Appeal Decision

Appeal No. 2017-9147

Tokyo, Japan
Appellant SEIKO EPSON CORPORATION

Tokyo, Japan
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The case of appeal against the examiner's decision of refusal of Japanese Patent Application No. 2012-84617, entitled "Gyro Sensor and Electronic Device Including the Same" (the application published on October 17, 2013, Japanese Unexamined Patent Application Publication No. 2013-213754, the number of claims: 7) has resulted in the following appeal decision.

Conclusion

The examiner's decision is revoked.

The invention of the present application shall be granted a patent.

Reason

No. 1 History of the procedures

The application relating to this case (hereinafter, referred to as "the present application") is a patent application filed on April 3, 2012. Amendment to the specification and the scope of claims for patent was made on April 1, 2015. After that, a notice of reasons for refusal was issued on February 5, 2016, and amendment to the specification and the scope of claims for patent was made on April 21, 2016, a final notice of reasons for refusal was issued on September 7, 2016, and then, amendment to the specification and the scope of claims for patent was made on November 1, 2016. However, this amendment was dismissed by a decision dated March 14, 2017 and the examiner's decision of refusal (hereinafter, referred to as "the examiner's decision") was made on the same day. A certified copy of the examiner's decision was delivered on April 11, 2017.

Against this, an appeal against the examiner's decision of refusal was made on June 22, 2017, and amendment to the specification and the scope of claims for patent (hereinafter, referred to as "the Amendment") was made at the same time.

The number of claims of the present application before the Amendment (that is, at the time of the examiner's decision) is 8 and the number after the Amendment is 7.

No. 2 Inventions according to the present application

The inventions according to claim 1 to claim 7 in the scope of claims for patent of the present application (hereinafter, referred to as "Invention 1" to "Invention 7") are acknowledged as follows, as specified by the matters described in claim 1 to claim 7 in the scope of claims for patent of the present application.

"[claim 1]
A gyro sensor, comprising:

a substrate;

a frame-shaped driving mass driven in a first direction by a driving unit;

a detection mass coupled to an inner side of the frame-shaped driving mass by a zig-zag-shaped detection spring portion arranged along a direction orthogonal to the first direction with respect to the driving mass in a plan view;

a driving spring portion coupled to the driving mass at one end and fixed to a first anchor portion, which is provided on the substrate, at the other end;

a first island portion connected to the first anchor portion, arranged side by side with the driving mass along the first direction, and electrically connected to the driving mass;

a first projection provided at least either on a surface opposed to the first island portion of the driving mass or on a surface opposed to the driving mass of the first island portion; and

a fourth projection provided on the substrate at a position overlapping with at least either the driving mass or the detection mass in a plan view: wherein

the fourth projection is formed integrally with the substrate;

the driving unit includes:

a movable electrode portion connected to the driving mass; and

a fixed electrode portion provided so as to be opposed to the movable electrode portion; and

the detection mass includes:

a movable electrode for detection connected to the detection mass; and

a fixed electrode for detection arranged so as to be opposed to the movable electrode for detection; and

the shortest distance between the driving mass and the first island portion is larger than the driving amplitude of the driving mass and smaller than the maximum amplitude of the movable electrode portion.

[claim 2]

A gyro sensor according to claim 1, wherein

the first island portion includes:

a first distance regulating portion which is formed such that a part of position opposed to the driving mass is expanded toward the driving mass and which regulates a distance with the driving mass; and wherein

the first projection is provided at least either on a surface opposed to the first distance regulating portion of the driving mass or on a surface opposed to the driving mass of the first distance regulating portion.

[claim 3]

A gyro sensor according to claim 1 or claim 2 comprising:

the two driving masses arranged along the first direction;

a connection spring portion that couples the two driving masses, and an intermediate portion of which is fixed by a second anchor portion;

a second island portion arranged between the two driving masses and connected to the second anchor portion; and

a second projection provided on at least either a surface opposed to the second island portion of the driving mass or a surface opposed to the driving mass of the second island portion.

[claim 4]

A gyro sensor according to claim 3, wherein

the second island portion includes:

a second distance regulating portion which is formed such that a part of each of positions opposed to the two driving masses is expanded toward each of the two driving masses and which regulates a distance with the driving masses; and wherein

the second projection is provided on at least either a surface opposed to the second distance regulating portion of the driving mass or a surface opposed to the driving mass of the second distance regulating portion.

[claim 5]

A gyro sensor according to any of claim 1 to claim 4, wherein

at least a pair of the first island portions are arranged along a direction crossing the first direction.

[claim 6]

A gyro sensor according to any of claim 1 to claim 5, wherein

a third projection is provided at least either on the detection mass or on the detection spring portion.

[claim 7]

An electronic device, comprising a gyro sensor according to any one of claim 1 to claim 6."

Note that any of Invention 2 to Invention 7 includes all the configurations of Invention 1.

No. 3 Outline of the examiner's decision

The invention relating to each of claim 1, claim 2, claim 5, and claim 8 of the present application could have been easily made by a person skilled in the art based on the inventions described in Cited Document 1 to Cited Document 4 which are described later; thus, the appellant should not be granted a patent for the Invention in accordance with the provisions of Article 29(2) of the Patent Act.

The invention relating to each of claim 3 and claim 4 of the present application could have been easily made by a person skilled in the art based on the inventions described in Cited Document 1 to Cited Document 5 which are described later; thus, the appellant should not be granted a patent for the Invention in accordance with the provisions of Article 29(2) of the Patent Act.

The invention relating to each of claim 6 and claim 7 of the present application could have been easily made by a person skilled in the art based on the inventions described in Cited Document 1 to Cited Document 7 which are described later; thus, the appellant should not be granted a patent for the Invention in accordance with the provisions of Article 29(2) of the Patent Act.

Cited Document 1: Japanese Unexamined Patent Application Publication: No. H11-002526

Cited Document 2: Japanese Unexamined Patent Application Publication: No. H11-173851

Cited Document 3: Japanese Unexamined Patent Application Publication No. 2005-326310

Cited Document 4: Japanese Unexamined Patent Application Publication No.

2012-042228

Cited Document 5: Japanese Unexamined Patent Application Publication No. 2000-046560

Cited Document 6: Japanese Unexamined Patent Application Publication No. 2002-207048

Cited Document 7: Japanese Unexamined Patent Application Publication: No. H09-033557

No. 4 Invention and others described in the Cited Documents

1 Cited Document 1

(1) Description in Cited Document 1

Cited Document 1 includes the following description. The underlines have been added by the body.

"[0001]

[Field of the Invention] The present invention relates to a vibrating type angular velocity sensor utilizing characteristics of a gyroscope."

"[0009]

[Means for solving the problem] A vibrating type angular velocity sensor, according to a first configuration of the present invention, is featured by comprising: a driving vibrator element supported by a first beam fixed by an anchor portion on a substrate, and driven by a driving comb electrode in an X-axial direction parallel to the substrate; a detecting vibrator element supported by a second beam on the driving vibrator element and being vibratable in a Y-axial direction parallel to the substrate; and detection electrodes of electric capacitances provided with a space along the X-axial direction apart from the detecting vibrating element, whereby an angular velocity about an axis in a Z axial direction perpendicular to the substrate is detected."

"[0012]

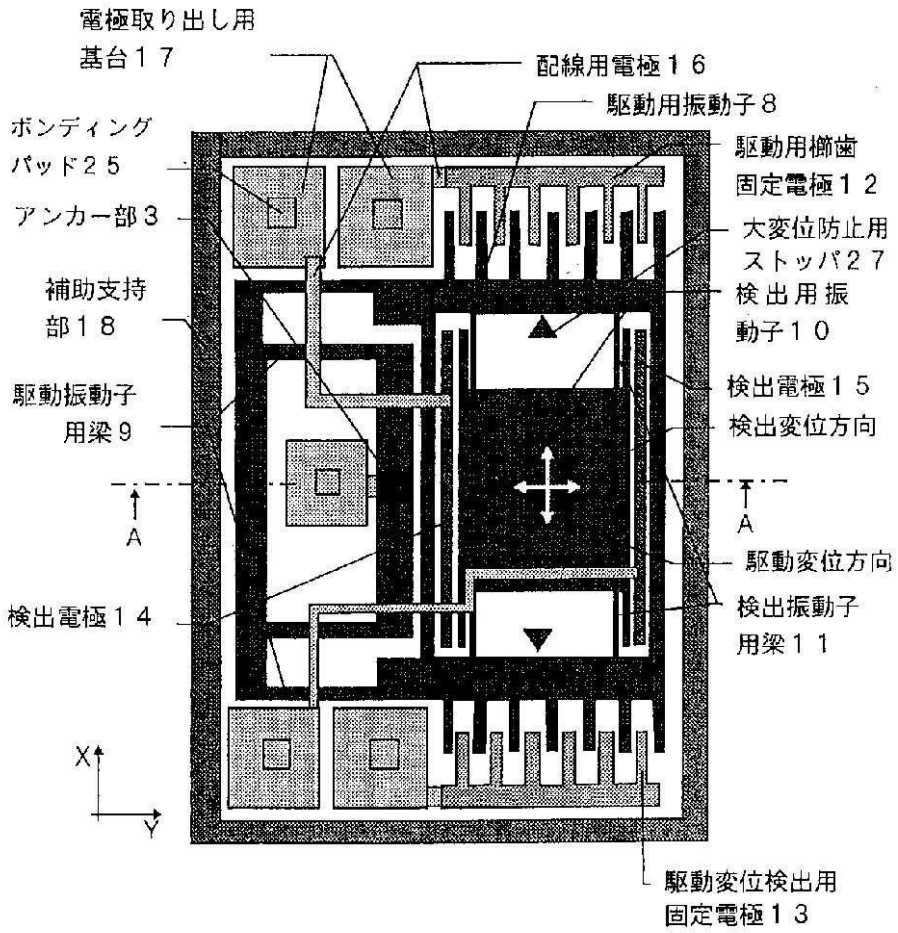
[Embodiments of the invention]

Embodiment 1. Both FIGS. 1 and 2 show a vibrating type angular velocity sensor according to embodiment 1 of the present invention. FIG. 1 is a plan view of this sensor, and FIG. 2 is an A-A line cross-sectional view of FIG. 1. A driving vibrator element 8 is supported by a beam 9 for the driving vibrator element (folded beam), corresponding to a first beam, and is fixed via an anchor portion 3 on a lower glass substrate 19. On an inner side of the driving vibrator element 8, a detecting vibrator element 10 for detecting Y-direction Coriolis force is supported by four beams 11 for the detecting vibrator element corresponding to a second beam. A driving comb fixed electrode 12 and a drive displacement detecting fixed electrode 13 are formed so as to be opposed to a side surface of the driving vibrator element 8, and further comb electrode structures are also formed on the driving vibrator element 8 so as to be opposed to the combs of theses electrodes 12 and 13. On the other hand, detection electrodes 14 and 15 of electric capacitances are formed with a gap of several micrometers apart from the element on both sides of the detecting vibrator element 10, so that a capacitor C1 and a capacitor C2 are formed between the detecting vibrator element 10 and these detection electrodes 14, 15. Thus, an equivalent circuit shown in

FIG. 7 is formed by these capacitors C1 and C2. The electrodes and the anchor portion 3 are coupled to respective electrode takeoff bases 17 via a wiring electrode 16 provided on the lower glass substrate 19. A bonding pad 25 is formed on these electrode takeoff bases 17. A large displacement preventing stopper 27 is provided between the driving vibrator element 8 and the detecting vibrator element 10 in order to avoid excessive displacement in the X-axial direction, caused when drop and shock happen to occur. Also, to restrict large displacement generated in both the positive and negative directions of the X-axial direction, this large displacement preventing stopper 27 is placed on both sides of the detecting vibrator element 10 between the driving vibrator element 8 and the detecting vibrator element 10 with a gap space of a displacement amount, to which a large displacement is to be restricted, provided on the driving vibrator element 8 side. In addition, an auxiliary supporting portion 18 is provided in such a manner as to surround each of such components as the driving vibrator element 8 and the detecting vibrator element 10. Preferably, these vibrator elements 8 and 10, the electrode takeoff bases 17, the stoppers 27, and the respective electrodes 12 to 16 are manufactured through bulk micromachining by using Si (silicon) of a semiconductor material. As shown in the sectional view of FIG. 2, the vibrator elements 8 and 10 are anode-jointed to the lower glass substrate 19 only at the anchor portion 3, and other parts are anode-jointed to the lower glass substrate 19 at either the entire surfaces thereof or portions thereof facing the lower glass substrate 19.

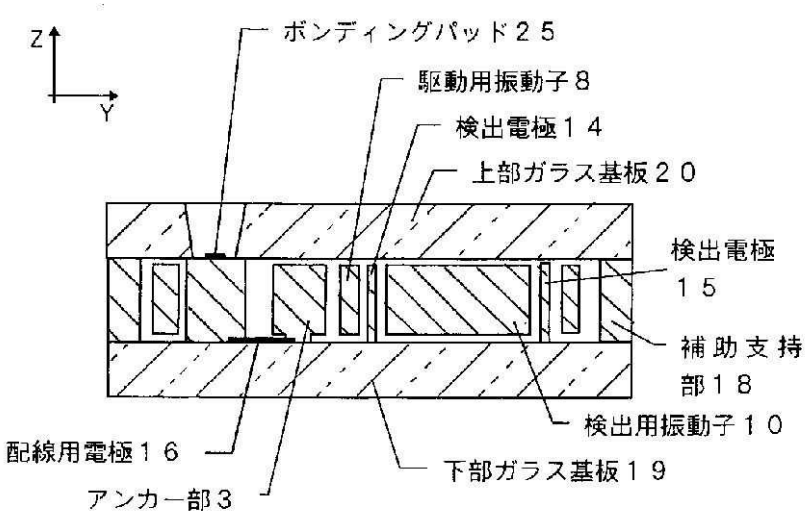
[0013] When the driving vibrator element 8 is excited to be driven in the X direction with employment of the above-described configuration, the angular velocity about an axis in the Z direction can be detected by the vibrations of the detecting vibrator element 10 in the Y direction.

[FIG. 1]



電極取り出し用基台１７　Electrode takeoff base 17
ボンディングパッド２５　Bonding pad 25
アンカー部３　Anchor portion 3
補助支持部１８　Auxiliary supporting portion 18
駆動振動子用梁９　Beam 9 for the driving vibrator element
検出電極１４　Detection electrode 14
配線用電極１６　Wiring electrode 16
駆動用振動子８　Driving vibrator element 8
駆動用櫛歯固定電極１２　Driving comb fixed electrode 12
大変位防止用ストッパ２７　Large displacement preventing stopper 27
検出用振動子１０　Detecting vibrator element 10
検出電極１５　Detection electrode 15
検出変位方向　Detection displacement direction
駆動変位方向　Drive displacement direction
検出振動子用梁１１　Beam 11 for the detecting vibrator element
駆動変位検出用固定電極１３　Drive displacement detecting fixed electrode 13

[FIG. 2]



ボンディングパッド２５　Bonding pad 25
駆動用振動子８　Driving vibrator element 8
検出電極１４　Detection electrode 14
上部ガラス基板２０　Upper glass substrate 20
配線用電極１６　Wiring electrode 16
アンカー部３　Anchor portion 3
検出用振動子１０　Detecting vibrator element 10
下部ガラス基板１９　Lower glass substrate 19
検出電極１５　Detection electrode 15
補助支持部１８　Auxiliary supporting portion 18

(2) The Invention described in Cited Document 1

It can be seen from FIG. 1 of Cited Document 1 that the driving vibrator element 8 is frame-shaped. In addition, it can be seen from FIG. 1 and FIG. 2 of Cited Document 1 that the electrode takeoff base 17 electrically connected with the anchor portion 3 (a portion where the bonding pad 25 is formed in FIG. 2) is arranged on the side opposite the driving vibrator element 8 across the anchor portion 3 along the Y-axis direction parallel to the lower glass substrate 19.

Then, according to the description of (1) above of Cited Document 1, the following invention (hereinafter, referred to as "the Cited Invention") is described in Cited Document 1.

"A vibrating type angular velocity sensor utilizing characteristics of a gyroscope comprising:

a frame-shaped driving vibrator element 8 which is supported by a beam 9 for the driving vibrator element corresponding to a first beam that is fixed by an anchor portion 3 on a lower glass substrate 19, and which is driven in an X-axis direction parallel to a lower glass substrate 19 by a driving comb electrode;

a detecting vibrator element 10 which is supported by four beams 11 for a

detecting vibrator element, corresponding to a second beam, on an inner side of the driving vibrator element 8 and which is vibratable in a Y-axis direction parallel to the lower glass substrate 19; and

detection electrodes 14 and 15 of electric capacitances which are provided with a space along the X-axis direction apart from the detecting vibrator element 10 and which form capacitors C1 and C2 respectively with the detecting vibrator element 10: wherein

the driving comb electrode is constituted of a driving comb fixed electrode 12 and a comb electrode structure formed on the driving vibrator element 8 so as to be opposed to the comb of the driving comb fixed electrode 12;

the anchor portion 3 is coupled to an electrode takeoff base 17 via a wiring electrode 16 provided on the lower glass substrate 19;

the electrode takeoff base 17 is arranged on a side opposite the driving vibrator element 8 across the anchor portion 3 along the Y-axis direction parallel to the lower glass substrate 19;

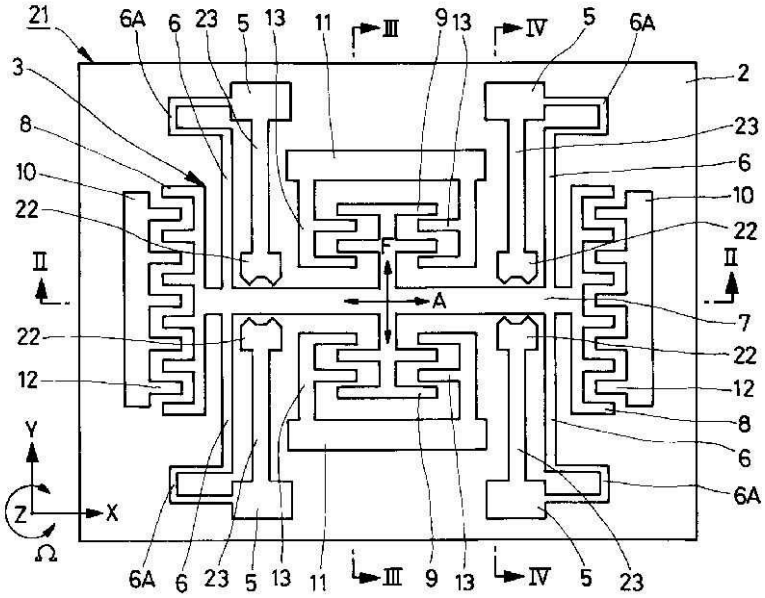
a large displacement preventing stopper 27 is provided between the driving vibrator element 8 and the detecting vibrator element 10 in order to avoid excessive displacement in the X-axis direction, caused when drop and shock happen to occur; and

the large displacement preventing stopper 27 is placed on both sides of the detecting vibrator element 10 between the driving vibrator element 8 and the detecting vibrator element 10 with a gap space of a displacement amount, to which a large displacement is to be restricted, provided on the driving vibrator element 8 side."

2 Cited Document 2

Cited Document 2 (especially, paragraphs [0041] to [0044], and FIG. 1) describes the technical matters of: integrally forming a supporting portion 5, a stopper 22, a connecting portion 23 between the supporting portion 5 and stopper 22, and two projections 22A and 22A formed on the surface of the stopper 22 opposed to the vibrator element 7; and holding the stopper 22 at the same potential as the vibrator element 7 via the supporting portion 5 and a beam 6.

[FIG. 1]



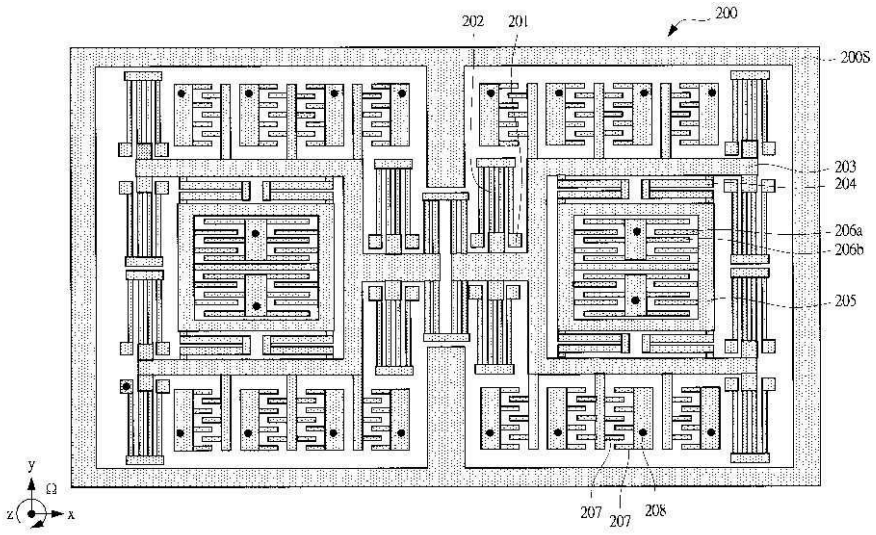
3 Cited Document 3

Cited Document 3 (especially, paragraph [0005]) describes the technical matters of: allowing breakage and deformation of a vibrating plate because of insufficient regulation effects unless a gap between a spindle and a regulating member is narrowed in providing the regulating member for regulating an excessive displacement of the spindle; and regulating even necessary amplitudes if the gap between the spindle and the regulating member is narrowed excessively.

4 Cited Document 4

Cited Document 4 (especially, paragraphs [0072] and [0073], and FIG. 14) describes an angular velocity sensor that includes a movable part 203, and a Coriolis element 205 which is coupled to the inner side of the movable part 203 by a zig-zag shaped detection beam 204 arranged along a direction orthogonal to a direction in which the movable part 203 is driven, wherein the Coriolis element 205 includes a detection electrode 206a connected to the Coriolis element 205, and a fixed electrode 206b arranged so as to be opposed to the detection electrode 206a.

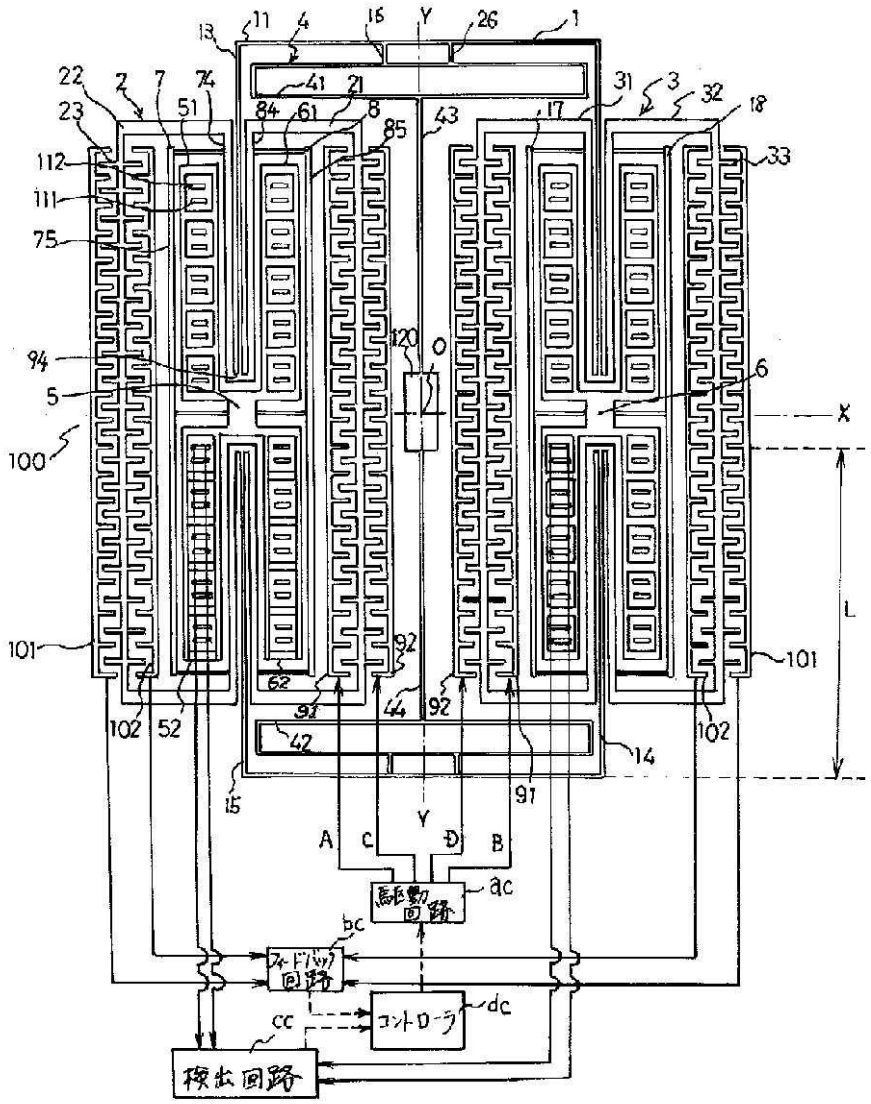
[FIG. 14]



5 Cited Document 5

Cited Document 5 (especially, paragraphs [0007] and [0021], and FIG. 1) describes the technical matters of: providing two driving masses (x vibrator elements 2 and 3) along a driving direction; and coupling the two driving masses by coupling spring parts (supporting beams 4 including movable beams 41 to 44, and coupling beams 11 and 14) to which a middle part (anchor portion 120) is fixed.

[FIG. 1]

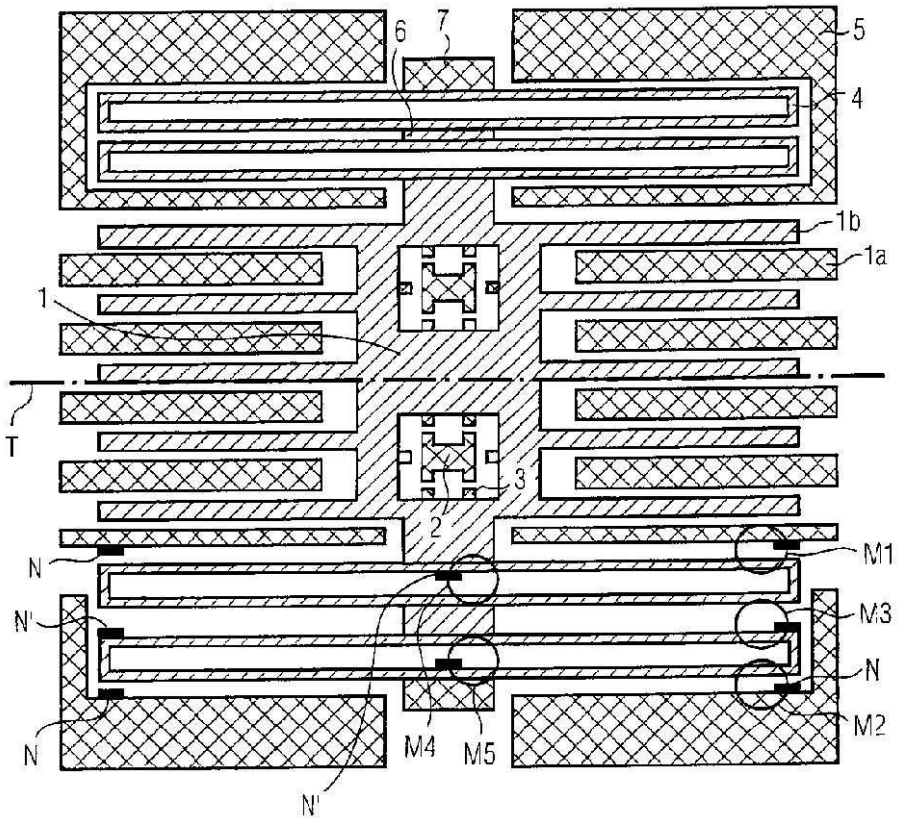


駆動回路　　Driving circuit
フィードバック回路　　Feedback circuit
コントローラ　　Controller
検出回路　　Detection circuit

6 Cited Document 6

Cited Document 6 (especially, paragraphs [0017], [0021] to [0024], and FIG. 1) describes the technical matters of: arranging a stopper member 2 in a detection direction of a vibration mass 1; and arranging nep-shaped stoppers N and N' in a detection direction of a U-shaped spring.

[FIG. 1]

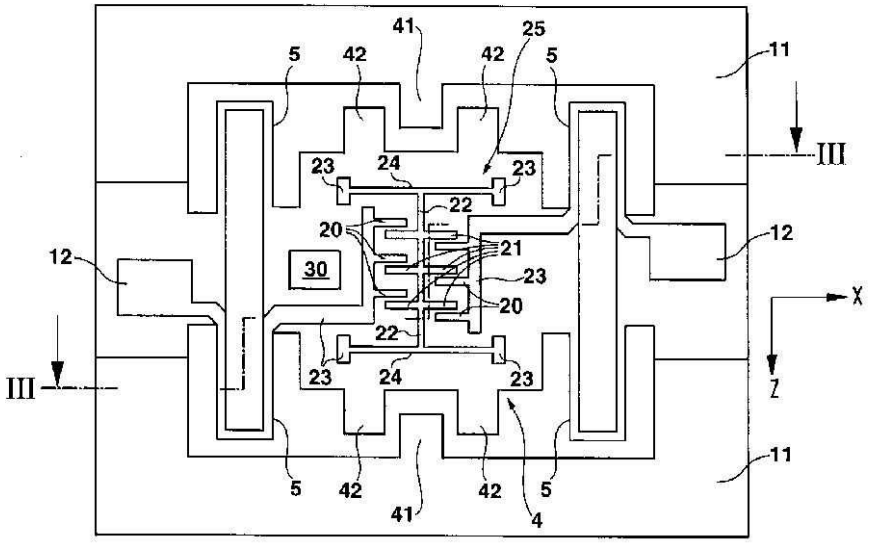


7 Cited Document 7

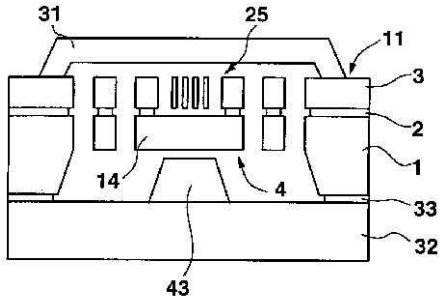
Cited Document 7 (especially, paragraph [0021] and FIG. 4) describes the technical matters of: providing a stopper 42 in a detection direction of a vibrator element 4; and arranging a stopper 41 on a frame 11 opposed to the vibrator element 4.

In addition, Cited Document 7 (especially, paragraph [0024] and FIG. 6) describes the technical matter of providing a lower stopper 43 at a position overlapping with the vibrator element 4 on a supporting plate 32 in the plan view.

[FIG. 4]



[FIG. 6]



No. 5 Comparison/Judgment
1 Regarding Invention 1 (part 1)
(1) Comparison
In comparison between Invention 1 and the Cited Invention, the following are recognized:

A The "vibrating type angular velocity sensor utilizing the characteristics of a gyroscope" of the Cited Invention corresponds to the "gyro senor" of Invention 1.

B The "lower glass substrate 19" of the Cited Invention corresponds to the "substrate" of Invention 1.

C The "driving comb electrode," "X-axis direction parallel to a lower glass substrate 19, " and "driving vibrator element 8" of the Cited Invention correspond to the "driving unit," "first direction," and "driving mass," respectively of Invention 1; and therefore, the "frame-shaped driving vibrator element 8 ... which is driven in an X-axis direction parallel to a lower glass substrate 19 by a driving comb electrode" of the Cited Invention corresponds to the "frame-shaped driving mass driven in a first direction by a driving unit" of Invention 1.

D Invention 1 is a "gyro sensor" and therefore, it is obvious that when the "frame-shaped driving mass" is "driven in a first direction by a driving unit", the "detection mass coupled to an inner side of the frame-shaped driving mass" is subjected to a Coriolis force and vibrates "in a direction orthogonal to the first direction" "in a plan view" (paragraph [0022] in the specification of the present application also includes a description to that effect.).

Whereas, the "Y-axis direction parallel to the lower glass substrate 19" of the Cited Invention is nothing but a direction orthogonal to the "X-axis direction parallel to a lower glass substrate 19" in a plan view.

Therefore, in light of C above, the "detecting vibrator element 10 which is supported" "on an inner side of the driving vibrator element 8" and "which is vibratable in a Y-axis direction parallel to the lower glass substrate 19" of the Cited Invention corresponds to the "detection mass coupled to an inner side of the frame-shaped driving mass" of Invention 1.

E The "detecting vibrator element 10" of the Cited Invention is "supported by four beams 11 for a detecting vibrator element, corresponding to a second beam, ... and which is vibratable in a Y-axis direction parallel to the lower glass substrate 19" and therefore, it is obvious that the "four beams 11 for a detecting vibrator element, corresponding to a second beam," function as springs.

Accordingly, the "four beams 11 for a detecting vibrator element, corresponding to a second beam" of the Cited Invention and the "zig-zag-shaped detection spring portion arranged along a direction orthogonal to the first direction with respect to the driving mass in a plan view" of the Invention 1 are common in terms of being a "detection spring portion."

F Summarizing D and E above, the "detecting vibrator element 10 which is supported by four beams 11 for a detecting vibrator element, corresponding to a second beam, on an inner side of the driving vibrator element 8 and which is vibratable in a Y-axis direction parallel to the lower glass substrate 19" of the Cited Invention and the "detection mass coupled to an inner side of the frame-shaped driving mass by a zig-zag-shaped detection spring portion arranged along a direction orthogonal to the first direction with respect to the driving mass in a plan view" of Invention 1 are common in terms of being a "detection mass coupled to an inner side of the frame-shaped driving mass by a ... detection spring portion."

G The "anchor portion 3" of the Cited Invention corresponds to the "first anchor portion" of Invention 1. In addition, the "driving vibrator element 8" of the Cited Invention is "supported by a beam 9 for the driving vibrator element corresponding to a first beam that is fixed by an anchor portion 3 on a lower glass substrate 19" and therefore, it is obvious that the "anchor portion 3" is provided on the "lower glass substrate 19" and both ends of the "beam 9 for a driving vibrator element corresponding to a first beam" are fixed to the "anchor portion 3" and "driving vibrator element 8," respectively. Further, as the "beam 9 for the driving vibrator element, corresponding to a first beam" "supports" the "driving vibrator element 8," it is obvious that it functions as a spring.

Accordingly, considering B and C above, the "beam 9 for the driving vibrator element corresponding to a first beam that is fixed by an anchor portion 3 on a lower glass substrate 19" of the Cited Invention corresponds to the "driving spring portion coupled to the driving mass at one end and fixed to a first anchor portion, which is provided on the substrate, at the other end" of Invention 1.

H The "anchor portion 3" of the Cited Invention "is coupled to an electrode takeoff base 17 via a wiring electrode 16 provided on the lower glass substrate 19" and therefore, it can be recognized that the "electrode takeoff base 17" of the Cited Invention is electrically connected with the "driving vibrator element 8" via the "wiring electrode 16," "anchor portion 3," and "driving vibrator element beam 9 corresponding to a first beam." In addition, the "electrode takeoff base 17" of the Cited Invention can be said to be an "island portion."

Therefore, in light of C and G above, the "electrode takeoff base 17" to which the "anchor portion 3" is "coupled" "via the wiring electrode 16 provided on the lower glass substrate 19" of the Cited Invention corresponds to the "first island portion electrically connected to the driving mass" of Invention 1.

I The "driving comb fixed electrode 12" of the Cited Invention corresponds to the "fixed electrode portion" of Invention 1; and in light of C above, the "comb electrode structure formed on the driving vibrator element 8" of the Cited Invention corresponds to the "movable electrode portion connected to the driving mass" of Invention 1.

In addition, the "comb electrode structure formed on the driving vibrator element 8" is "opposed to the comb of the driving comb fixed electrode 12" in the Cited Invention; and it can be conversely said that the "comb of the driving comb fixed electrode 12" is "opposed to the "comb electrode structure formed on the driving vibrator element 8." Therefore, in light of the correspondence relationship described above, this feature corresponds to the feature of Invention 1 that the "fixed electrode portion" is "provided so as to be opposed to the movable electrode portion" "connected to the driving mass."

Therefore, in light of C above, the feature of the Cited Invention that the "driving comb electrode" is "constituted of a driving comb fixed electrode 12 and a comb electrode structure formed on the driving vibrator element 8 so as to be opposed to the comb of the driving comb fixed electrode 12" corresponds to the feature of Invention 1 that the "driving unit" includes "a movable electrode portion connected to the driving mass" and "a fixed electrode portion provided so as to be opposed to the movable electrode portion."

J The "detection electrodes 14 and 15 of electric capacitances" of the Cited Invention "are provided with a space along the X-axial direction apart from the detecting vibrator element 10" and "form capacitors C1 and C2 respectively with the detecting vibrator element 10," and therefore, it is obvious that the "detecting vibrator element 10" has electrodes opposed to the "detection electrodes 14 and 15 of electric capacitances." In addition, in light of D above, the electrodes included in the "detecting vibrator element 10" of the Cited Invention correspond to the "movable electrode for detection connected to the detection mass" of Invention 1. Further, the "detection electrodes 14 and 15 of electric capacitances" of the Cited Invention correspond to the "fixed electrode for

detection arranged so as to be opposed to the movable electrode for detection" of Invention 1.

Accordingly, the feature that the "vibrating type angular velocity sensor" of the Cited Invention "comprises" "detection electrodes 14 and 15 of electric capacitances which are provided with a space along the X-axis direction apart from the detecting vibrator element 10 and which form capacitors C1 and C2 respectively with the detecting vibrator element 10" corresponds to the feature that the "detection mass" of the "gyro sensor" of Invention 1 "includes" "a movable electrode for detection connected to the detection mass" and "a fixed electrode for detection arranged so as to be opposed to the movable electrode for detection."

K The "gyro sensor" of Invention 1 comprises "a first projection provided on at least either a surface opposed to the first island portion of the driving mass or a surface opposed to the driving mass of the first island portion" and "the shortest distance between the driving mass and the first island portion" is "larger than the driving amplitude of the driving mass and smaller than the maximum amplitude of the movable electrode portion"; this is for the purpose of preventing a malfunction from occurring when the "driving mass" is largely displaced in the "first direction" as described in paragraph [0027] of the specification of the present application.

Accordingly, in light of C above, the "large displacement preventing stopper 27" of the Cited Invention which "is provided" "in order to avoid excessive displacement in the X-axis direction, caused when drop and shock happen to occur" and the "first projection" of Invention 1 are common in terms of being a "member for restricting displacement of the driving mass in the first direction."

(2) Corresponding features and different features

To summarize the results of comparisons described in (1) above, the corresponding features and different features between Invention 1 and the Cited Invention are as follows:

A Corresponding features

"A gyro sensor, comprising:

a substrate;

a frame-shaped driving mass driven in a first direction by a driving unit;

a detection mass coupled to an inner side of the frame-shaped driving mass by a detection spring portion;

a driving spring portion coupled to the driving mass at one end and fixed to a first anchor portion, which is provided on the substrate, at the other end;

a first island portion electrically connected to the driving mass; and

a member for restricting displacement of the driving mass in the first direction: wherein

the driving unit includes:

a movable electrode portion connected to the driving mass and;

a fixed electrode portion provided so as to be opposed to the movable electrode portion; and

the detection mass includes:

a movable electrode for detection connected to the detection mass; and

a fixed electrode for detection arranged so as to be opposed to the movable electrode for detection."

B Different features

(A) Different feature 1

In Invention 1, the "detection spring portion" is a "zig-zag-shaped detection spring portion arranged along a direction orthogonal to the first direction with respect to the driving mass in a plan view"; whereas, in the Cited Invention, the "four beams 11 for the detecting vibrator element, corresponding to a second beam" correspond to the "detection spring portion."

(B) Different feature 2

In Invention 1, the "first island portion" is "connected to the first anchor portion, arranged side by side with the driving mass along the first direction"; whereas, in the Cited Invention, the "electrode takeoff base 17" (corresponding to the "first island portion" of Invention 1) is not connected to the "anchor portion 3" (similarly, corresponding to the "first anchor portion") and in addition, "is arranged on the side opposite to the driving vibrator element 8 across the anchor portion 3 along the Y-axial direction parallel to the lower glass substrate 19" and according to the terminology of Invention 1, it is "arranged on a side opposite to the driving mass across the first anchor portion along a direction orthogonal to the first direction in a plan view."

(C) Different feature 3

In Invention 1, the "member for restricting displacement of the driving mass in the first direction"; that is, the "first projection" is "provided on at least either a surface opposed to the first island portion of the driving mass or a surface opposed to the driving mass of the first island portion" and "the shortest distance between the driving mass and the first island portion is larger than the driving amplitude of the driving mass and smaller than the maximum amplitude of the movable electrode portion"; whereas, in the Cited Invention, the "member for restricting displacement of the driving mass in the first direction"; that is, the "large displacement preventing stopper 27" which is "provided" "in order to avoid excessive displacement in the X-axis direction, caused when drop and shock happen to occur" is "provided" "between the driving vibrator element 8 and the detecting vibrator element 10" and "is placed on both sides of the detecting vibrator element 10 between the driving vibrator element 8 and the detecting vibrator element 10 with a gap space of a displacement amount, to which a large displacement is to be restricted, provided on the driving vibrator element 8 side."

(D) Different feature 4

Invention 1 includes a "fourth projection provided on the substrate at a position overlapping with at least either the driving mass or the detection mass in a plan view" and "formed integrally with the substrate"; whereas, the Cited Invention does not include a component corresponding thereto.

(3) Judgment regarding Different feature 2

In view of the case, Different feature 2 is first examined.

The electrode takeoff base 17 of the Cited Invention is arranged on a side

opposite the driving vibrator element 8 across the anchor portion 3 along the Y-axis direction parallel to the lower glass substrate 19; and changing this configuration so as to arrange the base side by side with the driving vibrator element 8 along the X-axis direction parallel to the lower glass substrate 19 (according to the terminology of Invention 1, so as to arrange it side by side with the driving mass along the first direction) is neither described nor suggested in any of Cited Document 1 to Cited Document 7.

In the first place, in the Cited Invention, the driving comb fixed electrode 12 and drive displacement detecting fixed electrode 13 are arranged at a position side by side with the driving vibrator element 8 along the X-axis direction parallel to the lower glass substrate 19, as can be seen from FIG. 1 of Cited Document 1; and in order to arrange the electrode takeoff base 17 at this position, it is necessary to remove the driving comb fixed electrode 12 or the drive displacement detecting fixed electrode 13. It is obvious that if the driving comb fixed electrode 12 or the drive displacement detecting fixed electrode 13 are removed, the driving vibrator element 8 cannot be driven and the vibrating type angular velocity sensor fails to function and therefore, it should be said that there is a disincentive in removing the driving comb fixed electrode 12 or the drive displacement detecting fixed electrode 13.

Accordingly, it cannot be said that a person skilled in the art can easily conceive of the configuration of Invention 1 relating to the different feature 2 based on the matters described in the Cited Invention and Cited Document 1 to Cited Document 7.

(4) Summary regarding Invention 1 (part 1)

As described in (3) above, it cannot be said that Invention 1 could have been easily made by a person skilled in the art, based on the inventions described in Cited Document 1 to Cited Document 4 or further based on the inventions described in Cited Document 5 to Cited Document 7 without examining Different feature 1, Different feature 3, and Different feature 4.

2 Regarding Invention 1 (part 2)

In 1 above, as a result of comparison between the "electrode takeoff base 17" of the Cited Invention and the "first island portion" of Invention 1, it is recognized that the "electrode takeoff base 17" of the Cited Invention to which the "anchor portion 3" is "coupled" "via a wiring electrode 16 provided on the lower glass substrate 19" corresponds to the "first island portion electrically connected to the driving mass" of Invention 1 (1 (1) H above).

In addition, the "large displacement preventing stopper 27" of the Cited Invention and the "first island portion" of Invention 1 can be compared.

This case is examined as follows.

(1) Comparison

In comparison between Invention 1 and the Cited Invention, the following are recognized in addition to 1 (1) A to G, I, and J.

A The "large displacement preventing stopper 27" of the Cited Invention "is placed on both sides of the detecting vibrator element 10 between the driving vibrator element 8 and the detecting vibrator element 10 with a gap space of a displacement amount, to

which a large displacement is to be restricted, provided on the driving vibrator element 8 side" and therefore it can be recognized that the stopper includes a portion coming into contact with the "driving vibrator element 8" that is about to be largely displaced, to prevent displacement of more than that amount. In addition, considering that the "driving vibrator element 8" "is driven in an X-axis direction parallel to a lower glass substrate 19," it can be said that the "large displacement preventing stopper 27" which is "placed ... with a gap space of a displacement amount, to which a large displacement is to be restricted, provided on the driving vibrator element 8 side" is arranged side by side with the "driving vibrator element 8" along "the X-axis direction parallel to the lower glass substrate 19."

Accordingly, the "large displacement preventing stopper 27" of the Cited Invention which is "placed ... with a gap space of a displacement amount, to which a large displacement is to be restricted, provided on the driving vibrator element 1 side" corresponds to the "first island portion" of Invention 1 which is "arranged side by side with the driving mass along the first direction."

B The "large displacement preventing stopper 27" of the Cited Invention is "provided" " in order to avoid excessive displacement in the X-axis direction, caused when drop and shock happen to occur" and is "placed ... with a gap space of a displacement amount, to which a large displacement is to be restricted, provided on the driving vibrator element 8 side"; and therefore it can be recognized that the stopper includes a portion coming into contact with the "driving vibrator element 8" that is about to be largely displaced, to prevent displacement of more than that amount. In addition, it is obvious that the portion is opposed to the "driving vibrator element 8."

Accordingly, that portion of the "large displacement preventing stopper 27" of the Cited Invention corresponds to the "first projection provided on" "a surface opposed to the driving mass of the first island portion" of Invention 1.

C The "large displacement preventing stopper 27" of the Cited Invention is "provided" " in order to avoid excessive displacement in the X-axis direction, caused when drop and shock happen to occur" and is "placed ... with a gap space of a displacement amount, to which a large displacement is to be restricted, provided on the driving vibrator element 1 side"; and therefore it is obvious that the stopper does not prevent normal driving of the "driving vibrator element 8." Then, it is recognized that the "gap space" of the Cited Invention is the shortest distance between the "driving vibrator element 8" and the "large displacement preventing stopper 27" and is larger than the maximum amplitude of the "driving vibrator element 8."

Accordingly, the "gap space" of the Cited Invention corresponds to the "shortest distance between the driving mass and the first island portion" of Invention 1; and the feature of the Cited Invention that the "large displacement preventing stopper 27" is "placed ... with a gap space of a displacement amount, to which a large displacement is to be restricted, provided on the driving vibrator element 8 side" corresponds to the feature of Invention 1 that the "shortest distance between the driving mass and the first island portion" is "larger than the driving amplitude of the driving mass."

(2) Corresponding features and different features

To summarize the results of comparisons described in (1) above, the

corresponding features and different features between Invention 1 and the Cited Invention are as follows:

A Corresponding features

"A gyro sensor, comprising:

a substrate;

a frame-shaped driving mass driven in a first direction by a driving unit;

a detection mass coupled to an inner side of the frame-shaped driving mass by a detection spring portion;

a driving spring portion coupled to the driving mass at one end and fixed to a first anchor portion, which is provided on the substrate, at the other end;

a first island portion arranged side by side with the driving mass along the first direction; and

a first projection provided on a surface opposed to the driving mass of the first island portion: wherein

the driving unit includes:

a movable electrode portion connected to the driving mass; and

a fixed electrode portion provided so as to be opposed to the movable electrode portion;

the detection mass includes:

a movable electrode for detection connected to the detection mass; and

a fixed electrode for detection arranged so as to be opposed to the movable electrode for detection; and

the shortest distance between the driving mass and the first island portion is larger than the driving amplitude of the driving mass."

B Different features

(A) Different feature 1

The same as Different feature 1 in 1 (2) B (A) above.

(B) Different feature 2'

The "first island portion" of Invention 1 is "connected to the first anchor portion" and "electrically connected to the driving mass"; whereas the "large displacement preventing stopper 27" of the Cited Invention (corresponding to the "first island portion" of Invention 1) is neither connected to the "anchor portion 3" (similarly, corresponding to the "first anchor portion") nor electrically connected to the "driving vibrator element 8" (similarly, corresponding to the "driving mass").

(C) Different feature 3'

The "shortest distance between the driving mass and the first island portion" of Invention 1 is "smaller than the maximum amplitude of the movable electrode portion"; whereas, it is not clear that the "gap space" of the Cited Invention (corresponding to the "shortest distance between the driving mass and the first island portion" of Invention 1) is smaller than the maximum amplitude of the "comb electrode structure formed on the driving vibrator element 8" (similarly, corresponding to the "movable electrode portion").

(D) Different feature 4

The same as Different feature 4 in 1 (2) B (D) above.

(3) Judgment regarding Different feature 2'

In view of the case, Different feature 2' is first examined.

A The "first island portion" is "connected to the first anchor portion" in Invention 1, which is literally understood as having the meaning that the "first island portion" and the "first anchor portion" are physically connected.

This understanding is consistent with the specification that the "first island portion" of Invention 1 is "connected to the first anchor portion" in addition to being "electrically connected to the driving mass." In addition, as the specification of the present application describes "the driving spring portion 14 is coupled to the driving mass 20 at one end and coupled to an island portion 40 (corresponding to a "first island portion") at the other end via the anchor portion 72. The island portion 40 is formed integrally with the anchor portion 72. The bottom surface is fixed to the substrate 60." ([0025]), it is also consistent with the feature that the "first island portion" and the "first anchor portion" are integrally formed in an example of Invention 1.

B Meanwhile, the large displacement preventing stopper 27 of the Cited Invention is placed on both sides of the detecting vibrator element 10 between the driving vibrator element 8 and the detecting vibrator element 10. In this case, the detecting vibrator element 10 is coupled to an inner side of the frame-shaped driving vibrator element 8 and therefore, the large displacement preventing stopper 27 is also placed on the inner side of the frame-shaped driving vibrator element 8.

On the other hand, the anchor portion 3 of the Cited Invention is provided outside of the frame-shaped driving vibrator element 8 as shown in FIG. 1 of Cited Document 1.

Accordingly, between the large displacement preventing stopper 27 and the anchor portion 3 of the Cited Invention, the frame-shaped driving vibrator element 8 exists.

C As described in A above, the feature of Invention 1 that the "first island portion" is "connected to the first anchor portion" means that the "first island portion" and the "first anchor portion" are structurally connected; and therefore, in order that the Cited Invention may have the configuration of Invention 1 relating to Different feature 2,' it is necessary to physically connect the large displacement preventing stopper 27 (corresponding to the "first island portion" of Invention 1) and the anchor portion 3 (similarly, corresponding to the "first anchor portion").

However, in the Cited Invention, the frame-shaped driving vibrator element 8 exists between the large displacement preventing stopper 27 and the anchor portion 3 as described in B above; and therefore, it is structurally difficult to physically connect the large displacement preventing stopper 27 and the anchor portion 3. Further, it is neither described nor suggested in Cited Document 1 to Cited Document 7 that such a physical connection is possible.

Accordingly, it cannot be said that a person skilled in the art can easily conceive of the configuration of Invention 1 relating to Different feature 2' based on the matters

described in the Cited Invention and Cited Document 1 to Cited Document 7.

(4) Summary regarding Invention 1 (part 2)

As described in (3) above, it cannot be said that Invention 1 could have been easily made by a person skilled in the art based on the inventions described in Cited Document 1 to Cited Document 4 or further based on the inventions described in Cited Document 5 to Cited Document 7 without examining Different feature 1, Different feature 3', and Different feature 4.

3 Regarding Invention 2 to Invention 7

Since any of Invention 2 to Invention 7 includes all the configurations of Invention 1, they are different from the Cited Invention at least in Different feature 1 to Different feature 4 between Invention 1 and the Cited Invention (1 (2) B (A) to (D) above), or they are different from the Cited Invention at least in Different feature 1, Different feature 2', Different feature 3', and Different feature 4 between Invention 1 and the Cited Invention (2 (2) B (A) to (D) above).

In addition, as described in 1 (3) above, it cannot be said that a person skilled in the art could have easily conceived the configuration of Invention 1 relating to Different feature 2 based on the matters described in the Cited Invention and Cited Document 1 to Cited Document 7; and therefore, the same applies to the configurations of Invention 2 to Invention 7 relating to Different feature 2.

Further, as described in 2 (3) above, it cannot be said that a person skilled in the art could have easily conceived the configuration of Invention 1 related to Different feature 2,' based on the matters described in the Cited Invention and Cited Document 1 to Cited Document 7; and therefore, the same applies to the configurations of Invention 2 to Invention 7 relating to Different feature 2'.

Accordingly, it cannot be said that Invention 2 to Invention 7 could have been easily made by a person skilled in the art based on the inventions described in Cited Document 1 to Cited Document 4 or further based on the inventions described in Cited Document 5 to Cited Document 7.

No. 6 Regarding the examiner's decision

In the examiner's decision, it was judged that providing the large displacement preventing stopper 27 (projection) on the "surface opposed to the driving mass of the first island portion" (a "surface opposed to the driving mass of the first island portion" after the amendment of the case) in the invention described in Cited Document 1 was not significantly difficult (notice of reasons for refusal dated February 5, 2016).

However, as described in No. 5, 1 (3) above, in comparison between the "electrode takeoff base 17" of the Cited Invention and the "first island portion" of Invention 1, it cannot be said that a person skilled in the art could easily conceive of the configuration of Invention 1 relating to Different feature 2 based on the matters described in the Cited Invention and Cited Document 1 to Cited Document 7. In addition, as described in No. 5, 2 (3), in comparison between the "large displacement preventing stopper 27" of the Cited Invention and the "first island portion" of Invention 1, it cannot be said that a person skilled in the art could easily conceive of the configuration of Invention 1 relating to Different feature 2' based on the matters described in the Cited Invention and Cited Document 1 to Cited Document 7.

That is, the configuration itself of "a first island portion connected to the first anchor portion, arranged side by side with the driving mass along the first direction, and electrically connected to the driving mass" of Invention 1 cannot be easily conceived of by a person skilled in the art based on the Cited Invention and therefore, the reasons for refusal stated in the examiner's decision cannot be maintained without examining the feature that the large displacement preventing stopper 27 (projection) is provided on the "surface opposed to the driving mass of the first island portion."

No. 7 Closing

As described above, it cannot be said that the present application should be rejected due to the reasons of the examiner's decision.

In addition, no other reasons for rejecting the present application are found.

Therefore, the appeal decision shall be made as described in the conclusion.

April 16, 2018

Chief administrative judge: NAKATSUKA, Naoki
Administrative judge: KOBAYASHI, Norifumi
Administrative judge: SUHARA, Hiromitsu