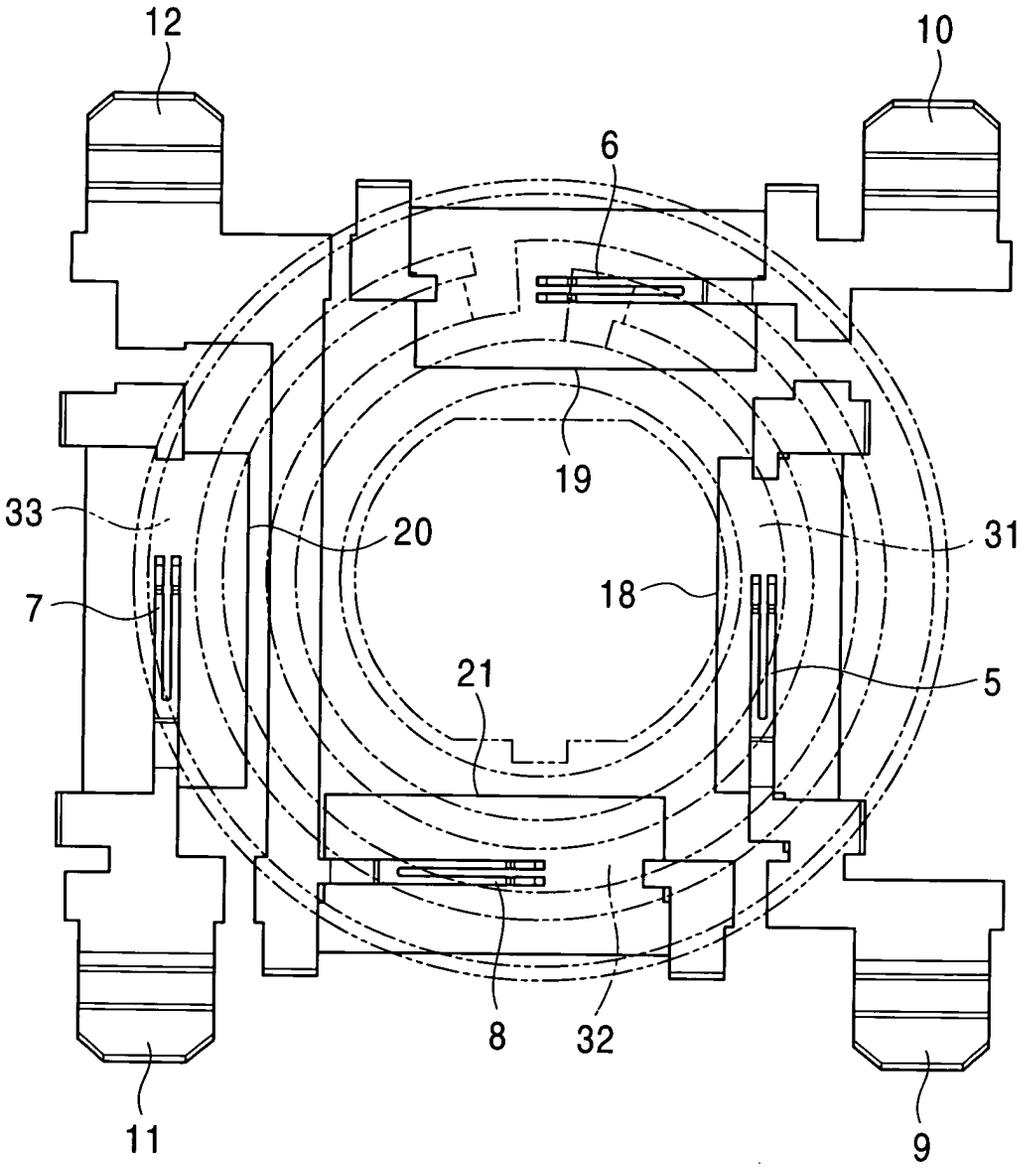


FIG. 11

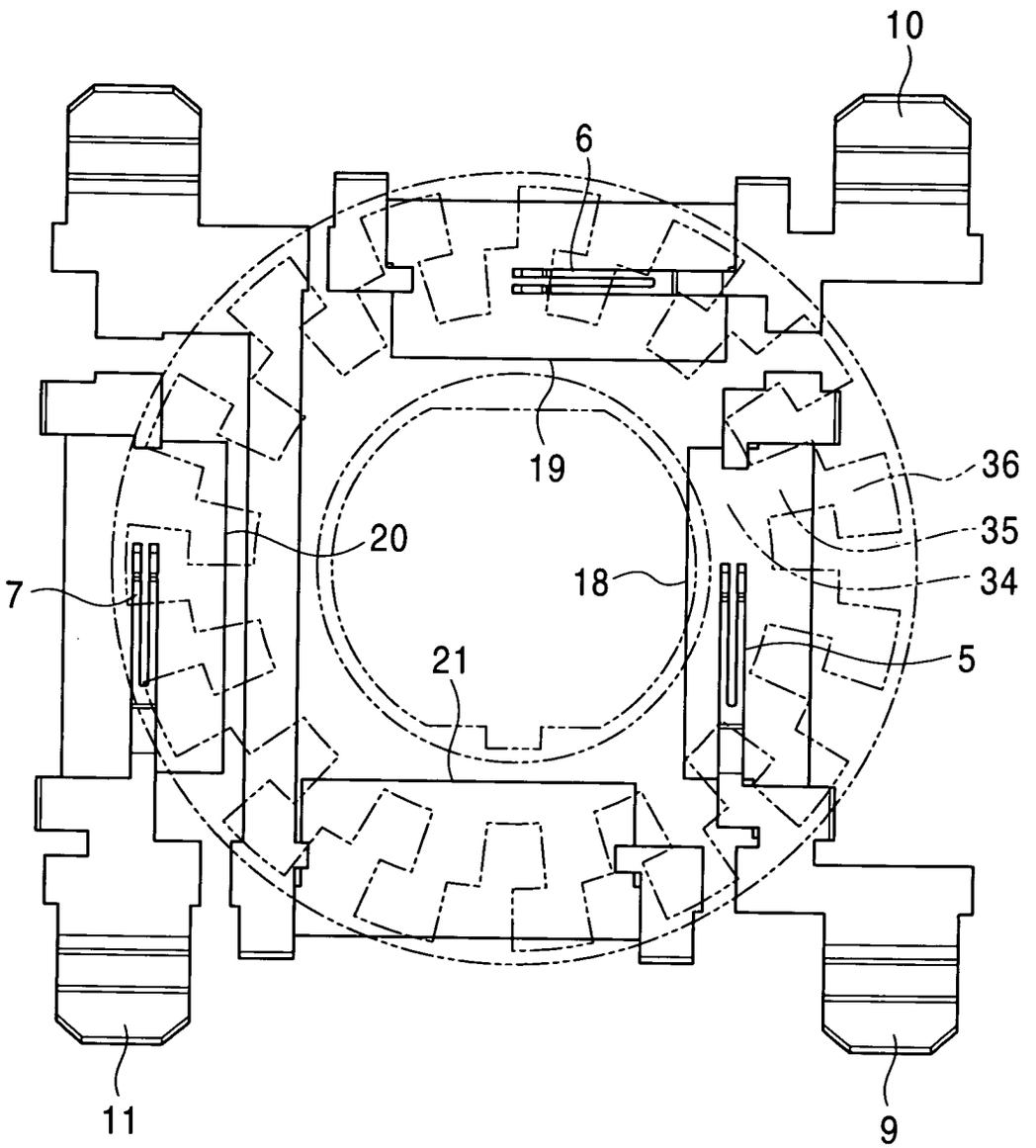


FIG. 12A
PRIOR ART

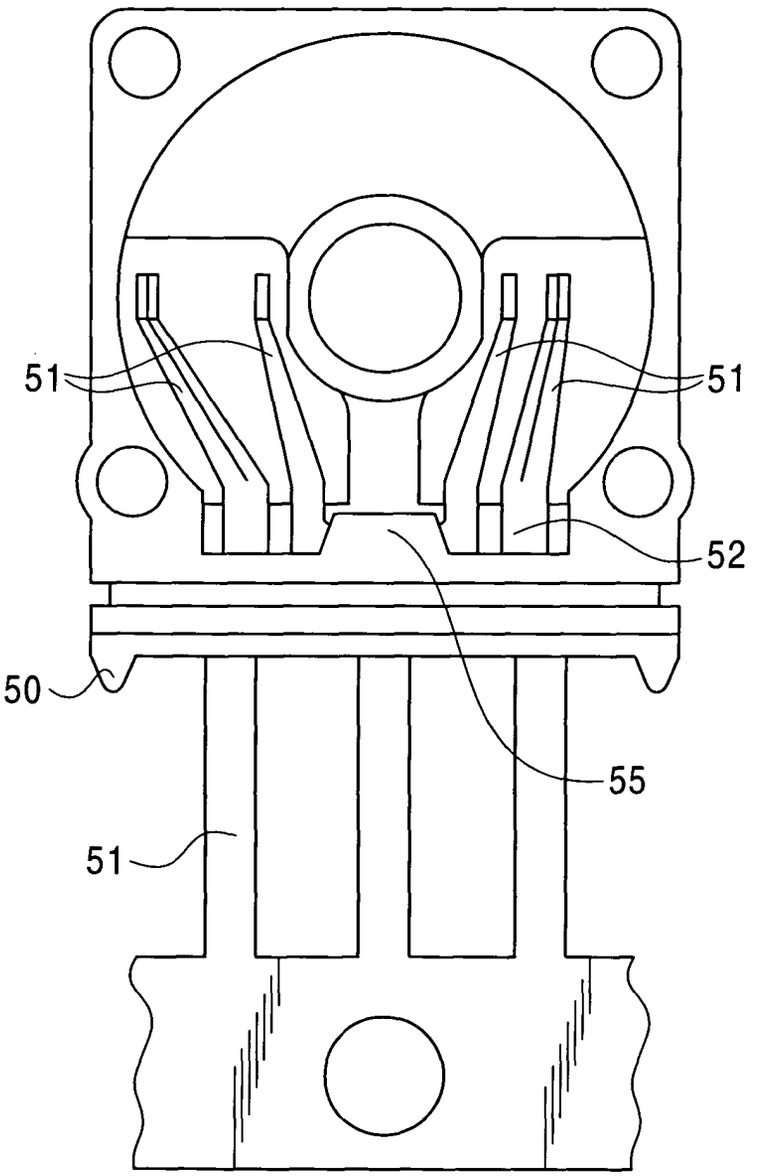
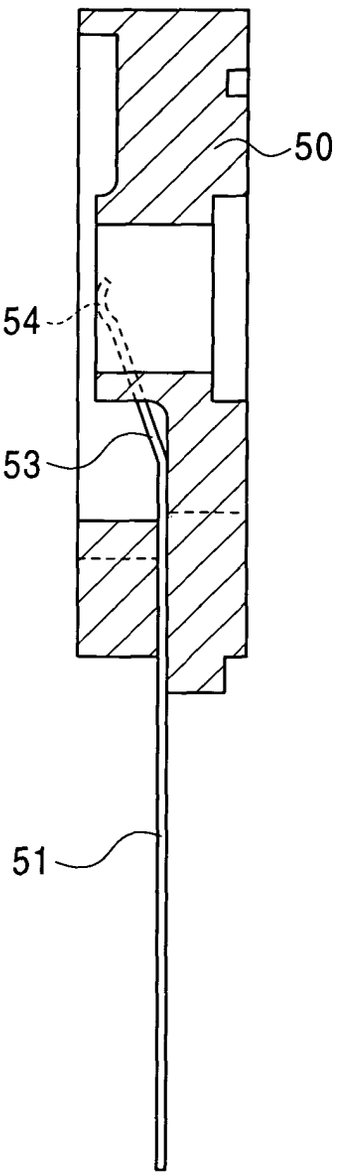


FIG. 12B
PRIOR ART



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EUROPEAN SEARCH REPORT

Application Number
EP 04 00 9957

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.7)
A	US 4 879 803 A (SEMURA NORIO ET AL) 14 November 1989 (1989-11-14) * column 5, last line , last paragraph - column 6, line 1, paragraph 1; figure 6 *	1	H01H19/58
A	US 6 340 801 B1 (ISHIHARA YUKIHIRO ET AL) 22 January 2002 (2002-01-22) * abstract; figures 3,11 *	1	
A	US 5 422 448 A (KUMAZAWA KIYOHIKO ET AL) 6 June 1995 (1995-06-06) * abstract; figures 1,3 *	1	
A	DE 90 11 795 U (A.B.ELEKTRONIK GMBH) 29 November 1990 (1990-11-29) * claims; figures *	1	

TECHNICAL FIELDS SEARCHED (Int.Cl.7)

H01H

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	14 July 2004	Janssens De Vroom, P

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14-07-2004

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 4879803 A	14-11-1989	JP 1073012 U	17-05-1989
		JP 1044813 A	17-02-1989
		JP 2542861 B2	09-10-1996
		CA 1330356 C	21-06-1994
		DE 3827470 A1	02-03-1989
		US 5027021 A	25-06-1991
US 6340801 B1	22-01-2002	JP 2001148219 A	29-05-2001
		FI 20002516 A	20-05-2001
US 5422448 A	06-06-1995	JP 6043979 U	10-06-1994
DE 9011795 U	29-11-1990	DE 8911243 U1	02-11-1989
		DE 9011795 U1	29-11-1990

EPO FORM P0459

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