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(54) **OPERATING DEVICE WITH ILLUMINATION FUNCTION**

(57) An object of the present invention is to provide an operating device that carry out illumination with a high decoration effect by a simple structure that utilizes existing members. The operating device comprises an operating panel (10) provided with an operating section window (12), and operating sections (20A, 20B, 20C, 20D, 20E) disposed inside the operating section window (12). A light source for illumination is disposed on a rear side

of the operating panel (10). Lights emitted from the source for illumination are irradiated by a light guide system including a light guide member (60) and the like from a rear side of the operating section to a panel surface at a peripheral area around the operating section window (12). The panel surface defines a panel reflection surface (13) with a shape that reflects the lights to a front side of the operating panel (10).

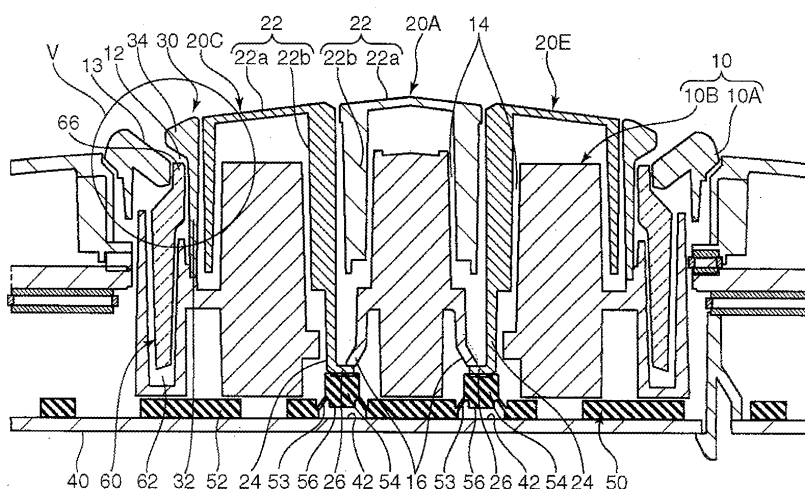


Figure 2

Description

FIELD OF THE INVENTION

[0001] This invention relates to an operating device to be disposed in an interior of a motor vehicle or the like and having an illumination function.

BACKGROUND OF THE INVENTION

[0002] In a conventional operating device, an operating device has been known that includes an operating panel, and an operating section, such as switches or the like provided on an operating panel and further has an illumination function for indicating a position of the operating section. For example, Patent Document 1 discloses an operating device including a light source for illumination (LED) provided on a rear side of an operating panel, switch buttons each having an indicating section and provided on the operating panel, and light guide members disposed between the light source for illumination and the respective switch buttons. The light guide members lead lights emitted from the light source for illumination to a rear side of the switch buttons to cause light-emission in the indicating sections of the switch buttons.

[0003] In such an operating device, there is a requirement that illuminates a peripheral area around the operating section so that the peripheral area floats up from the other parts in association with a decorating purpose. In order to accomplish such illumination, a ring-like light guide member may be disposed around the switch buttons in the operating section and may irradiate lights onto a panel surface. However, such illumination makes a profile of the illumination too clear to enhance a decoration effect. A special light guide member or the other component that irradiates soft lights will result in a significant high cost.

Patent Document 1: JP 2000-106049 A1

SUMMARY OF THE INVENTION

[0004] In view of the above situation, an object of the present invention is to provide an operating device that carry out illumination with a high decoration effect by a simple structure that utilizes existing members. In order to achieve the object, an operating device of the present invention comprises: an operating panel provided with an operating section window; an operating section disposed inside the operating section window in the operating panel; a light source for illumination disposed on a rear side of the operating panel for emitting lights for illumination; and a light guide system for guiding the lights emitted from the light source for illumination from a rear side of the operating section to a peripheral area around the operating section window in the operating panel. A front surface on the peripheral area around the operating section window out of a front surface of the operating

panel defines a panel reflection surface with a shape that reflects the lights irradiated to the peripheral area around the operating section window by the light guide system.

[0005] In the operating device, the lights emitted from the light source for illumination are guided to the light guide system so that the lights are irradiated onto the panel reflection surface that is the front surface of the operating panel disposed on the peripheral area around the operating section window and are further reflected on the panel reflection surface to the front surface of the operating panel to serve as illumination lights. These illumination lights realize soft and high decoration illumination in comparison with, for example, the lights irradiated directly onto a panel front side from the light guide member. In addition, since the panel reflection surface utilizes the front surface of the operating panel, it is possible to reduce the number of parts and costs in production.

BRIEF DESCRIPTION OF THE DRAWINGS

[0006]

[Fig. 1] Figure 1 is a front elevation view of an embodiment of an operating device in accordance with the present invention.

[Fig. 2] Figure 2 is a longitudinal section view of the operating device shown in Figure 1, illustrating an internal structure of the operating device.

[Fig. 3] Figure 3 is a partially broken perspective view of a light guide member in the operating device.

[Fig. 4] Figure 4 is a longitudinal section view of the operating device taken along lines IV-IV in Figure 1, illustrating a light guide system in the operating device.

[Fig. 5] Figure 5 is an enlarged section view of a part of the operating device taken by a circle V in Figure 2.

DETAILED DESCRIPTION OF THE INVENTION

[0007] Referring now to the drawings, a preferred embodiment of an operating device in accordance with the present invention will be described below.

[0008] An operating device of the present invention shown in Figures 1 and 2 is provided in an interior of a motor vehicle. The operating device includes an operating panel 10, a plurality of operating buttons 20A, 20B, 20C, 20D, 20E that correspond to operating members, a decoration ring 30 that corresponds to a decoration member, a circuit board 40, and an elastic member 50 for a push switch.

[0009] The operating panel 10 includes a body panel 10A and a holding panel 10B. The body panel 10A is directed to an interior of a motor vehicle. The body panel 10A is provided with an operating section window 12. An operating section including the operating buttons 20A to 20E and decoration ring 30 is disposed inside the operating section window 12. The holding panel 10B supports

a rear side of the operating section.

[0010] The respective operating buttons 20A to 20E are subject to pushing actions so that a push switch comprising the circuit board 40 and the elastic member 50 for the push switch is turned on. Each of the operating buttons 20A to 20E includes a button body 22 that is exposed from a front surface of the operating panel 10 and receives the pushing actions toward an inner part direction (in a downward direction in Figure 2), and a pushing portion 24 that extends from the button body 22 in the pushing action direction.

[0011] In the present invention, each button body 22 is formed into cap-like configurations. In more detail, each button body 22 includes a top wall 22a that receives the pushing actions and a side wall 22b that extends from the top wall 22a in the pushing action direction.

[0012] On the other hand, the holding panel 10B is provided with a guide groove 14 into which each side wall 22b is inserted from the panel surface side (downward in Figure 2). When each side wall 22b is inserted into each guide groove 14, the respective operating buttons 20A to 20E is held on the holding panel 10B so that the operating buttons 20A to 20E are guided in the pushing action direction.

[0013] The operating button 20A out of the operating buttons 20A to 20E is formed into a small circular shape taken from a front side of the operating panel 10 in Figure 1 (taken from upper side in Figure 2) while the other operating buttons 20B to 20E are arranged to surround the operating button 20A. Whole peripheral edges of the operating buttons 20B to 20E define a great circular shape (properly, elliptical shape that is inclined slightly with respect to the panel surface). The decoration ring 30 is disposed around the outer peripheral edges of the operating buttons 20B to 20E.

[0014] The decoration ring 30 includes a tubular ring body 32 and a reflection portion 34 that extends outward from a front side end (upper end in Figure 2) of the ring body 32. The ring body 32 is supported on the holding panel 10B. The reflection portion 34 constitutes a part of a light guide system mentioned after. The decoration ring 30 includes a resin matrix and a plating layer (for example, trivalent chrome plating) having a metallic luster and applied on the resin matrix. The metallic luster can display a profile of a button group comprising the operating buttons 20A to 20E.

[0015] The circuit board 40 is disposed on a rear side of the operating panel 10 substantially in parallel to the body panel 10A. The circuit board 40 together with the elastic member 50 for the pushing switch constitute a plurality of pushing switches. In more detail, the circuit board 40 is provided on the surface with a plurality of board side contacts 42. The board side contacts 42 are arranged at positions corresponding to the pushing portions 24 of the operating buttons 20A to 20B.

[0016] The elastic member 50 for the pushing switch is integrated into a unit and made of an elastic material, such as rubber. The elastic member 50 includes a plate-

like base 52 and a plurality of elastically displacing portions 54.

[0017] The base 52 is disposed between the operating panel 10 and the circuit board 40 to be secured between them. The base 52 is provided with a plurality of through-holes that expose the board side contacts at the front side. The elastically displacing portions 54 are disposed on an area inside the through-holes.

[0018] Each of the elastically displacing portions 54 is formed into a substantially cylindrical shape and is provided with bottom surface opposed to each of the board side contacts 42. An operating side contact 56 is provided on each of the bottom surfaces of the elastically displacing portions 54. An outer peripheral surface of each elastically displacing portion 54 is connected through a thin portion 53 to a peripheral edge around each through-hole. When the thin portion 53 is not deformed, the thin portion 53 keeps the elastically displacing portion 54 at a position where the operating side contact 56 and board side contact 42 are spaced apart from each other. On the other hand, when a pushing action force is applied from the pushing portion 24 to the elastically displacing portion 54 in a direction toward the circuit board 40, the thin portion 53 is elastically deformed. When the thin portion is elastically deformed, the elastically displacing portion 54 is permitted to be elastically displaced in the pushing action direction so as to bring the contacts 56 and 42 into contact with each other. When the contacts 56 and 42 are brought into contact with each other, the pushing switch including the contacts 56 and 42 are turned on.

[0019] In the present embodiment, a portion being engaged 26 projects from a distal end of the pushing portion 24 in a direction perpendicular to the pushing action direction (that is, a direction in parallel to the circuit board 40). The portion being engaged 26 together with the distal end of the pushing portion 24 define a pushing surface. On the other hand, deflection pieces 16 extend from the holding panel 10B to the circuit board 40. When a distal end of each of the deflection pieces 16 is brought into contact with the portion being engaged 26 from a opposite side from the circuit board 40, return positions (reset positions at the time when the pushing action is released) of the operating buttons 20A to 20E are defined.

[0020] Furthermore, the operating device has an illumination function that indirectly lights a peripheral area around the decoration ring 30 that constitutes the operating section. Referring now to Figures 3 to 5, a structure for the illumination function will be described below.

[0021] A plurality of light sources 44 for illumination are mounted on the circuit board 40. Although it is preferable that each of the light sources 44 for illumination is, for example, an LED, each light source 44 may be a light-emitting element. In the present embodiment, as shown in Figure 1, each of the light sources 44 for illumination is disposed at six positions along the decoration ring 30 and is exposed via a through-hole (not shown) in the elastic member 50 at a side of the operating panel 10. Lights emitted from the light sources 44 for illumination

are led to the front side of the operating panel 10 by the light guide system and a panel reflection surface 13 formed on the peripheral area around the operating section window 12 in the body panel 10A so as to serve as illumination lights.

[0022] The light guide system serves to guide the lights emitted from the respective light sources 44 for illumination from the rear side of the operating section to the panel reflection surface 13. In the present embodiment, a light guide member 60 and a reflection portion 34 of the decoration ring 30 constitute the light guide system.

[0023] The light guide member 60 is formed into a substantially cylindrical shape shown in Figure 3 and is disposed coaxially with and around the operating section. As shown in Figure 4, the light guide member 60 is disposed between the respective light sources 44 for illumination and the reflection portion 34 of the decoration ring 30. The rear side end of the light guide member 60 is secured to the circuit board 40. The light guide member 60 is provided on a rear side end with a plurality of recesses 62 that bridge troughs in the holding panel 10B and with a plurality of recesses 64 that span the respective light sources 44 for illumination. That is, the respective light sources 44 for illumination are disposed in the respective recesses 64. The light guide member 60 leads the lights emitted from the light sources 44 for illumination to the front side of the operating panel 10. As shown in Figures 4 and 5, the light guide member 60 permits the emitted lights to illuminate the panel front side (upper side in Figures 4 and 5) from a panel side end 66 that is an end of the operating panel 10.

[0024] The reflection portion 34 of the decoration ring 30 is disposed so as to cover the panel side end 66 of the light guide member 60 from the front side of the panel (upper side in Figures 4 and 5). A rear side of the reflection portion 34, namely a surface opposed to the panel side end 66, defines a reflection surface 34a for light-leading (Figure 5) utilizing a metallic luster. The reflection surface 34a reflects the lights irradiated from the panel side end 66 to the panel reflection surface 13 at the outside of the radial direction. In the present embodiment, the reflection surface 34a for light-leading is formed into a substantially conical surface inclined by an angle of about 45 degrees with respect to the axial direction (that is, the pushing action direction) of the operating section.

[0025] In the present embodiment, the panel reflection surface 13 is a conical surface that gradually enlarges a diameter from an immediate outside (outside in the radial direction) of the panel side end 66 of the light guide member 60 to the panel surface. The panel reflection surface 13 further reflects the lights reflected from the reflection surface 34a for light-leading to the panel front side. The reflected lights illuminate the area around the decoration ring 30 for a purpose of illumination.

[0026] The illuminating lights are irradiated from the rear side of the reflection portion 34 of the decoration ring 30 to the panel reflection surface 13 disposed on the outside in the radial direction and are reflected on the

panel reflection surface 13. In addition, the panel reflection surface 13 is constructed only by the front side surface (in general, painted surface) of the body panel 10A. Consequently, in comparison with lights emitted directly from, for example, the light guide member 60, the lights reflected from the panel reflection surface 13 is soft and can realize a high decoration effect in illumination. In particular, in the case where the surface of the body panel 10A including the panel reflection surface 13 is subject to a metallic painting treatment, it is possible to provide illuminating lights that is softer than, for example, a metallic surface while maintaining a reflection factor necessary for illumination.

[0027] An inclination angle of the panel reflection surface 13 may be set to be any angle within a range in which the illuminating lights can leak outward from the decoration ring 30. However, basically, it is preferable that the panel reflection surface 13 is inclined by an angle of more than 45 degrees (less than 60 degrees in the drawings) with respect to a normal line to the surface of the operating panel. Since the inclined panel reflection surface 13 can reflect the lights irradiated from the light guide system, it is possible to present an expansive felling to the illuminating lights.

[0028] The reflection surface 34a for light-leading in the present embodiment utilizes a metallic luster on the surface of the decoration ring 30 that constitutes the decoration member. However, for example, in the case where there is no decoration member, a peripheral area around the operating section (for example, the outer peripheral area around the operating buttons 20B to 20E) may be utilized. In this case, a metallic layer for light reflection may be coated on the rear side of the reflection portion to partially form a reflection surface. Furthermore, it is possible to omit the reflection portion and for only the light guide member to define the light guide system. In this case, a shape of the light guide member may be set so that lights are irradiated from the rear side of the peripheral area around the operating section to the outside in the radial direction. However, if the light guide system includes the reflection surface for light-leading described above, the shape of the light guide member can be further simplified and can enhance flexibility in design.

[0029] A shape of the outer periphery of the operating section and a shape of the panel reflection surface taken from the panel front side are not necessarily limited to a circle or an ellipse. They may be, for example, a rectangle, or the other shape. However, if the shapes are the circle or ellipse, it is possible to perform uniform illumination over a whole periphery of the operating section.

[0030] As described above, the present invention can provide an operating device that carry out illumination with a high decoration effect by a simple structure that utilizes existing members. That is, the operating device comprises an operating panel provided with an operating section window, an operating section disposed inside the operating section window in the operating panel, a light source for illumination disposed on a rear side of the op-

erating panel for emitting lights for illumination, and a light guide system for guiding the lights emitted from the light source for illumination from a rear side of the operating section to a peripheral area around the operating section window in the operating panel. A front surface on the peripheral area around the operating section window out of a front surface of the operating panel defines a panel reflection surface with a shape that reflects the lights irradiated to the peripheral area around the operating section window by the light guide system.

[0031] In the operating device, the lights emitted from the light source for illumination are guided to the light guide system so that the lights are irradiated onto the panel reflection surface that is the front surface of the operating panel disposed on the peripheral area around the operating section window and are further reflected on the panel reflection surface to the front surface of the operating panel to serve as illumination lights. These illumination lights realize soft and high decoration illumination in comparison with, for example, the lights irradiated directly onto a panel front side from the light guide member. In addition, since the panel reflection surface utilizes the front surface of the operating panel, it is possible to reduce the number of parts and costs in production.

[0032] It is preferable that the light guide system includes a light guide member that guides the lights emitted from the light source for illumination to a vicinity of the peripheral area around the operating section. This light guide member can enhance flexibility of arrangement of the light source for illumination. For example, even if the light source for illumination is separated away from the vicinity of the peripheral area around the operating section, it is possible to guide the lights emitted from the light source for illumination to the vicinity of the peripheral area around the operating section.

[0033] It will be preferable that the light guide system is made of only the light guide member, that is, the light guide member directly irradiates the lights for illumination from the rear side of the operating section to the panel reflection surface. However, it will be further preferable that the light guide system includes a reflection portion that is formed by the peripheral area of the operating section and covers the light guide member at the front side of the operating panel in addition to the light guide member, and that the rear side of the reflection portion defines a reflection surface for light-leading that reflects the lights guided by the light guide member to the panel reflection surface. Even if, for example, the light guide member directly irradiates the illumination lights to the front side of the operating panel, the reflection surface for light-leading of the reflection portion leads the illumination lights to the panel reflection surface by reflecting the illumination lights on the rear side of the reflection portion. This enables the shape of the light guide member to be simplified and flexibility of a design of the light guide member to be widened.

[0034] The reflection portion may be provided for spe-

cial-purpose to reflect the lights. However, in the case where the operating section includes an operating member that is subject to an operating action and a decoration member that is disposed around the operating member and has a surface with a metallic luster, it is possible to directly utilize the surface of the decoration member as a reflection surface for light-leading by utilizing the metallic luster for decoration on the surface of the decoration member, so long as the rear side of the reflection portion defines the reflection surface for light-leading. Accordingly, it is possible to simplify a structure for illumination.

[0035] In the present invention, particular shapes of an outer peripheral edge of the operating section and the panel reflection surface taken from the front side of the operating panel are not limited. However, it is preferable that the shapes are, for example, circles or ellipses. These shapes can effect uniform illumination over the whole periphery of the operating section.

[0036] The front surface of the operating panel including the panel reflection surface may be a surface directly exposing a matrix material or a coated surface. In particular, a metallic-coated surface will be most preferable. The coated surface can provide illuminating lights softer than, for example, a metallic surface while maintaining a reflection factor necessary for illumination.

[0037] Also, preferably, the panel reflection surface is inclined by an angle of more than 45 degrees with respect to a normal line to the surface of the operating panel. Since the inclined panel reflection surface reflect the lights led from the light guide system outward, it is possible to present an expansive feeling to the illumination lights.

Claims

1. An operating device having an illumination function, comprising:

an operating panel provided with an operating section window;
 an operating section disposed inside said operating section window in said operating panel;
 a light source for illumination disposed on a rear side of said operating panel for emitting lights for illumination; and
 a light guide system for guiding the lights emitted from said light source for illumination from a rear side of said operating section to a peripheral area around said operating section window in said operating panel;
 a front surface on said peripheral area around said operating section window out of a front surface of said operating panel being adapted to define a panel reflection surface with a shape that reflects said lights irradiated to said peripheral area around said operating section window to a front side of said operating panel by said

light guide system.

2. An operating device having an illumination function according to Claim 1,
wherein said light guide system includes a light guide member that guides said lights emitted from said light source for illumination to a vicinity of said peripheral area around said operating section.
3. An operating device having an illumination function according to Claim 2,
wherein said light guide system further includes a reflection portion that constitutes said peripheral area around said operating section and covers said light guide member at a front side of said operating panel, and a rear side of said reflection portion defines a reflection surface for light-leading that reflects the lights guided by said light guide member to said panel reflection surface.
4. An operating device having an illumination function according to Claim 3,
wherein said operating section includes an operating member that is subject to an operating action and a decoration member that is disposed around said operating member and has a surface with a metallic luster, said decoration member has said reflection portion, and a rear side of said reflection portion defines said reflection surface for light-leading.
5. An operating device having an illumination function according to any one of Claims 1 to 4,
wherein an outer peripheral edge of said operating section and said panel reflection surface are circles or ellipses taken from a front side of said operating panel.
6. An operating device having an illumination function according to any one of Claims 1 to 5,
wherein said panel reflection surface is a metallic-coated surface.
7. An operating device having an illumination function according to any one of Claims 1 to 6,
wherein said panel reflection surface is inclined by an angle of more than 45 degrees with respect to a normal line to said surface of said operating panel.

Amended claims under Art. 19.1 PCT

1. (After Amended) An operating device having an illumination function, comprising:

an operating panel provided with an operating section window;
an operating section disposed inside said operating section window in said operating panel;

a light source for illumination disposed on a rear side of said operating panel for emitting lights for illumination; and
a light guide system for guiding the lights emitted from said light source for illumination from a rear side of said operating section to a peripheral area around said operating section window in said operating panel;
a front surface on said peripheral area around said operating section window out of a front surface of said operating panel being adapted to define a panel reflection surface with a shape that reflects said lights irradiated to said peripheral area around said operating section window to a front side of said operating panel by said light guide system, said light guide system including a light guide member that guides said lights emitted from said light source for illumination to a vicinity of said peripheral area around said operating section and a reflection portion that constitutes said peripheral area around said operating section and covers said light guide member at a front side of said operating panel, and a rear side of said reflection portion being adapted to define a reflection surface for light-leading that reflects the lights guided by said light guide member to said panel reflection surface.

2. (Cancelled)

3. (Cancelled)

4. (After Amended) An operating device having an illumination function according to Claim 1,
wherein said operating section includes an operating member that is subject to an operating action and a decoration member that is disposed around said operating member and has a surface with a metallic luster, said decoration member has said reflection portion, and a rear side of said reflection portion defines said reflection surface for light-leading.

5. (After Amended) An operating device having an illumination function according to Claim 1 or 4,
wherein an outer peripheral edge of said operating section and said panel reflection surface are circles or ellipses taken from a front side of said operating panel.

6. (After Amended) An operating device having an illumination function according to any one of Claims 1, 4, and 5,
wherein said panel reflection surface is a metallic-coated surface.

7. (After Amended) An operating device having an illumination function according to any one of Claims 1,

and 4 to 6,
wherein said panel reflection surface is inclined by
an angle of more than 45 degrees with respect to a
normal line to said surface of said operating panel.

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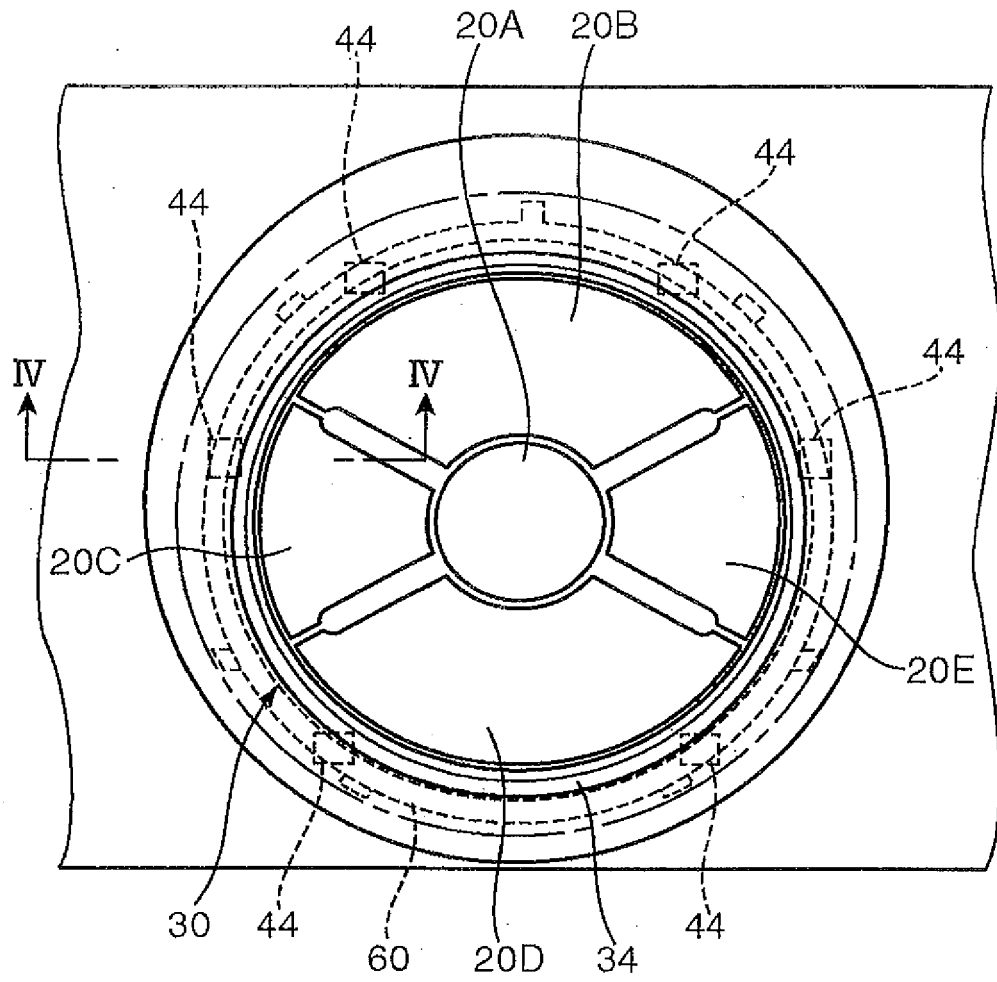


Figure 1

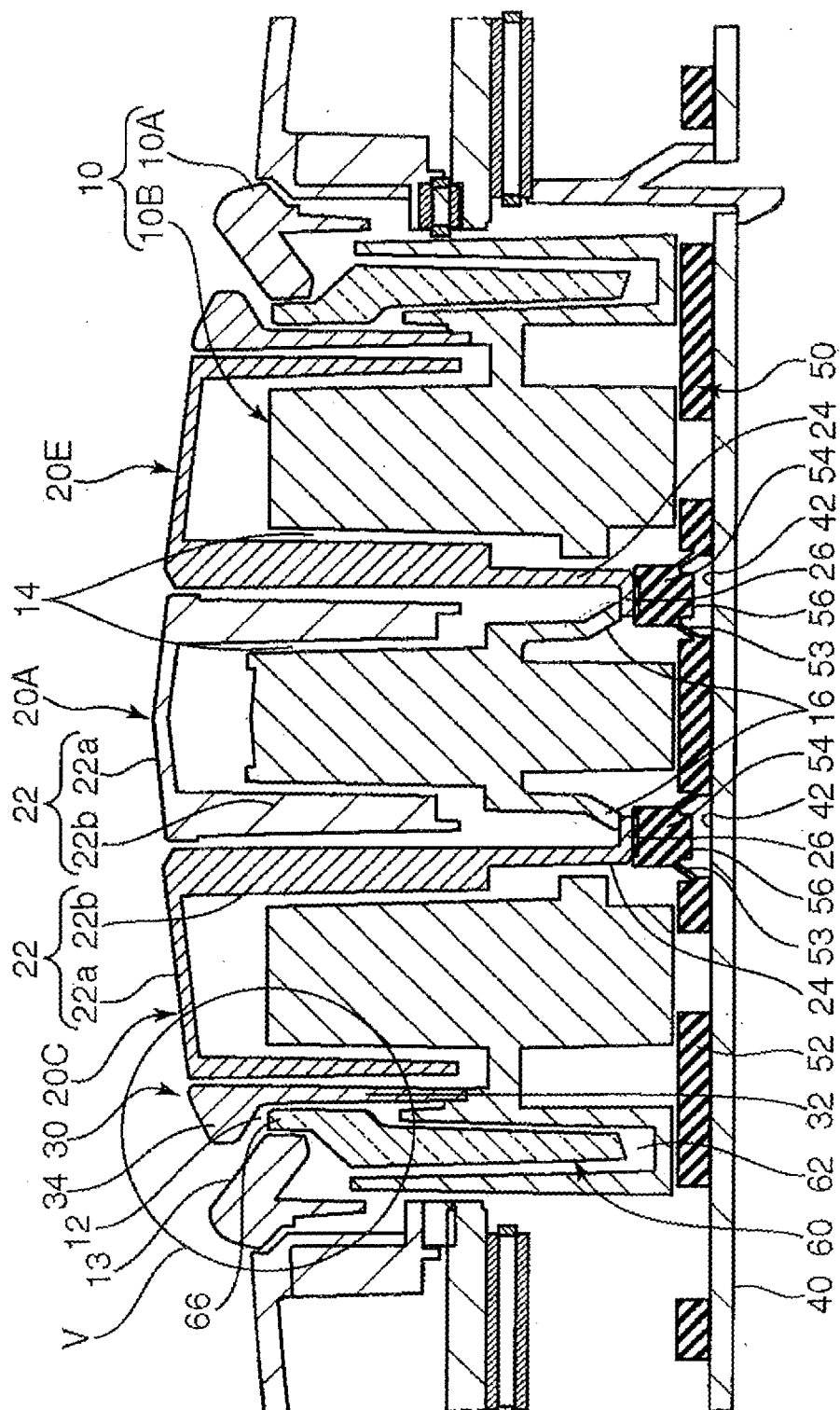


Figure 2

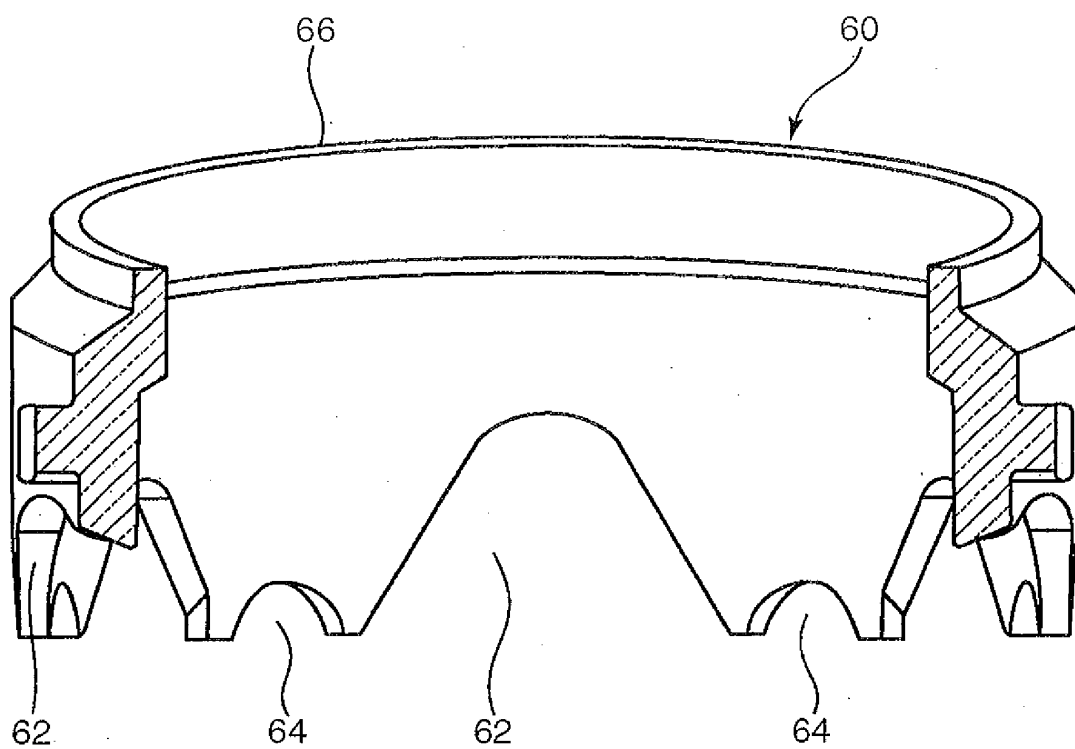


Figure 3

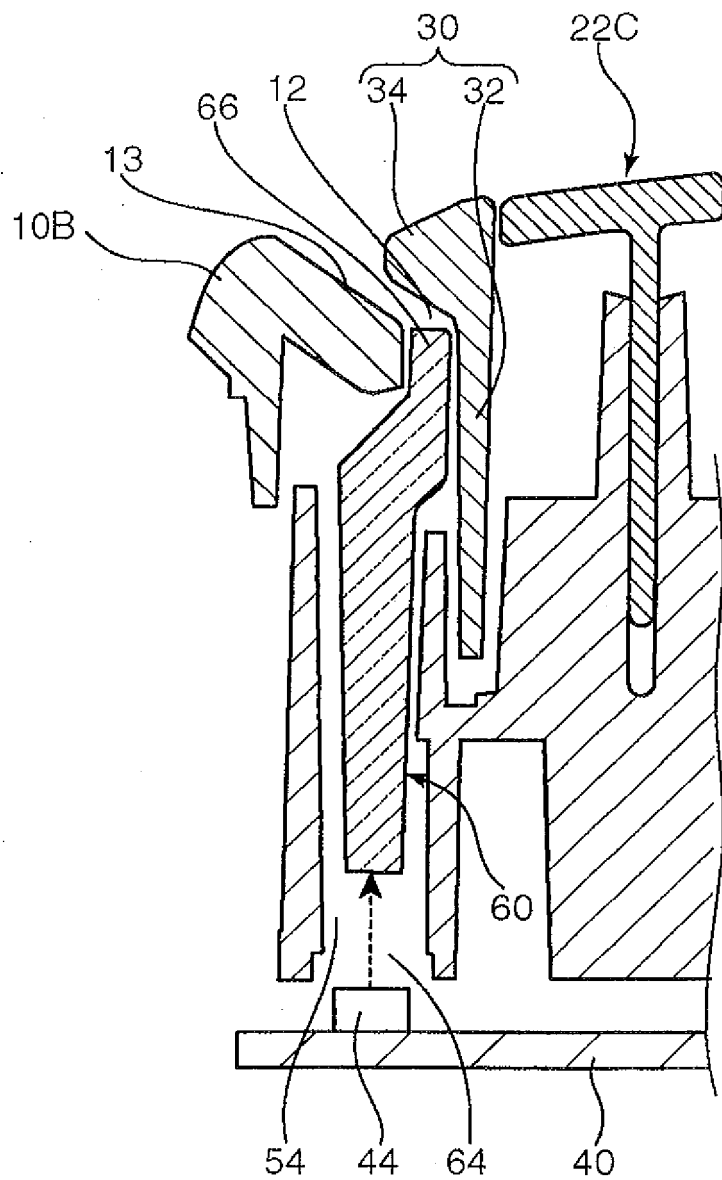


Figure 4

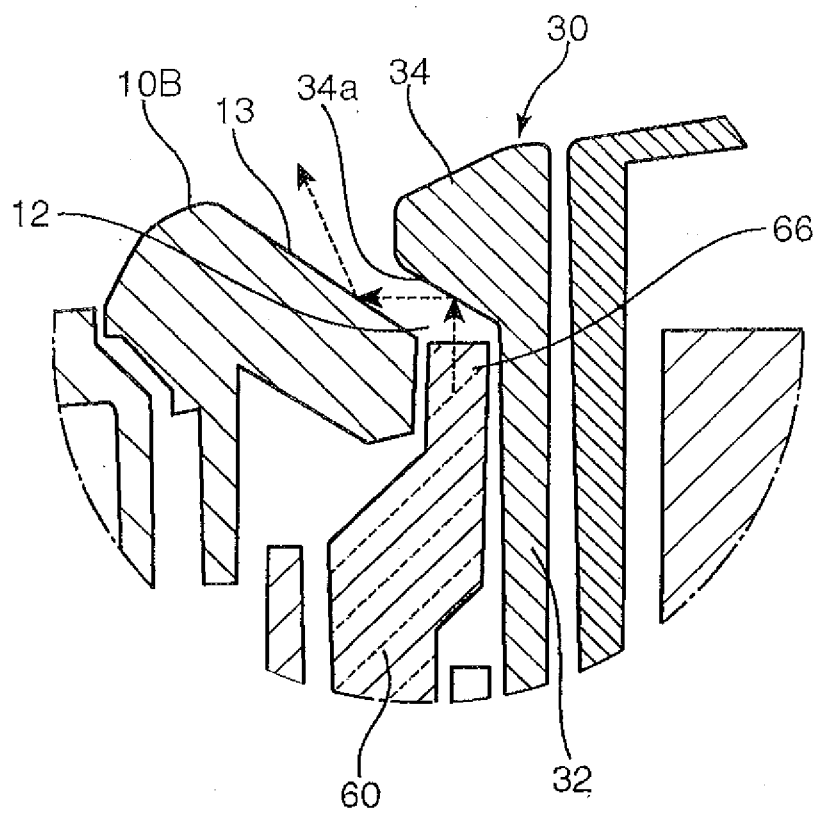


Figure 5

INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2008/064626

A. CLASSIFICATION OF SUBJECT MATTER

H01H9/18 (2006.01) i, H01H13/02 (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)

H01H9/18, H01H13/02

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	1996-2008
Kokai Jitsuyo Shinan Koho	1971-2008	Toroku Jitsuyo Shinan Koho	1994-2008

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.
Y A	JP 2006-202634 A (Tokai Rika Co., Ltd.), 03 August, 2006 (03.08.06), Par. Nos. [0010] to [0014]; Fig. 1 (Family: none)	1, 2, 5-7 3, 4
Y A	JP 2001-352379 A (Matsushita Electric Industrial Co., Ltd.), 21 December, 2001 (21.12.01), Par. Nos. [0010] to [0017]; Fig. 4 (Family: none)	1, 2, 5-7 3, 4
Y A	JP 2005-216798 A (Matsushita Electric Industrial Co., Ltd.), 11 August, 2005 (11.08.05), Par. No. [0021]; Fig. 1 (Family: none)	2, 5-7 3, 4

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

* Special categories of cited documents:

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Date of the actual completion of the international search
04 September, 2008 (04.09.08)Date of mailing of the international search report
16 September, 2008 (16.09.08)Name and mailing address of the ISA/
Japanese Patent Office

Authorized officer

Facsimile No.

Telephone No.

INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2008/064626

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	JP 2000-082362 A (Tokai Rika Co., Ltd.), 21 March, 2000 (21.03.00), Par. Nos. [0008] to [0009]; Fig. 3 (Family: none)	3, 4
A	JP 2005-011672 A (Omron Corp., Fujitec Co., Ltd.), 13 January, 2005 (13.01.05), Par. Nos. [0010], [0035] to [0036], [0072]; Fig. 7 & US 2004/0256210 A1 & TW 236025 B & KR 10-2004-0110105 A & CN 1574139 A	3, 4

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REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- JP 2000106049 A [0003]