(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) **EP 2 506 278 A1**

(12) **EUROPEAN PATENT APPLICATION**
published in accordance with Art. 153(4) EPC

(43) Date of publication:
03.10.2012 Bulletin 2012/40

(21) Application number: **10832810.5**

(22) Date of filing: **10.11.2010**

(51) Int Cl.:
H01H 13/14 *(2006.01)*

(86) International application number:
PCT/JP2010/006605

(87) International publication number:
WO 2011/064954 (03.06.2011 Gazette 2011/22)

(84) Designated Contracting States:
AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR

(30) Priority: **24.11.2009 JP 2009265995**

(71) Applicant: **Sumitomo Wiring Systems, Ltd.**
Yokkaichi-shi, Mie 510-8503 (JP)

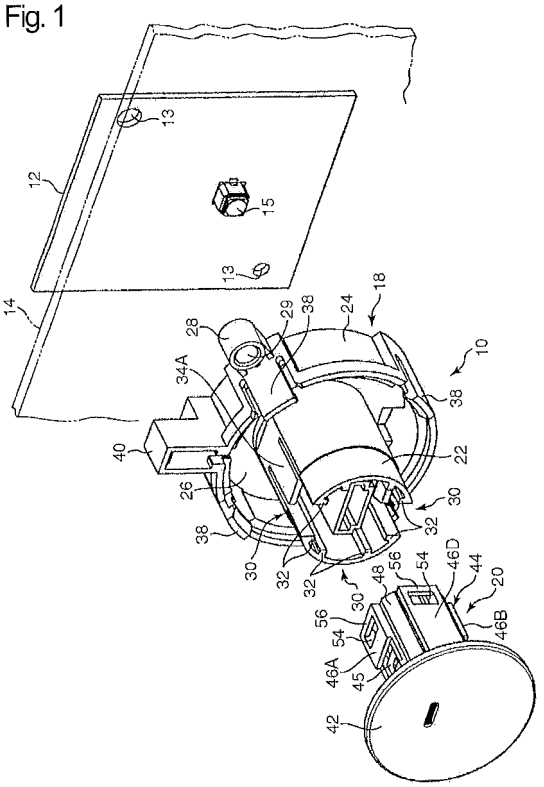
(72) Inventors:
- **NAKAJIMA, Hirokatsu**
  Yokkaichi-shi
  Mie 510-8503 (JP)
- **CHAEN, Satoru**
  Yokkaichi-shi
  Mie 510-8503 (JP)

(74) Representative: **Winter, Brandl, Fürniss, Hübner, Röss, Kaiser, Polte - Partnerschaft**
Alois-Steinecker-Strasse 22
85354 Freising (DE)

(54) VEHICLE PRESS-OPERATION MEMBER, AND VEHICLE PRESS-OPERATION APPARATUS COMPRISING SAME

(57) Provided is a vehicle press-operation member 10 wherein an amount of protrusion from a panel decreases rapidly when receiving a certain amount of pressing force or more, with which it is easy to design a breakable portion for the rapid decrease, and the rapid decrease is reliable. The press-operation member 10 includes a base member 18 and a member to be operated 20 which protrudes from the base member 18 and receives a pressing operation. The base member 18 has a guide holding portion 30 which guides the member to be operated 20 in a pressing operation direction of the member to be operated 20 and a stopper 50 which, by coming in contact with the member to be operated 20, restricts a rearward movement of the member to be operated 20. The member to be operated 20 has a guided portion 46D which is guided by the guide holding portion 30, and a contact portion 56 which, by coming in contact with the stopper 50, restricts a rearward movement of the member to be operated 20. Either of the stopper 50 or the contact portion 56 breaks by receiving a reaction force from the other when the member to be operated 20 receives pressure with a large, certain amount of force or more, thereby allowing a further slide of the member to be operated 20.

Fig. 1



EP 2 506 278 A1

Description

TECHNICAL FIELD

[0001] The present invention relates to a vehicle press-operation member, which is a member being provided on an instrument panel of a vehicle or the like and receiving a pressing operation, and can change in shape in such a way as to reduce the amount of protrusion from a surface of the instrument panel or the like, when receiving a certain amount of pressing load or more, and to a vehicle operation apparatus including the vehicle press-operation member.

BACKGROUND ART

[0002] In a vehicle such as an automobile, in general, an operating member for operating an air conditioner, audio instrument or the like is provided on a panel (for example, an instrument panel) which faces inside a vehicle interior, and a pressing operation member which receives a pressing operation with a finger or the like exists therein. The vast majority of such press-operation members are provided so as to protrude inside the vehicle interior from a surface of the panel in such a way as to be able to receive an operation by a passenger.

[0003] It is preferable that the amount of protrusion of such a press-operation member is designed so as to satisfy both safety and operability aspects. Specifically, it is desirable to secure a certain large amount of protrusion in order to facilitate an operation by the passenger. On the other hand, assuming a case in which the passenger makes contact with a protruding portion of the press-operation member when the vehicle collides or stops suddenly, it is desirable, from the viewpoint of safety, that the amount of protrusion of the pressing operation member is small, and actually, there exist some countries which restrict the amount of protrusion.

[0004] Therefore, to date, as means for satisfying both safety and operability, development of an apparatus wherein, when a certain amount of pressing load or more is applied to the pressing operation member, one portion of the pressing operation member can move rearward in the pressing direction (that is, the amount of protrusion decreases rapidly) is being promoted.

[0005] For example, the press-operation apparatus as shown in Fig. 14 is disclosed in Patent Document 1. The apparatus includes a circuit substrate 6, a stator member 7 provided thereon, and a push knob 4 which is a press-operation member held on the stator member 7. The push knob 4 integrally has a cylindrical large diameter portion 4a on the side of receiving a pressing operation, a small diameter portion 4b, which is smaller in diameter than the large diameter portion 4a and is held on the stator member 7, and a fragile portion 4e which radially connects the rear end of the large diameter portion 4a and the front end of the small diameter portion 4b.

[0006] The fragile portion 4e is thinner than the other regions, and a plurality of slits 4d are formed therein. The shear strength of the fragile portion 4e is designed such that, when a large pressing load (in the drawing, a load from above) is applied to the large diameter portion 4a, the fragile portion 4e is broken being sheared in an up-down direction, which causes the large diameter portion 4a to be displaced in a descending direction (that is, to retract) relative to the small diameter portion 4b and the amount of protrusion of the whole of the push knob to thereby be rapidly reduced.

[0007] With respect to the apparatus, the shape of the fragile portion 4e needs to be designed such that, when a load applied to the large diameter portion 4a is of a predetermined value or more, a certain amount of shear load or more acts on the fragile portion 4e to thereby cause the fragile portion 4e to break. However, such design is difficult. Specifically, the shear load varies depending on a position on the large diameter portion 4a to which a pressing load is applied, and moreover, a position on the fragile portion 4e to which a pressing load is applied from the rear end of the large diameter portion 4a and a position on the fragile portion 4e which breaks are different in the radial direction, which thereby makes it difficult to specify a relationship between the pressing force and the shear load of the fragile portion 4e. Also, the fragile portion 4e is designed on the assumption that a shear load acts circumferentially equally on the fragile portion 4e, but actually, there is fear that, when a pressing force is applied to an off-center position on the large diameter portion 4a, the push knob inclines to thereby cause a disproportion (a circumferential disproportion) in a load applied to the fragile portion 4e.

Related Art Documents

Patent Documents

[0008] Patent Document 1: JP-A-2004-79484

SUMMARY OF THE INVENTION

[0009] An object of the invention is to provide a vehicle press-operation member wherein it is easy to design a breakable portion which is broken in order to reduce the amount of protrusion from a panel when a certain amount of pressing force or more is applied, and it is possible to increase the reliability of a reduction in the amount of protrusion when the pressing force acts, and a vehicle operation apparatus including the vehicle press-operation member. Specifically, the invention provides a vehicle press-operation member, which is provided on a panel in a vehicle interior in such a way as to protrude on the vehicle interior side from a surface of the panel for receiving a pressing operation, is configured in such a way that the amount of protrusion decreases by receiving pressure with a certain amount of force or more. The vehicle press-operation member includes a base member mounted on the panel or a member fixed to the panel,

and a member to be operated which is mounted on the base member in such a way as to protrude on the vehicle interior side from the base member and receives a pressing operation. The base member has a guide holding portion which holds, while guiding, the member to be operated in such a way that the member to be operated slides to the base member in a direction parallel to the pressing direction, and a stopper which, by coming in contact with the member to be operated, restricts the member to be operated from sliding in a direction in which the member to be operated moves more rearward than a predetermined pressing restriction position, and the member to be operated has a guided portion which fits in the guide holding portion and is guided by the guide holding portion, and a contact portion which, by coming in contact with the stopper of the base member, prevents the slide in the direction in which the member to be operated moves rearward. Either of the stopper or the contact portion configures a breakable portion having a shape such that it is broken by receiving a pressing force from the other in the pressing direction when the member to be operated receives pressure with a certain amount of force or more, thereby allowing a further slide of the member to be operated in the pressing direction.

BRIEF DESCRIPTION OF THE DRAWINGS

[0010]

[Fig. 1] Fig. 1 is an exploded perspective view of a vehicle operation apparatus according to an embodiment of the invention, seen from a front side.

[Fig. 2] Fig. 2 is an exploded perspective view of a pressing operation member of the vehicle press-operation apparatus seen from a back side.

[Fig. 3] Fig. 3 is a front view of the press-operation member.

[Fig. 4] Fig. 4 is a side view of the vehicle operation apparatus.

[Fig. 5] Fig. 5 is a sectional view taken along line V-V of Fig. 4.

[Fig. 6] (a) is a sectional view taken along line VI-VI of Fig. 5, and (b) is a sectional side view showing a condition in which an operating knob which is a member to be operated moves rearward, from the condition of (a), accompanying a break of a breakable portion.

[Fig. 7] Fig. 7 is a sectional view taken along line VII-VII of Fig. 5.

[Fig. 8] Fig. 8 is a perspective view showing a base member of the pressing operation member.

[Fig. 9] Fig. 9 is a front view of the base member.

[Fig. 10] Fig. 10 is a perspective view of the operating knob seen from the back side.

[Fig. 11] Fig. 11 is a perspective view of the operating knob seen from the front side.

[Fig. 12] Fig. 12 is a sectional perspective view showing a condition in which the operating knob is in a pressing restriction position.

[Fig. 13] Fig. 13 is a sectional perspective view showing a condition in which the operating knob moves more rearward than the pressing restriction position accompanying a break of the breakable portion.

[Fig. 14] Fig. 14 is a sectional view of a heretofore known vehicle operation apparatus.

MODES FOR CARRYING OUT THE INVENTION

[0011] Preferred embodiments of the invention will be described referring to Figs. 1 to 13.

[0012] A vehicle operation apparatus according to the embodiment includes a press-operation member 10, a circuit substrate 12, and a panel 14. The panel 14 is mounted in an appropriate place (for example, on an instrument panel) inside a vehicle interior, and the circuit substrate 12 is fixed to the reverse of the panel 14. The press-operation member 10 is fixed to the circuit substrate 12 in a condition in which it passes through an unshown through hole provided in the panel 14, and receives a pressing operation in a direction approximately perpendicular to the circuit substrate 12 from the front side of the panel 14 and receives pressure with a certain amount of force or more which exceeds a normal operation force, to thereby change in shape in such a way that the amount of protrusion of the pressing operation member 10 decreases. Details thereof will be described hereafter.

[0013] The press-operation member 10 includes a base member 18 fixed to the circuit substrate 12 and an operating knob 20 mounted in the base member 18 in such a way as to protrude farther on the vehicle interior side than the base member 18. The operating knob 20 corresponds to a member to be operated, which receives the pressing operation.

[0014] The base member 18 has an inside cylinder portion 22, an outside cylinder portion 24, an annular wall 26, and a plurality of mounting portions 28, and these are integrally formed from, for example, a synthetic resin.

[0015] The inside cylinder portion 22 has a hollow cylindrical shape having a central axis in a direction parallel to the pressing operation direction, and has a bottom wall 23 at its rear end. The inside cylinder portion 22 has guide holding portions 30, which hold the operating knob 20, in appropriate places (in the drawings, four places circumferentially spaced 90° from each other) on its outer peripheral surface. The guide holding portions 30 hold the operating knob 20 in such a way that the operating knob 20 can slide (move forward and rearward) in a direction parallel to the pressing operation direction.

[0016] Each guide holding portion 30 has a pair of holding protrusions 32 protruding inward from an inner peripheral surface of the inside cylinder portion 22. The paired holding protrusions 32 extend in a direction parallel to the central axis while being spaced a certain distance L away from each other in a circumferential direction of the inside cylinder portion 22. That is, a space for

allowing the operating knob 20 to slide is secured between the holding protrusions 32.

[0017] Retentive pieces 34A and 34B are formed respectively in upper and lower spaces, among the four spaces, of the inside cylinder portion 22. The retentive pieces 34A and 34B, being for preventing the operating knob 20 coming off from the inside cylinder portion 22, as well as extending forward from back end positions of the corresponding spaces, each have a front end which can bend in a radial direction, and respectively have inwardly protruding retentive protrusions 36A and 36B at the front ends (Figs. 8 and 9).

[0018] The outside cylinder portion 24, having axial dimensions smaller than those of the inside cylinder portion 22, is formed in such a way as to encircle the inside cylinder portion 22 all around from radially outside the inside cylinder portion 22, and a rear end portion (to be exact, a portion slightly closer to the front side than the rear end) of the outside cylinder portion 24 connects with an outer peripheral surface at the rear end of the inside cylinder portion 22 via the annular wall 26 (Fig. 5).

[0019] The mounting portions 28 protrude radially outward from corresponding appropriate places of the outer peripheral surface of the outside cylinder portion 24. A bolt through hole 29 passing through each mounting portion 28 in an axial direction (a direction parallel to the pressing operation direction) is provided in each mounting portion 28. Meanwhile, bolt through holes 13 are provided in positions of the circuit substrate 12 corresponding to the bolt through holes 29 (Fig. 3), and bolts inserted into the corresponding two bolt through holes 29 and 13 are mounted with nuts to thereby fix the base member 18 to the circuit substrate 12 in a condition in which the rear end surface of the outside cylinder portion 24 is in contact with the circuit substrate 12.

[0020] The operating knob 20 is held in the base member 18 in such a way as to move rearward (slide) in the pressing operation direction by receiving a pressing operation in the pressing operation direction.

[0021] Specifically, the operating knob 20 has an operated plate 42 which receives a pressing operation with a finger or the like, and a held cylinder 44 extending rearward from the rear surface of the operated plate 42.

[0022] The held cylinder 44 has four guided portions 46A, 46B, 46C, and 46D disposed on the top, bottom, left, and right respectively, and a plurality (herein, four) of connecting portions 48, positioned a predetermined distance radially inwardly of the guided portions 46A, 46B, 46C, and 46D, each of which connects circumferentially mutually adjacent guided portions.

[0023] Each guided portion 46A to 46D has a flat plate-like shape perpendicular to the radial direction of the held cylinder 44. Then, each guided portion 46A to 46D is inserted between the holding protrusions 32, which configures each guide holding portion 30 in the inside cylinder portion 22 of the base member 18, in a direction parallel to the pressing operation direction to be thereby held in such a way as to be slidable in the same direction.

[0024] Also, a rectangular through hole 45 having predetermined dimensions in a front-rear direction of the upper and lower guided portions 46A and 46C (a direction parallel to the pressing operation direction) is provided in each of the upper and lower guided portions 46A and 46C, and the retentive protrusions 36A and 36B of the retentive pieces 34A and 34B of the base member 18 are fitted in the corresponding through holes 45. The front-rear direction positions and dimensions of the through holes 45 are set in such a way that the retentive protrusions 36A and 36B prevent the operating knob 20 from coming off from the inside cylinder portion 22 while allowing the operating knob 20 to slide.

[0025] Furthermore, a pressing operation bar 47 (Figs. 2 and the like) extends more rearward than the rear end of the lower guided portion 46D.

[0026] Meanwhile, stopper ribs 50 in positions corresponding to the guided portions 46A to 46D are protruded from the front side surface of the bottom wall 23 of the inside cylinder portion 22. In the embodiment, the ribs 50 extend in directions perpendicular to the guided portions 46A to 46D, that is, in the radial direction, and come in contact with the rear ends of the guided portions 46A to 46D, thereby restricting a slide stroke of the operating knob 20. That is, the rear ends of the guided portions 46A to 46D configure contact portions which come in contact with the ribs 50 to thereby prevent the operating knob 20 from sliding in a direction in which it moves more rearward than its contact position (pressing restriction position), and the ribs 50, which come in contact with the contact portions, configure stoppers which restrict the slide.

[0027] Also, a through hole 52 for allowing the pressing operation bar 47 to pass through the bottom wall 23 is provided in the bottom wall 23. Meanwhile, a switch element 15 which is an operation detector is provided in a position on the circuit substrate 12 corresponding to the pressing operation bar 47. The switch element 15 outputs a detection signal by receiving the pressure of the pressing operation bar 47 when the operating knob 20 slides in such a way as to move rearward to the pressing restriction position.

[0028] Furthermore, as a feature of the apparatus, the rear ends of the guided portions 46A to 46C, among the rear ends of the guided portions 46A to 46D configuring the contact portions, configure breakable portions, and the breakable portions have a shape such that they are broken by receiving a reaction force from the ribs 50 when the operating knob 20 receives pressure with a certain amount of force or more which is larger than the normal pressing operation force, thereby allowing the operating knob 20 to slide in a direction in which the operating knob 20 moves more rearward than the pressing restriction position. Specifically, as shown in Fig. 6(a), with a rearmost end region left in the rear end portion of each guided portion 46A to 46C, a rectangular through hole 54 passing through each guided portion 46A to 46D is formed in a position closer to the front side than the rearmost region,

whereby the rearmost end region is configured as a linear beam portion 56 perpendicular to each rib 50. Then, the length and cross-sectional shape of the beam portion 56 are set in such a way that, when a certain amount of pressing load or more is applied to the operating knob 20, the intermediate region of the beam portion 56 is broken, as shown in an A portion of Fig. 6 (b), by a reaction force received from the rib 50 in pressure contact with the intermediate region.

[0029] Meanwhile, an operation side breakable portion is formed in the rear end portion of the guided portion 46D in which the pressing operation bar 47 is provided. The operation side breakable portion is broken by a reaction force which the pressing operation bar 47 receives from the switch element 15 when the operating knob 20 receives a certain amount of pressure or more. Specifically, as shown in Fig. 7, in the same way as in the guided portions 46A to 46C, with a rearmost end region of the guided portion 46D left in the rear end portion of the guided portion 46D, a rectangular through hole 54D is formed in a position closer to the front side than the rearmost end region, whereby the rearmost end region is configured as a linear beam portion 56D perpendicular to the pressing operation bar 47. Then, the length and cross-sectional shape of the beam portion 56D are set in such a way that the intermediate region of the beam portion 56D is broken by a reaction force received from the switch element 15 via the pressing operation bar 47 when a certain amount of pressing load or more is applied to the operating knob 20. The break strength of the beam portion 56D is set in such a way that a pressing load when the beam portion 56D breaks is equivalent to a pressing load when each beam portion 56 breaks.

[0030] The operating apparatus according to the embodiment is provided with a kind of dial operation member (rotating operation member) 60 shown in Figs. 12 and 13 in addition to the vehicle operation member 10. The dial operation member 60, being one which receives a rotating operation, includes a ring-like base member 62 and a dial member (member to be operated) 64 of a ring-like shape in the same way. Also, the base member 18 is loaded with an unshown spring mechanism which makes an operator feel a click along with a rotation of the dial operation member 60.

[0031] The base member 62 is held on the press-operation member 10 side of the base member 18 in such a way as to be rotatable around an axis the same as the central axis of the base member 18. Specifically, a plurality of holding pieces 38 are extended forward from the outside cylinder portion 24 of the base member 18, and the holding pieces 38 hold the base member 62 in such a way as to embrace it from radially outside.

[0032] The dial member 64 has a supported cylinder 65 supported from radially inside by the base member 62, a dial ring 66 provided along the outer perimeter of the operated plate 42 of the operating knob 20, and a plurality of connecting portions 68 radially connecting the dial ring 66 and supported cylinder 65 in such a way that the dial ring 66 and supported cylinder 65 rotate integrally. The supported cylinder 65 is engaged with the base member 62 in such a way as to rotate integrally with the base member 62 and move rearward to the base member 62 in a direction of the pressing force, in the same way as the operating knob 20, when the dial member 64 receives a certain amount of pressing force or more.

[0033] Means which allow the rearward movement of the dial member 64 are not limited. For example, a breakable portion similar to the breakable portions of the press-operation member 10 side (beam portions 56 and 56D) may be provided in the dial member 64, and means may be such that the dial member 64 is held on the base member 62 so as to be slidable in the front-rear direction, and biased to the front side by a spring or the like, and when receiving pressure, moves rearward accompanying a compressive deformation of the spring.

[0034] In the operating apparatus according to the invention, the dial operation member 60 is not essential. That is, the pressing operation member 10 may be used alone.

[0035] Next, an action of the operation apparatus will be described.

[0036] The operating knob 20 of the pressing operation member 10, in a condition before it receives a pressing operation, is held in a position in which the pressing operation bar 47 of the operating knob 20 lightly touches the switch element 15, or is spaced away from the switch element 15. When the operating knob 20 is pressingly operated from the position, the operating knob 20 slides in a direction in which the operating knob 20 moves rearward in the pressing operation direction, and the pressing operation force is applied to the switch element 15 by the pressing operation bar 47, and the switch element 15 outputs a detection signal. At this time, each guide holding portion 30 of the base member 18 guides each guided portion 46A to 46D of the operating knob 20, thereby stabilizing the slide of the operating knob 20. Also, a rearward movement position of the operating knob 20 is restricted to a position (the pressing restriction position) in which the beam portions 56 at the rear ends of the guided portions 46A to 46D come in contact with the ribs 50 on the base member 18 (Fig. 12).

[0037] On the other hand, when a certain amount of pressing force or more (a force significantly larger than the normal pressing operation force) is applied to the operating knob 20, for example, the case where a passenger strongly presses against the operating knob 20 or the like, due to a vehicular collision or the like, the beam portions 56 of the guided portions 46A to 46C and the beam portion 56D of the guided portion 46D approximately simultaneously break due to the pressing force, whereby the operating knob 20 moves more rearward from the pressing restriction position (Fig. 13). Specifically, an intermediate region of the beam portion (breakable portion) 56 at the rear end of each guided portion 46A to 46C receives a reaction force from each rib 50 in response to the pressing force, while an intermediate re-

gion of the beam portion (breakable portion on the operation side) 56D of the guided portion 46D receives a reaction force in response to the pressing force, from the switch element 15, via the pressing operation bar 47. These cause each beam portion to break under approximately the same conditions.

[0038] The amount of protrusion of the press-operation member 10 from the panel 14 decreases rapidly owing to the rearward movement of the operating knob 20 accompanying the break. Also, in the embodiment, due to the application of the pressing force, the dial ring 66 around the operating knob 20 also moves rearward to the base member 62 integrally with the supported cylinder 65, which guarantees a rapid reduction in the amount of protrusion of the whole operation member.

[0039] At the time of the rearward movement, a reaction force equivalent to the pressing force applied to the operating knob 20 is applied directly to the beam portions 56 from the ribs 50 which are the stoppers of the base member 18, and the beam portions 56 break in a position on which the reaction force acts. This makes it easy to specify a relationship between the pressing force and a break load of the beam portions 56 which are the breakable portions. Also, as the direction of rearward movement of the operating knob 20 accompanying the break is restricted by the guide holding portions 30 of the base member 18, maldistribution of a pressing load caused by an inclination of the operating knob 20 is unlikely to occur. These points make it easy to design each beam portion 56 which is a breakable portion.

[0040] In particular, in the embodiment, the ribs 50 which are the stoppers of the base member 18 and the beam portions 56 which is to come in contact with the ribs 50 are provided respectively in a plurality of positions arranged on a plane perpendicular to the pressing operation direction of the operating knob 20, whereby a reaction force which the beam portions 56 receive from the ribs 50 is equalized. This makes it easier to design the beam portions 56. Also, as the break strength of this kind of beam portion 56 can be calculated based on a general bending theory, it is easy to design the beam portions. The same also applies to the beam portion 56D which is the breakable portion on the operation side.

[0041] In the invention, the contact portions (in the illustrated example, the beam portions 56) do not necessarily have to be provided in portions to be pressed, and the contact portions may be provided separately from the portions be pressed. However, that the rear end portions of the guided portions configure the contact portions, as heretofore described, enables a further simplification of the structure.

[0042] In particular, with respect to the pressing operation member 10 in the illustrated example, the simple structure wherein at least the rear end portion of each guided portion 46A to 46D is formed into a plate, and the through hole 54 is provided in the rear end portion, makes it possible to form a beam portion 56 suitable for the breakable portion in a portion closer to the leading end side than the through hole 54.

[0043] In the invention, the breakable portions may be included in the stoppers on the base member side, rather than in the contact portions on the member to be operated (in the illustrated example, the operating knob 20) side. For example, beam-like stoppers may be formed in the base member, and the stoppers may be broken by a pressing force received from the contact portions on the member to be operated.

Working Example

[0044] For example, in the internal protrusion regulations in China and Europe, when an operation apparatus has a protruding object protruding 9.5mm or more from a panel, it is required to reduce the amount of protrusion of the protruding object to 9.5mm or less when a static load of approximately 380N acts on the protruding object. In order to meet the requirement with the operating apparatus shown in Figs. 1 to 13, it is sufficient to design the beam portions 56 and 56D in the following manners.

1) Break load Pf of each beam portion

[0045] In the operating apparatus, as the four beam portions 56, 56, 56, and 56D are circumferentially equally spaced at 90° intervals, in order that the operating knob 20 moves rearward by receiving a pressing load of 380N, it is sufficient that the beam portions are designed in such a way that each beam portion breaks by receiving a load of 380/4=95(N), that is, in such a way that the break load Pf of each beam portion is 95N.

2) Shape design of beam portions

[0046] When a load P acts on the intermediate regions of the beam portions 56 and 56D which are two-end fixing beams, and taking the length of the beam portions (that is, the width of the through holes 54) as Lb and bending moment acting on the intermediate regions as M, a relationship between them is expressed by the following equation.

[0047]

$$P = 8 \times M / Lb \quad \cdots (1)$$

Taking the maximum bending stress of the intermediate regions of the beam portions 56 and 56D when the bending moment M in the equation acts as σ_{max} and the section modulus of the beam portions 56 and 56D as Z, the bending moment M is expressed by

$$M = \sigma_{max} \times Z \quad \cdots (2)$$

[0048] Herein, when the plate thickness of the guided portions 46A to 46D in which the beam portions are formed (that is, the width of the beam portions) is taken to be t, and the thickness of the beam portions (a distance from the rear end of each through hole 54 to the rear end of each guided portion 46A to 46D) is taken to be d_2, the section modulus Z of the beam portions 56 and 56D in the illustrated example is expressed by

$$Z = t \times d_2/6 \cdots (3)$$

[0049] When the equation (2) and equation (3) are substituted into the equation (1), the following equation is obtained.

$$P = 8 \times \sigma_{max} \times t \times d_2/6Lb \cdots (4)$$

[0050] Herein, as the maximum bending stress σ_{max} when the beam portions 56 and 56D break is determined by a material property, by fixing the shape (L, t, and d_2) of the beam portions in such a way that P = Pf (≈ 95N) in the equation (4), it is possible to construct an operation apparatus wherein the beam portions 56, 56, 56, and 56D break approximately equally when the operating knob 20 receives a pressing stress of approximately 380N.

[0051] As described above, the invention provides a vehicle press-operation member wherein it is easy to design a breakable portion which is broken in order to reduce an amount of protrusion from a panel when a certain amount of pressing force or more is applied, and it is possible to increase the reliability of a reduction in the amount of protrusion when the pressing force acts, and a vehicle operation apparatus provided with the vehicle press-operation member. Specifically, the invention provides a vehicle press-operation member which is provided on a panel in a vehicle interior in such a way as to protrude on the vehicle interior side from a surface of the panel and to receive a pressing operation, and is configured in such a way that the amount of protrusion decreases by receiving pressure with a certain amount of force or more. The vehicle press-operation member includes a base member mounted on the panel or a member fixed to the panel, and a member to be operated which is mounted on the base member in such a way as to protrude on the vehicle interior side from the base member, and receives a pressing operation. The base member has a guide holding portion which holds, while guiding, the member to be operated in such a way that the member to be operated slides to the base member in a direction parallel to the pressing direction, and a stopper which comes in contact with the member to be operated to thereby restrict the member to be operated from sliding in a direction in which the member to be operated moves more rearward than a predetermined pressing restriction position, and the member to be operated has a guided portion which fits in the guide holding portion and is guided by the guide holding portion, and a contact portion which comes in contact with the stopper of the base member to thereby prevent the slide in the direction in which the member to be operated moves rearward. Either of the stopper or the contact portion configures a breakable portion having a shape such that it is broken by receiving a pressing force from the other in the pressing direction when the member to be operated receives pressure with a certain amount of force or more, thereby allowing a further slide of the member to be operated in the pressing direction.

[0052] In the pressing operation member, when the member to be operated is pressed with the normal operation force, the member to be operated slides with the pressing force in a direction in which it moves rearward, but the slide is stopped in a position in which the contact portion of the member to be operated and the stopper of the base member come in contact with, thereby preventing a further rearward movement. That is, the stopper fulfils its original function of restricting the pressing operation stroke of the member to be operated to a stroke up to the pressing restriction position.

[0053] On the other hand, when a large pressing force is applied to the member to be operated, for example, by the passenger of the vehicle making a strong contact with the member to be operated or the like, the contact portion of the member to be operated makes pressure contact with the stopper on the base member side with a pressure corresponding to the pressing force, and the breakable portion included in the contact portion or stopper is broken by the pressure contact. Owing to the break, the member to be operated moves rearward toward the base member side up to a deeper position than the pressing restriction position, whereby the amount of protrusion of the whole of the pressing operation member from the panel decreases rapidly, and the passenger's safety is secured.

[0054] When pressing, a reaction force equivalent to the pressing force is applied to the contact portion from the stopper of the base member, and the break occurs in that position, thus making it easy to specify a relationship between the pressing force and the break load of the breakable portion. Also, as a direction of rearward movement of the member to be operated accompanying the break is fixed by the guide holding portion, the maldistribution of the pressing load caused by an inclination of the member to be operated is unlikely to occur. Consequently, it is easy to design the breakable portion.

[0055] In particular, in the event that the stoppers of the base member and the contact portions of the member to be operated are provided respectively in a plurality of positions arranged on a plane perpendicular to the pressing direction of the member to be operated, and so are the contact portions of the member to be operated, a break load which each breakable portion receives from

the corresponding stopper or contact portion is equalized, thereby making it easier to design the breakable portions.

[0056] For example, the adoption of an arrangement such that the member to be operated has the guided portions one each in a plurality of positions arranged around a specific central axis parallel to the pressing direction of the member to be operated, and the rear end portions of two or more of the guided portions among the guided portions configure the contact portion, further simplifies the structure by utilizing the rear end portions of the guided portions as the contact portions.

[0057] Also, as a specific configuration of the breakable portion, one is preferable wherein the breakable portion, which includes a beam portion extending in a direction perpendicular to the pressing direction of the member to be operated, and breaks by a longitudinally intermediate region of the beam portion receiving the pressing force. With a breakable portion including this kind of beam portion, it is possible to calculate the break strength of the beam portion based on the general bending theory. Consequently, it is easy to design the breakable portion.

[0058] For example, when utilizing the rear end portion of the guided portion as the contact portion as heretofore described, a structure is preferable wherein the rear end portion of the guided portion configuring the contact portion is formed into a plate, a through hole passing through an end portion of the plate in a direction of the plate thickness is provided, a portion closer to the leading end side than the through hole forms a beam portion extending in a direction perpendicular to the pressing direction of the member to be operated, and a longitudinally intermediate region of the beam portion breaks by receiving the pressing force. In this structure, a beam portion suitable for the breakable portion is formed with a simple structure wherein a through hole is provided in a plate-like rear end portion of the guided portion.

[0059] Also, the invention is an operation apparatus, which is provided in a vehicle and includes a panel provided in such a way as to face inside a vehicle interior, a circuit substrate fixed to the reverse of the panel, the vehicle press-operation member which is provided on the panel so as to be operable in such a way as to protrude on the vehicle interior side from the surface of the panel and changes in shape in such a way that the amount of protrusion decreases by receiving a certain amount of pressing force or more, and an operation detector which is provided on the circuit substrate and outputs an electrical signal when the member to be operated of the vehicle press-operation member is operated up to the pressing restriction position, wherein the base member of the vehicle press-operation member is fixed to the panel.

[0060] In the operating apparatus, by providing the member to be operated of the vehicle press-operation member with a pressing operation portion which is provided in a position differing from the contact portion and, in accordance with a pressing operation of the member to be operated, transmits the pressing force to the operation detector, and a breakable portion on the operation side, which breaks with a reaction force which the press-operation portion receives from the operation detector when the member to be operated receives a certain amount of pressure or more, the pressing operation portion also can be utilized as a breakable portion. In this case, it is sufficient to set the shape of the breakable portion on the operation side in such a way that a pressing load when the breakable portion on the operation side breaks is equal to a pressing load when the breakable portion breaks.

Claims

1. A vehicle press-operation member which is provided on a panel in a vehicle interior in such a way as to protrude on the vehicle interior side from a surface of the panel, and changes in shape in such a way that the amount of protrusion thereof decreases by receiving a certain amount of force or more, comprising:

   a base member mounted on the panel or a member fixed to the panel; and
   a member to be operated which is mounted on the base member in such a way as to protrude on the vehicle interior side from the base member and receives a pressing operation, wherein the base member has a guide holding portion which holds, while guiding, the member to be operated in such a way that the member to be operated slides to the base member in a direction parallel to the pressing direction, and a stopper which, by coming in contact with the member to be operated, restricts the member to be operated from sliding in a direction in which the member to be operated moves more rearward than a predetermined pressing restriction position,
   the member to be operated has a guided portion which fits in the guide holding portion and is guided by the guide holding portion, and a contact portion which, by coming in contact with the stopper of the base member, prevents the slide in the direction in which the member to be operated moves rearward,
   and
   either of the stopper or the contact portion includes a breakable portion having a shape such that it is broken by receiving a pressing force from the other in the pressing direction when the member to be operated receives pressure with a certain amount of force or more, thereby allowing the member to be operated to slide in a direction in which the member to be operated moves still more rearward than the pressing re-

striction position.

2. The vehicle press-operation member according to claim 1, wherein
the stoppers of the base member and the contact portions of the member to be operated are provided respectively in a plurality of positions arranged on a plane perpendicular to the pressing direction of the member to be operated.

3. The vehicle press-operation member according to claim 2, wherein
the member to be operated has the guided portions one each in a plurality of positions arranged on a plane perpendicular to the pressing direction of the member to be operated, and the rear end portions of two or more of the guided portions, among the guided portions, configure the contact portions.

4. The vehicle press-operation member according to any one of claims 1 to 3, wherein
the breakable portion which includes a beam portion extending in a direction perpendicular to the pressing direction of the member to be operated, wherein a longitudinally intermediate region of the beam portion receives the pressing force to thereby break.

5. The vehicle press-operation member according to claim 3, wherein
the rear end portion of the guided portion configuring the contact portion is formed into a plate, a through hole passing through an end portion of the plate in a direction of the plate thickness is provided, a portion closer to the leading end side than the through hole forms a beam portion extending in a direction perpendicular to the pressing direction of the member to be operated, and a longitudinally intermediate region of the beam portion breaks by receiving the pressing force.

6. A vehicle operation apparatus, which is provided in a vehicle, comprising:

a panel provided in such a way as to face inside a vehicle interior;
a circuit substrate fixed to the reverse of the panel;
the vehicle press-operation member according to any one of claims 1 to 5, which is provided on the panel so as to be operable in such a way as to protrude on the vehicle interior side from the surface of the panel and changes in shape in such a way that the amount of protrusion decreases by receiving a certain amount of pressure or more; and
an operation detector which is provided on the circuit substrate and outputs an electrical signal when the member to be operated of the vehicle press-operation member is operated up to the pressing restriction position, wherein
the base member of the vehicle press-operation member is fixed to the panel.

7. The vehicle operation apparatus according to claim 6, wherein
the member to be operated of the vehicle press-operation member has a pressing operation portion which is provided in a position differing from the contact portion and transmits the pressing force to the operation detector in accordance with a pressing operation of the member to be operated, and an operation side breakable portion which breaks with a reaction force, which the pressing operation portion receives from the operation detector when the member to be operated receives a certain amount of pressure or more, wherein the shape of the operation side breakable portion is set in such a way that a pressing load when the operation side breakable portion breaks is equal to a pressing load when the breakable portion breaks.

Fig. 1

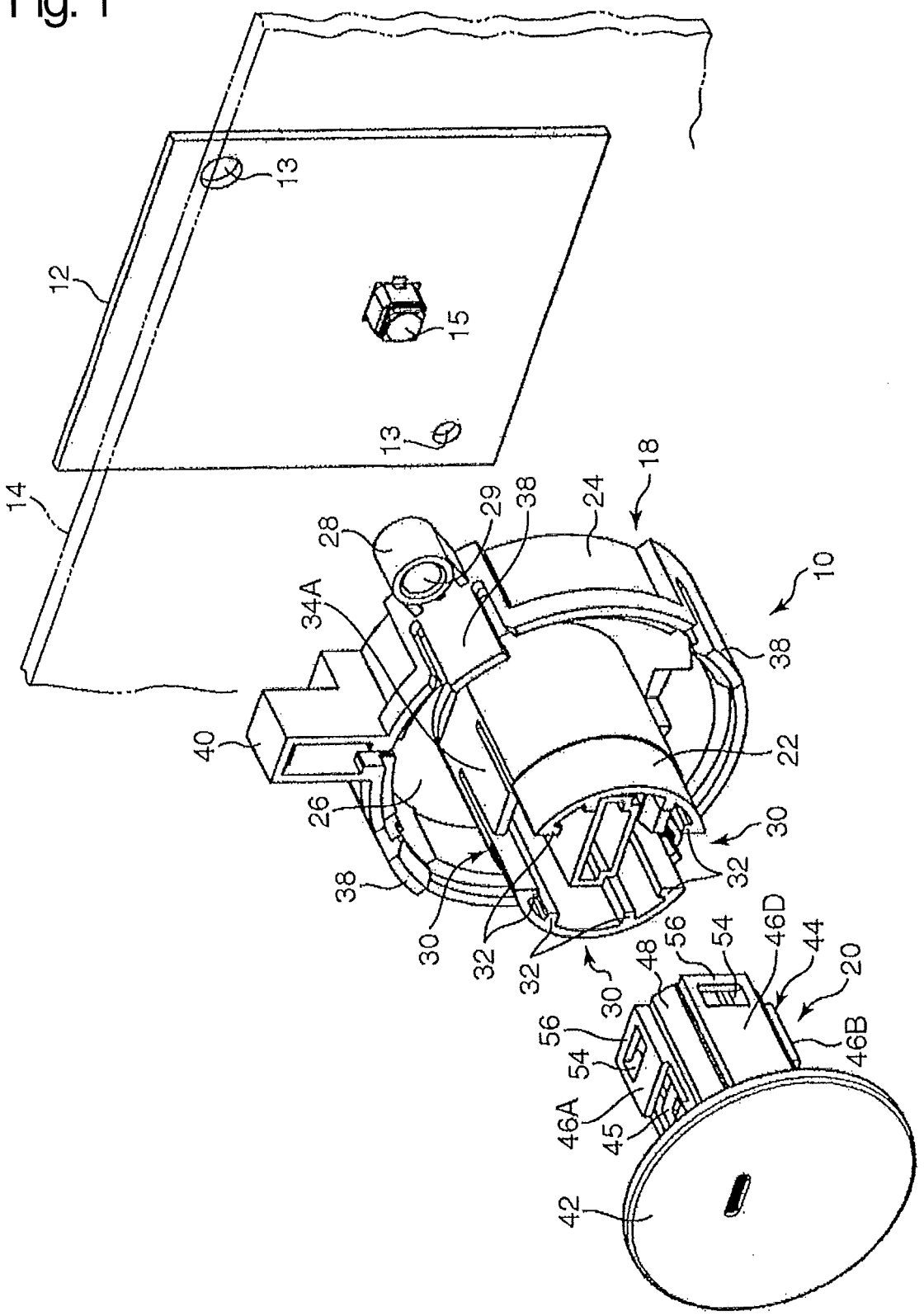

13
12
15
13
14
18
24
29
38
28
34A
10
38
40
22
26
30
38
32
30
32
32
30
48
56
54
46D
44
20
56
54
46B
46A
45
42

Fig. 2

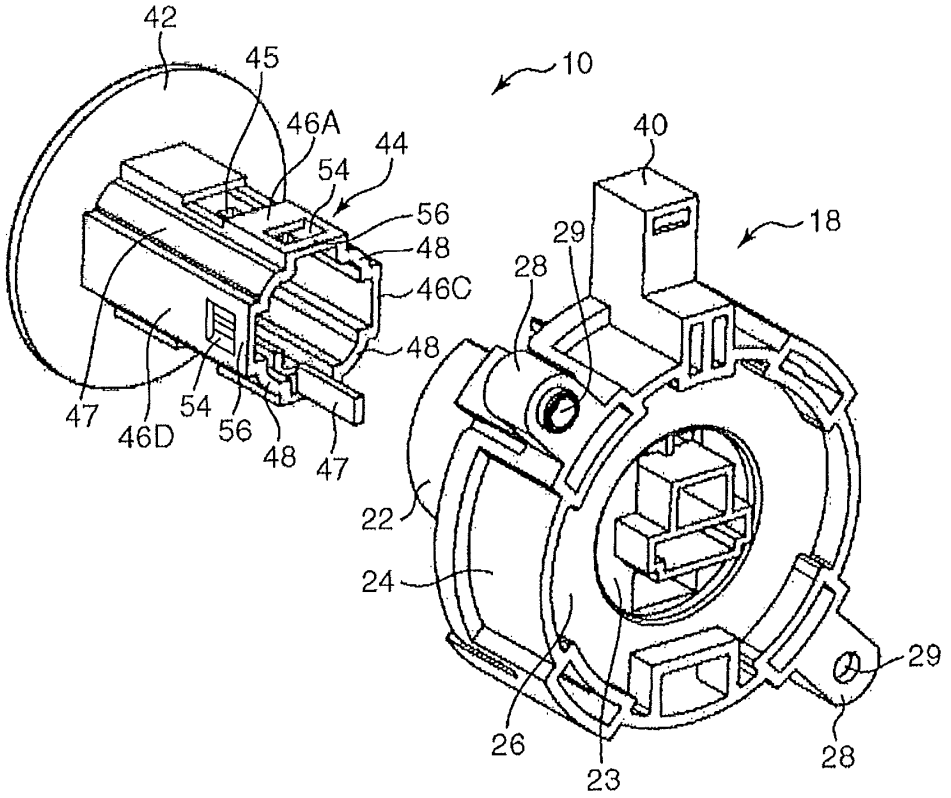

42
45
10
46A
44
40
54
56
18
29
48
28
46C
48
47
46D
54
56
48
47
22
24
29
26
23
28

Fig. 3

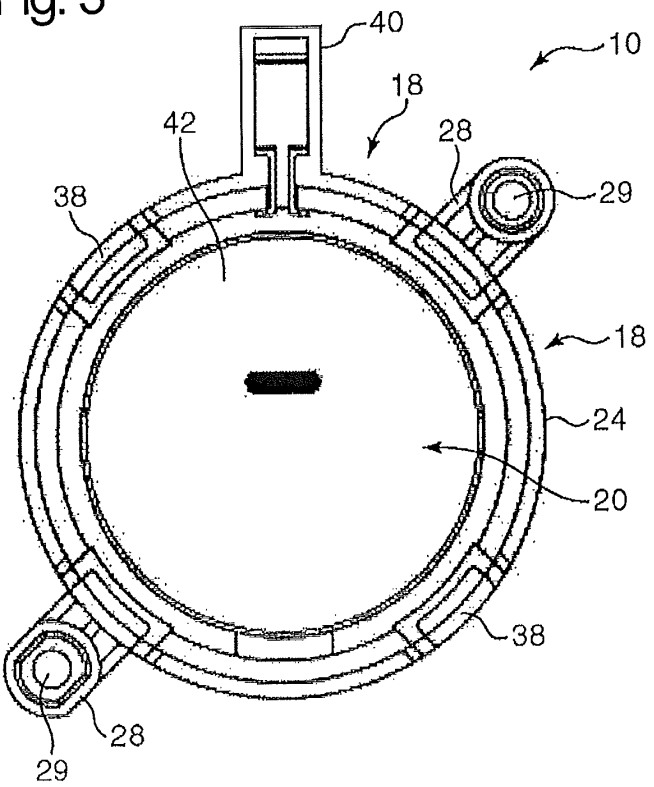

40
10
18
42
28
38
29
18
24
20
38
28
29

Fig. 4

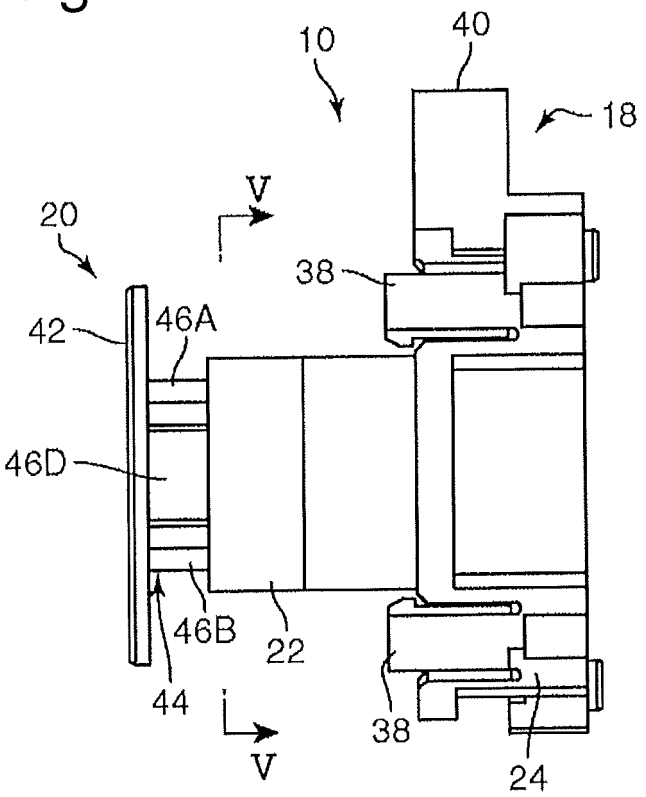

10
40
18
V
20
38
42
46A
46D
46B
22
44
38
24
V

Fig. 5

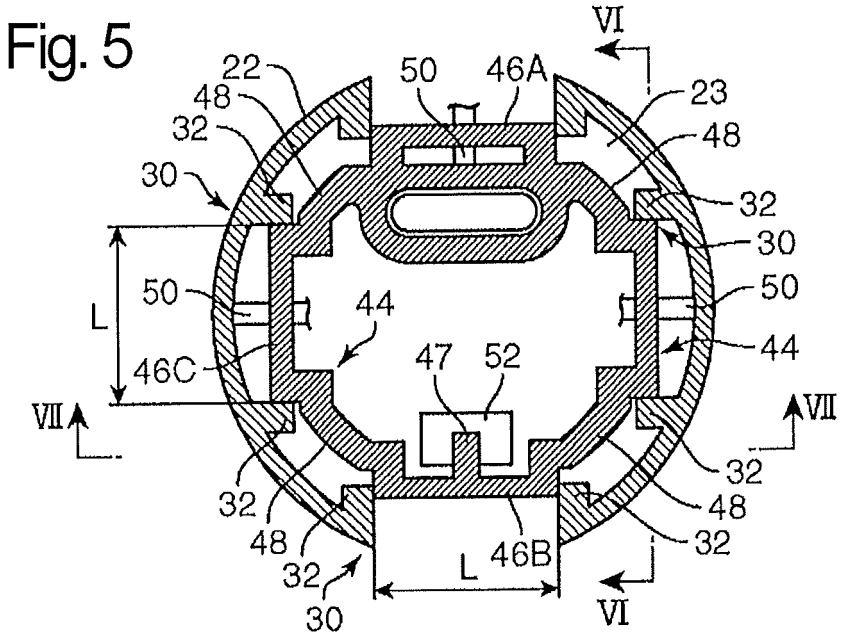
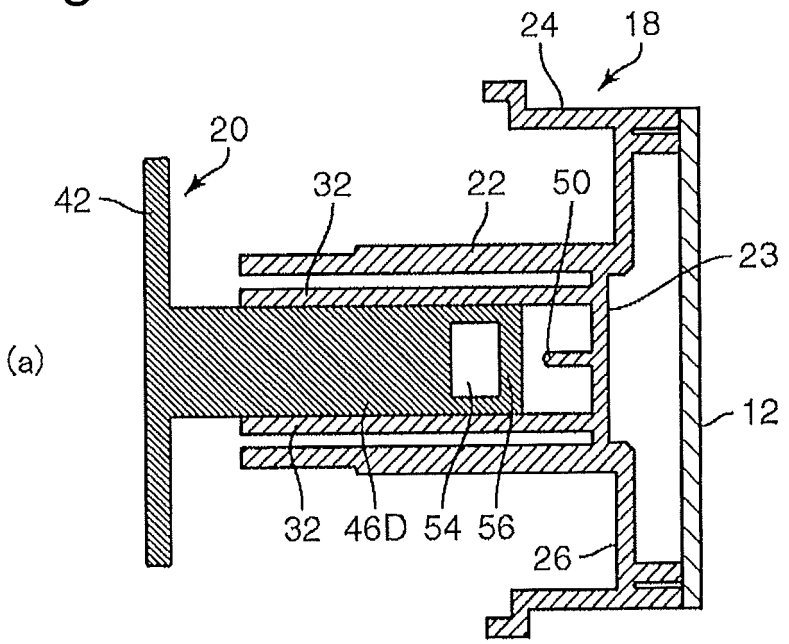

VI
22
50
46A
23
48
32
48
30
32
30
50
L
50
44
44
47
52
46C
VII
VII
32
32
48
48
32
32
L
46B
30
VI

Fig. 6


(a)
24
18
20
42
32
22
50
23
12
32
46D
54
56
26

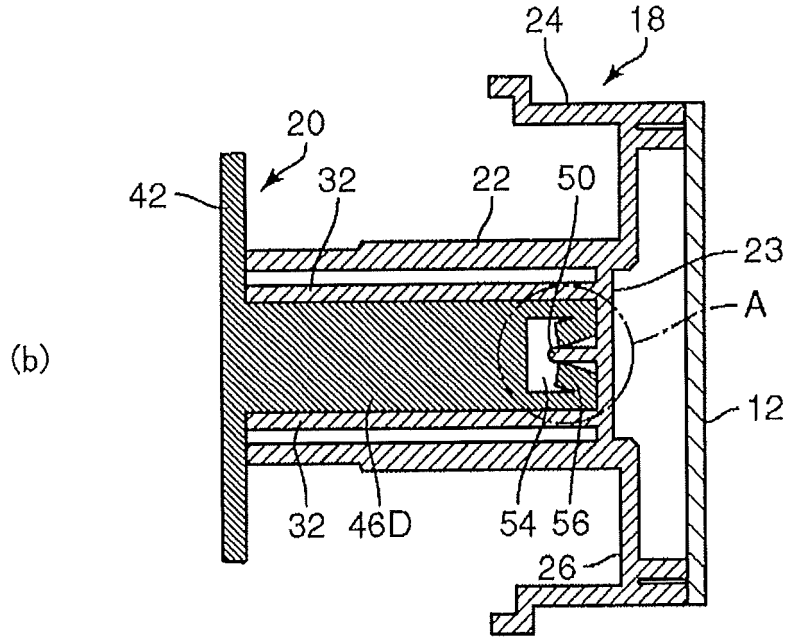

(b)
24
18
20
42
32
22
50
23
A
12
32
46D
54
56
26

Fig. 7

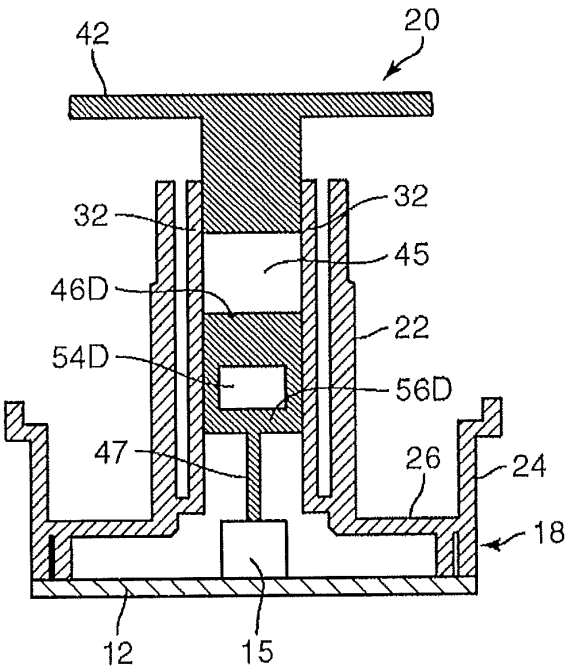

42
20
32
32
45
46D
22
54D
56D
47
26
24
18
12
15

Fig. 8

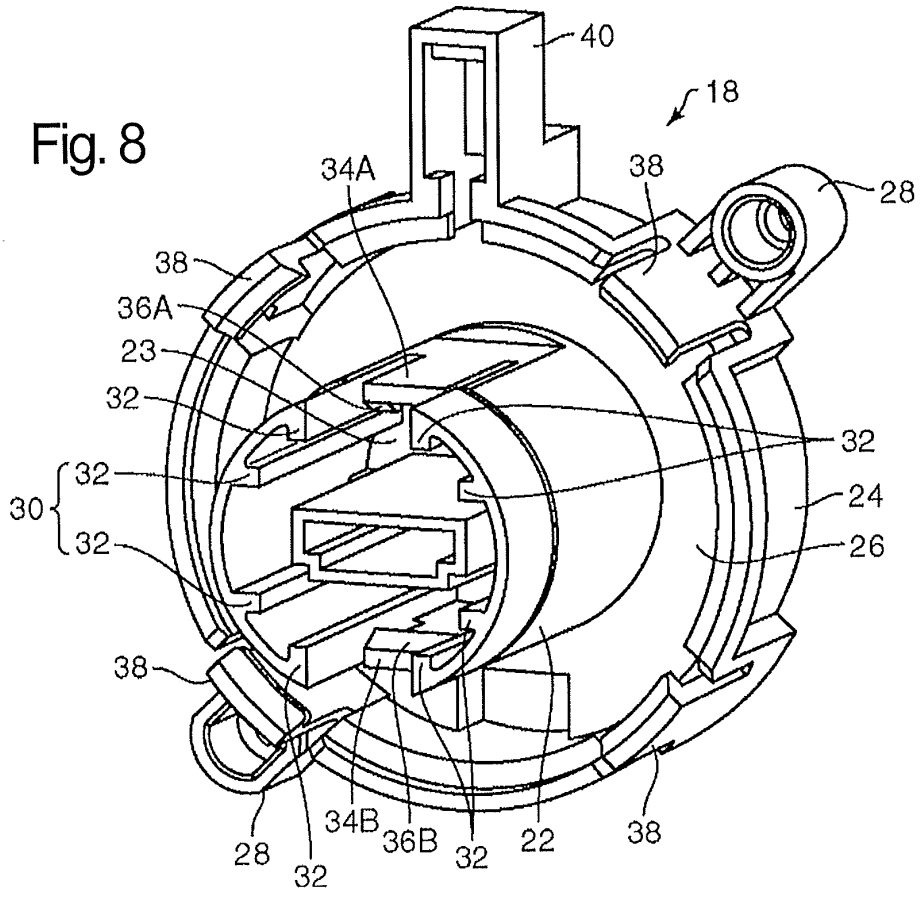

40
18
34A
38
28
38
36A
23
32
32
32
30
32
24
32
26
38
28
32
34B
36B
32
22
38

Fig. 9

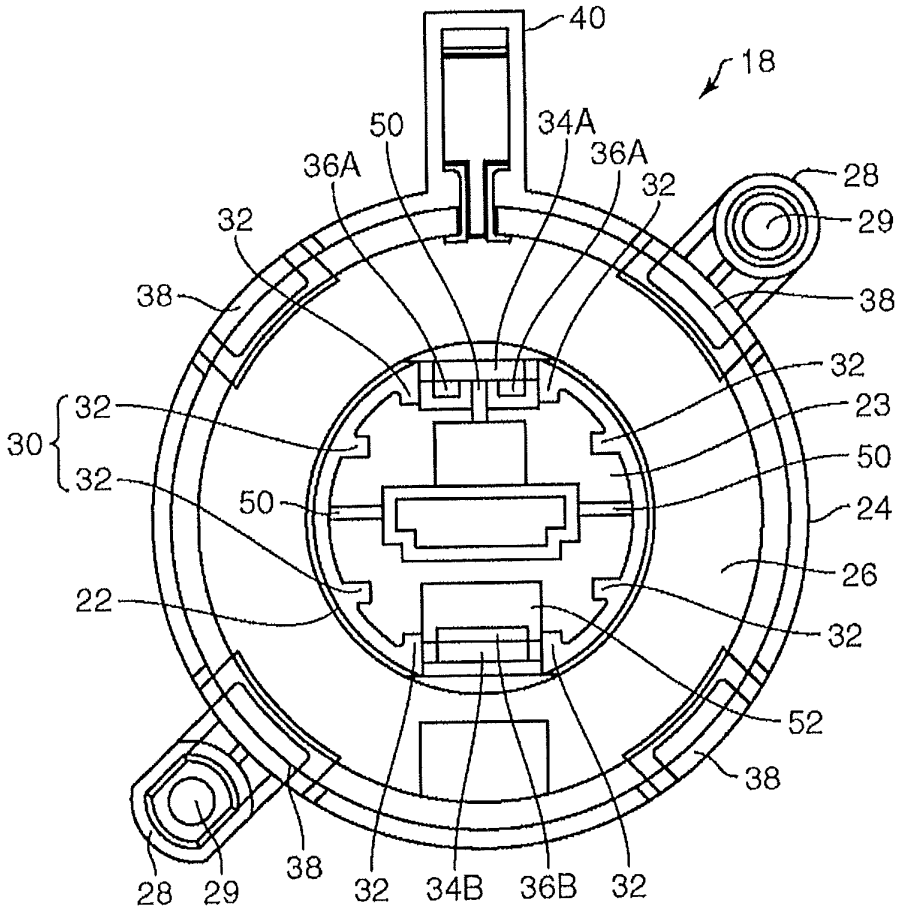

40
18
50
34A
36A
36A
32
28
29
32
38
38
32
32
23
30
32
50
50
24
26
22
32
52
38
28
29
38
32
34B
36B
32

Fig. 10

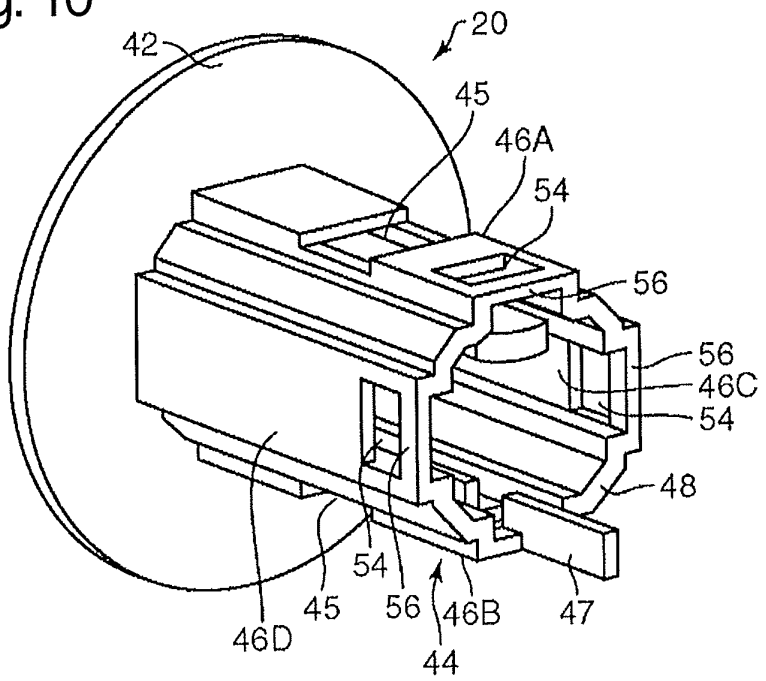

20
42
45
46A
54
56
56
46C
54
48
54
45
56
46B
47
46D
44

Fig. 11

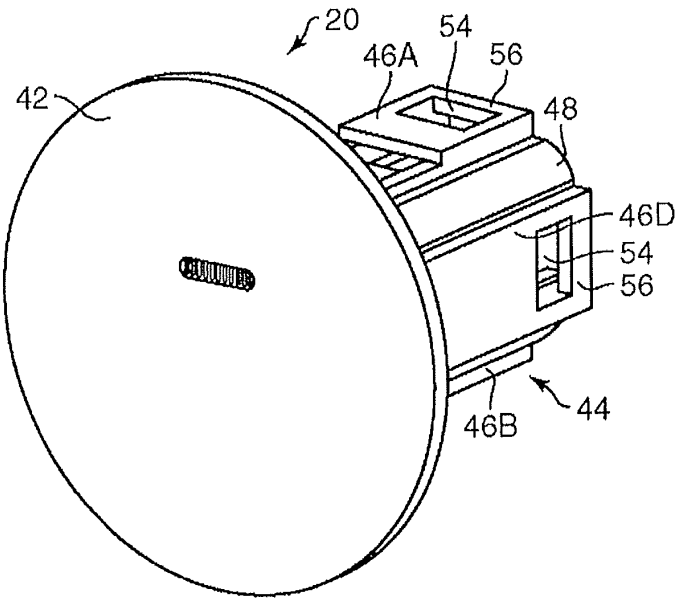

20
54
46A
56
42
48
46D
54
56
44
46B

Fig. 12

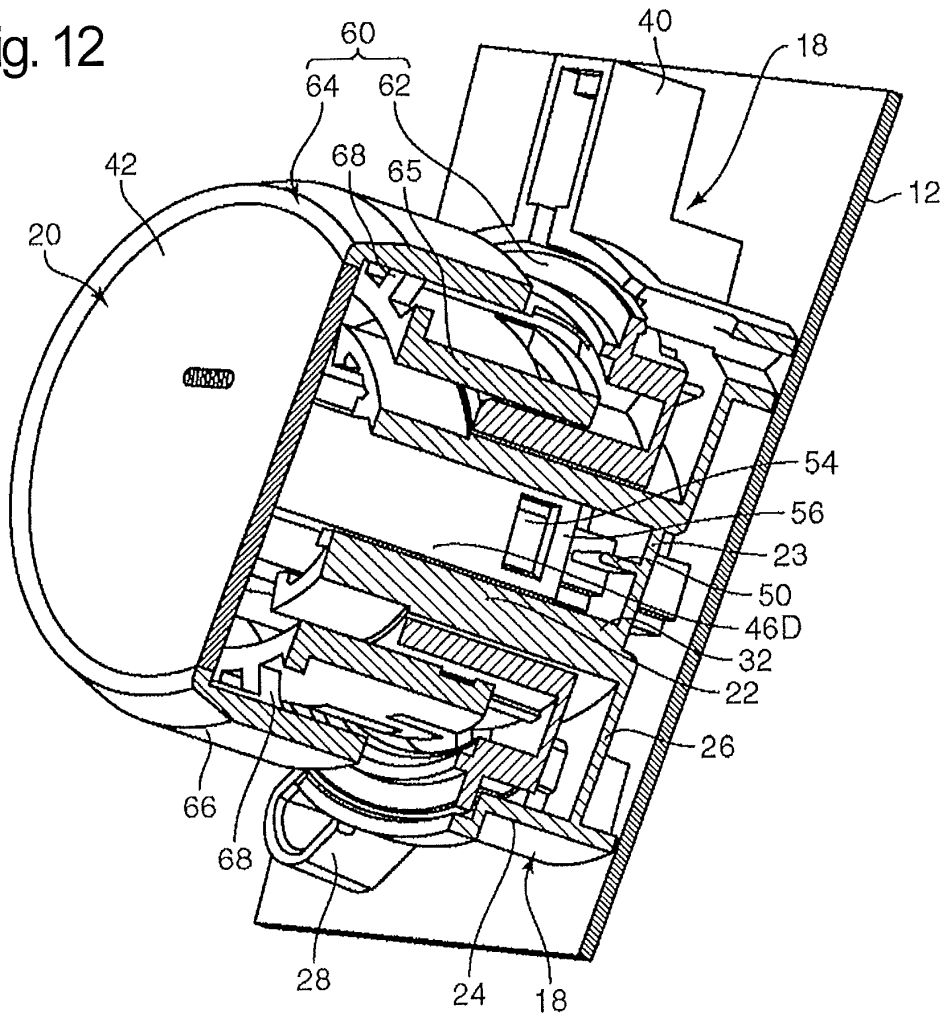

60
64
62
40
18
42
68
65
12
20
54
56
23
50
46D
32
22
26
66
68
28
24
18

Fig. 13

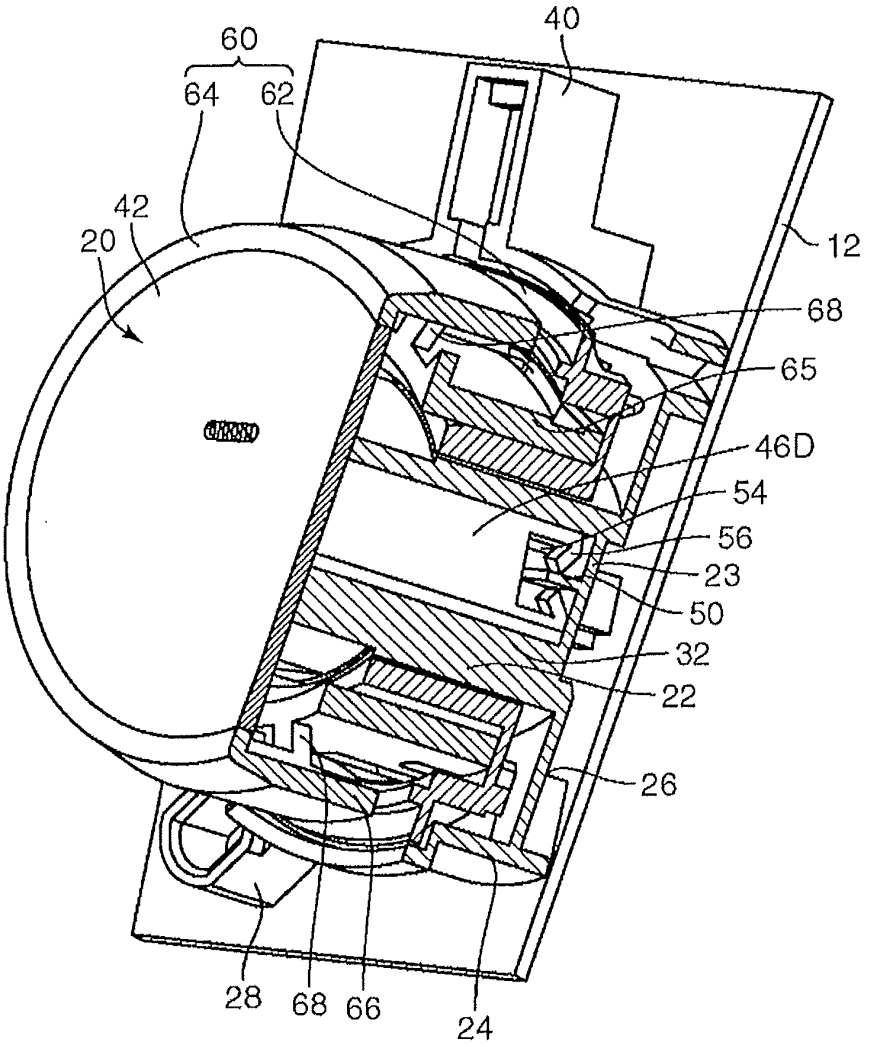
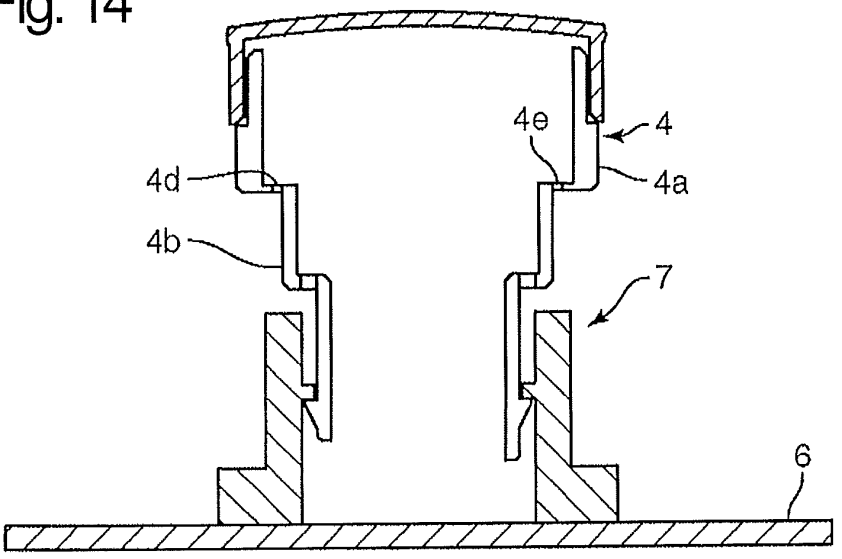

60
64
62
40
42
20
12
68
65
46D
54
56
23
50
32
22
26
28
68
66
24

Fig. 14


4e
4
4d
4a
4b
7
6

INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP2010/006605

A. CLASSIFICATION OF SUBJECT MATTER
H01H13/14(2006.01)i

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
H01H13/14, H01H19/14

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
Jitsuyo Shinan Koho 1922-1996 Jitsuyo Shinan Toroku Koho 1996-2011
Kokai Jitsuyo Shinan Koho 1971-2011 Toroku Jitsuyo Shinan Koho 1994-2011

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	JP 2003-162936 A (Kenwood Corp.), 06 June 2003 (06.06.2003), entire text; all drawings (Family: none)	1-7
A	JP 2-129817 A (Matsushita Electric Industrial Co., Ltd.), 17 May 1990 (17.05.1990), entire text; all drawings (Family: none)	1-7
A	JP 2006-253063 A (Alpine Electronics, Inc.), 21 September 2006 (21.09.2006), entire text; all drawings (Family: none)	1-7

☐ Further documents are listed in the continuation of Box C. ☐ See patent family annex.

* Special categories of cited documents:
"A" document defining the general state of the art which is not considered to be of particular relevance
"E" earlier application or patent but published on or after the international filing date
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
"O" document referring to an oral disclosure, use, exhibition or other means
"P" document published prior to the international filing date but later than the priority date claimed
"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
14 January, 2011 (14.01.11)	25 January, 2011 (25.01.11)
Name and mailing address of the ISA/ Japanese Patent Office Facsimile No.	Authorized officer Telephone No.

Form PCT/ISA/210 (second sheet) (July 2009)

REFERENCES CITED IN THE DESCRIPTION

This list of references cited by the applicant is for the reader's convenience only. It does not form part of the European patent document. Even though great care has been taken in compiling the references, errors or omissions cannot be excluded and the EPO disclaims all liability in this regard.

Patent documents cited in the description

- JP 2004079484 A **[0008]**