



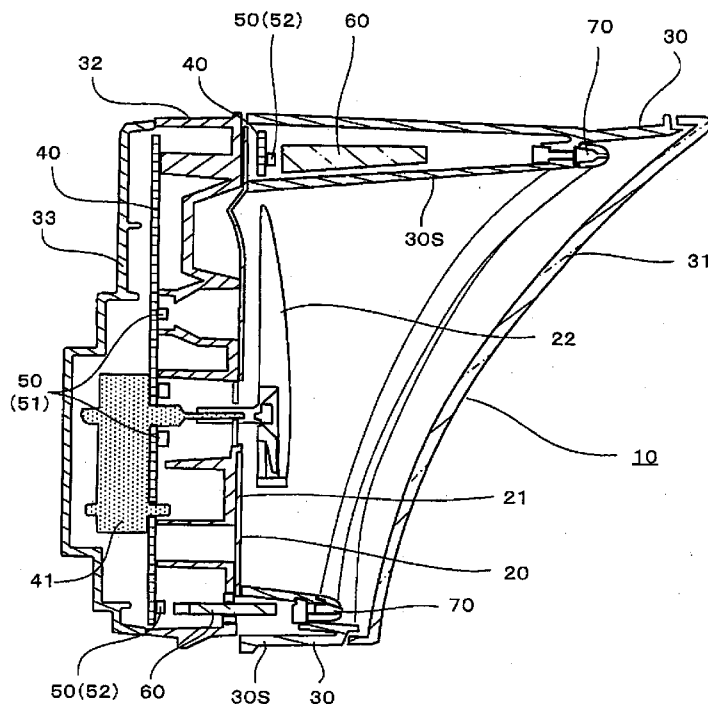
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[Continued on next page]

(54) Title: METER WITH ILLUMINATED DISPLAY

Fig.1



(57) Abstract: A meter, comprising a meter unit, a visor arranged around the meter unit, a wiring board, a light source mounted on the wiring board, an annular light guiding member provided within the visor at a side of a light emitting surface of the light source so as to surround the meter unit, and a light emitting portion forwardly emitting light emitted by the light source and transmitted through the light guiding member and annually provided along an edge portion of the visor so as to surround the meter unit, wherein a protruding-length of the light guiding member is displaced to a longitudinal direction of the meter unit.

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## DESCRIPTION

### METER WITH ILLUMINATED DISPLAY

#### Technical Field

The present invention relates to a meter including meter units, such as a speedometer and a tachometer, of a vehicle or the like.

#### Background Art

There are known meters mounted on conveyances such as vehicles, ships and airplanes (hereinafter referred to collectively as vehicles). FIGS. 4A and 4B illustrate an example of a meter of this kind (see PTL 1).

FIG. 4A is a perspective view of a conventional meter. FIG. 4B is an enlarged cross-sectional view of a main part of the meter. On the conventional meter 100, meter units 200, i.e., a tachometer 200c, a speedometer 200a, and a fuel meter 200d are arranged from the left side of FIG. 4A. On the circumference of each of the meter units 200, visors 300, a light guiding member 600, and a light emitting member 700 are formed annularly. In addition, the light guiding member 600 is arranged to be sandwiched by the visors 300 (see FIG. 4B). A light source 500 is placed at a rear end portion of the light guiding member 600. A reflecting surface 600S whose distal-end-portion takes a cross-sectionally triangular shape is provided at a front end portion of the light guiding member 600. In addition, the light emitting member 700 serving as a prism member cross-sectionally triangularly shaped to form a virtual image having an annular shape in front view of the

meter is provided to be fit into the front end portion of the light guiding member 600.

With the above configuration, the manner of visually recognizing the light emitting member 700 differs between the case of turning off the light source 500 and that of turning on the light source 500. That is, in the case of turning off the light source 500, the light emitting member 700 can visually be recognized as a virtual image. On the other hand, in the case of turning on the light source 500, light irradiated from the light source 500 is substantially totally reflected on the reflecting surface 600S to the inside of the meter. Thus, the light emitting member 700 emits light which is irradiated only in the direction of the line of sight of a driver. Consequently, the quality of the daytime appearance of the meter is good. Even in night, there is substantially no possibility of reflecting, from the front glass of each of the meters, light emitted from the front end portion of the light guiding member 600. In addition, increase of the number of components can be suppressed. The flexibility of setting the arrangement of a meter device can be enhanced. The above techniques are disclosed in PTL 1.

## **Citation List**

### **Patent Literature**

[PTL 1] JP-A-2004-257749

## **Summary of Invention**

## **Technical Problem**

In the meter 100 described in PTL 1, the light emitting member 700 emits light reflected from the reflecting surface 600S of the light guiding member 600. However, the reflecting surface 600S and the light guiding member 600 are arranged to be sandwiched by the edge portions of the visors 300. Thus, the reflecting surface 600S and the light guiding member 600 are constrained by the appearances and the shapes of the visors 300. As illustrated in FIGS. 4A and 4B, the substantially circular light emitting member 700 is arranged only on the periphery of each of the meter units 200. Accordingly, the flexibility of designing the light emitting member is low. It is difficult to adapt the light emitting member to the appearance and the design of the entire meter 100. Particularly, there are demands for improving the display quality, such as stereoscopic visibility, of the meter units 200 because the vehicular meter 100 is arranged so as to catch a driver's eyes even while not used for the intended use of the meter. However, the meter 100 has a drawback in that the meter 100 doesn't follow the demands.

The present invention is accomplished in view of the above circumstances. An object of the present invention is to provide a meter capable of having the flexibility of determining the arrangement position of the light emitting portion, securing the desired luminance of the light emitting portion, and improving the display quality.

### **Solution to Problem**

In order to achieve the foregoing object, a meter according to the present invention is featured in the following figures (1) to (4).

(1) A meter comprising a meter unit, a visor arranged around the meter unit, a wiring board, a light source mounted on the wiring board, an annular light guiding member provided within the visor at a side of a light emitting surface of the light source so as to surround the meter unit, and a light emitting portion forwardly emitting light emitted by the light source and transmitted through the light guiding member and annually provided along an edge portion of the visor so as to surround the meter unit, wherein a protruding-length of the light guiding member is displaced to a longitudinal direction of the meter unit.

(2) In a meter having the above configuration (1), a light-source-side surface of the light guiding member has a portion which corresponds to the light source, formed substantially flat.

(3) In a meter having the above configuration (2), a light-emitting-side surface of the light guiding member that is opposed to the light-source-side surface, is unevenly and continuously formed.

(4) In a meter having one of the above configurations (1) to (3), the light source includes a plurality of irradiating-light-sources irradiating the meter units and a plurality of emitting-light-sources for causing the light emitting portion to emit light, and the light guiding member is provided at a side of a light emitting surface of the emitting-light source.

With the above configuration (1), a meter can be provided, which is capable of regulating an amount of light incident upon the light emitting portion with the light guiding member, securing stable light emitting of the light emitting portion, allowing the protruding-length of the light guiding member to follow the position of the light emitting portion, and obtaining the stereoscopic visibility of the light emitting portion.

With the above configuration (2), light emitting from the light source is incident upon the light guiding member without waste. An amount of incident light is constant. Consequently, the optical design of the light guiding member is facilitated.

With the above configuration (3), the separation distance to the light emitting portion from the light guiding member can be regulated. Accordingly, an amount of light incident upon the light emitting portion can be regulated.

With the above configuration (4), the functions of the light source can be separated. Thus, the flexibility of design can be enhanced.

### **Advantageous Effects of Invention**

According to the present invention, a meter can be provided, which can freely arrange the light emitting portion according to the arrangement of the meter units while feeling a sense of depth, and can surely guide source-light from the light guiding member to the light emitting portion by following the shape in the depth direction of each visor, and can enhance the quality of

appearance thereof, especially, in night and the like.

The present invention has briefly been described above. However, details of the present invention will further be clarified by reading thorough the following description of a best mode for carrying out the present invention with reference to the accompanying drawings.

### **Brief Description of the Drawings**

FIG. 1 is a cross-sectional view illustrating an embodiment of a meter according to the present invention.

FIG. 2 is a front view illustrating the meter illustrated in FIG. 1.

FIG. 3 is a cross-sectional view taken on line III-III shown in FIG. 2.

FIG. 4A is a perspective view of a conventional meter.

FIG. 4B is an enlarged cross-sectional view of a main part of the meter.

### **Description of Embodiments**

Hereinafter, a preferred embodiment of the present invention is described in detail with reference to the drawings.

#### **<Specific Configuration>**

A meter 10 which is an embodiment of the present invention is described with reference to FIG. 1.

FIG. 1 is a cross-sectional view illustrating an embodiment of the meter 10. The meter 10 is roughly configured by a plurality of meter units 20



arranged at a substantially central part of the meter 10, a visor 30 arranged on the outer circumference of the meter 10 to surround a dial 21 and a pointer 22 of each of the meter units 20, a front glass 31 configured to cover the front end of the visor 30, a case 32 placed at the rear end of the visor 30, and a rear cover 33 configured to cover the rear end of the case 32. The dials 21 are attached to the front portion (corresponding to the side of the visor 30) of the case 32, and the wiring board 40 is attached to the rear portion (corresponding to the side of the rear cover 33) of the case 32. An inner device 41 provided with a motor for rotatably driving the pointer 22 and the like, is attached to the back portion of the wiring board 40.

A light source 50 including a plurality of light emitting diodes (LEDs) is mounted on the wiring board 40. The light source 50 includes a plurality of irradiating-light-sources 51 irradiating the meter units 20 from back, and plural emitting-light-sources 52 for causing a light emitting portion 70, which will be described below, to emit light. In order to transmit light emitted from the emitting-light-sources 52 and to guide the light in a predetermined direction, a light guiding member 60 made of a light-permeable synthetic resin material, such as polycarbonate resin or acrylic resin, is provided to extend in a light emitting direction of the emitting-light-sources 52. The light guiding member 60 is placed within a leg 30S of the visor 30 and formed like a ring to surround the meter units 20. An annular light emitting portion 70 made of a light-permeable synthetic resin material, such as polycarbonate resin or acrylic resin, is provided to extend along an edge portion of the visor 30 to surround the meter units 20. Light emitted from the emitting-light-sources 52 is transmitted through

the inside of the light guiding member 60 and guided to the light emitting portion 70.

Although the light guiding member 60 is arranged in the leg 30S of the visor 30, the light guiding member 60 is formed to protrude to the front (i.e., right-wardly in FIG. 1) in a longitudinal direction of the meter 10 from vicinity of the emitting-light-sources 52. The term "longitudinal direction" described herein designates a lateral direction in FIG. 1 and corresponds to the front-back direction of a vehicle or the like in a state in which the meter 10 is mounted on the body of the vehicle. In addition, the protruding length of the light guiding member 60 (i.e., the length of a protruded part of the light guiding member 60) varies with arrangement positions in the light guiding member 60. For example, an upper part and a lower part of the visor 30, which respectively correspond to an upward direction and a downward direction in FIG. 1, differ from each other in protruding-length. That is, at an upper portion of the visor 30, the light guiding member 60 is formed such that the upper part thereof protruded toward the light emitting portion 70 is long in protruding-length and somewhat thick. On the other hand, at a lower portion of the visor 30, the light guiding member 60 is formed such that the lower part thereof protruded toward the light emitting portion 70 is short in protruding-length and thin. The particular shape of the light guiding member 60 is described in detail with reference to FIG. 3.

Light emitted from the emitting-light-source 52 is collected with maintaining constant directionality while transmitted through the light guiding

member 60. Then, the light is incident upon the light emitting portion 70 placed at a position spaced apart from a light emitting surface of the light guiding member 60. Attenuation of light in the light guiding member 60 can be suppressed as much as possible by adjusting the length and the thickness of the light guiding member 60. Simultaneously, the amount of light incident upon the light emitting portion 70 can be adjusted. A desired luminance of the light emitting portion 70 can be obtained.

One mode of arrangement of the light emitting portion 70 is described hereinafter with reference to FIG. 2. FIG. 2 is a front view illustrating the meter 10 according to the present invention.

In the meter 10, the plurality of meter units 20 are arranged. A speedometer 20a and a water temperature meter 20b are arranged at the left side (corresponding to the left side of FIG. 2) of a shift position indicator 25. A tachometer 20c and a fuel meter 20d are arranged at the right side (corresponding to the right side of FIG. 1) of the shift position indicator 25. At the left side of the shift position indicator 25, the light emitting portion 70 according to the present invention is provided to surround the speedometer 20a and the water temperature meter 20b. At the right side of the shift position indicator 25, the light emitting portion 70 according to the present invention is provided to surround the tachometer 20c and the fuel meter 20d. That is, the light emitting portion 70 is provided not only on periphery of a single meter 20. As indicated in the description of the one mode according to the present invention, a plurality of meter units 20 can be surrounded by the light emitting

portion 70. The light emitting portion 70 can appropriately be arranged according to requests concerning the design of the meter.

The visor 30 is a component that implements the appearance-shape of the meter 10. The appearance-shape of the meter 10 is an important factor of the design. Simultaneously, the light emitting state of the light emitting portion 70 that is provided along an edge of the visor 30 is an important factor of the design. Variation of the shape, such as the protruding-length, of the light guiding portion 60 with locations is not required to be constrained by the appearance-shape and the cross-sectional shape in the depth direction of the visor 30. Stable emitting of light from the light emitting portion 70 can be secured. The quality of display required by the meter 10 can be enhanced.

An embodiment of the light guiding member 60 is described in detail hereinafter with reference to FIG. 3. FIG. 3 is a cross-sectional view taken on line III-III shown in FIG. 2.

The light guiding member 60 varies in protruding-length with locations in a longitudinal direction (see an arrow L in FIG. 3). That is, the light guiding member 60 is formed such that the cross-section of the light guiding member 60 protrudes like a chevron in the vicinity of a central part of FIG. 3, and that the cross-section thereof is concavely shaped at both sides of the central part of FIG. 3. It is clearly seen from FIG. 3 that there is variation of the length of the cross-section of the protruded part of the light guiding member 60, which is calculated by setting the emitting-light-source 52 as a base point. If a surface

of the light guiding member 60, which faces the emitting-light-sources 52 mounted on the wiring board 40, is defined as a light-source-side surface 61 of the light guiding member 60, and another surface of the light guiding member 60 is defined as a light-emitting-side surface 62 of the light guiding member 60, the light-source-side surface 61 is formed substantially flat to facilitate the incidence of light emitted from the emitting-light-source 52 upon the light guiding member 60, while the light-emitting-side surface 62 is formed as a continuous concave-convex surface to adjust an amount of emitting light of the light guiding member 60. The light guiding member 60 receives light emitted from the plural emitting-light-sources 52, guides the received light to a desired location, and emits the received light to the light emitting portion 70 from the light-emitting-side surface 62.

<Outline of the present invention>

The meter 10 according to the embodiment of the present invention has at least one or more meter units 20, and includes the visor 30 arranged around the meter units 20, the case 32, the rear cover 33, and the wiring board 40. The light source 50 including a plurality of LEDs and the like is mounted on the wiring board 40. The annular light guiding member 60 is provided at the side of the light emitting surface of the light source 50 to be placed in the visor 30 and surround the meter units 20. The light emitting portion 70 for forwardly emitting light emitted by the light source 50 and transmitted through the light guiding member 60 is provided like a ring along an edge portion of the visor 30 to surround the meter units 20. The light guiding member 60 is featured in that the protruding-length varies in the longitudinal direction of the meter 10.

With this configuration, the meter 10 can be provided, which can adjust an amount of light incident upon the light emitting portion 70 with the light guiding member 60 and secure stable emitting of light from the light emitting portion 70, and which can adapt the protruding-length of the light guiding member 60 to follow the position of the light emitting portion 70, and can obtain the stereoscopic visibility of the light emitting portion 70.

In the meter 10 according to the embodiment of the present invention, the light-source-side surface 61 of a part of the light guiding member 60, which corresponds to the light source 50, is formed substantially flat. With this configuration, light emitting from the light source 50 is incident upon the light guiding member 60 without waste, so that an amount of incident light is constant. Thus, the optical design of the light guiding member 60 can be facilitated.

In addition, in the meter 10 according to the embodiment of the present invention, a light-emitting-side surface 62 of the light guiding member 60 that is opposed to the light-source-side surface 61, is unevenly and continuously formed. With this configuration, the separation distance to the light emitting portion 70 from the light guiding member 60 can be regulated. Accordingly, an amount of light incident upon the light emitting portion 70 can be regulated.

In the meter 10 according to the embodiment of the present invention, the light source 50 includes a plurality of irradiating-light-sources 51 for irradiating the meter units 20, and plural emitting-light-sources 52 for causing

the light emitting portion 70 to emit light, and that the light guiding member 60 is provided at the side of the light emitting surface of each emitting-light-source 52. With this configuration, the functions of the light source 50 can be separated. Consequently, the flexibility of design can be enhanced.

Incidentally, the present invention is not limited to the above embodiment. Appropriate modification, improvement and the like can be made. The materials, shapes, dimensions, numerical values, modes, numbers, arrangement locations, and the like of each component of the above embodiment are optional and not limited to specific ones, as long as the present invention can be implemented.

Although the embodiment has been described in detail by separating the light source 50 into the irradiating-light-sources 51 and the emitting-light-sources 52, the irradiating-light-sources 51 may also serve as the emitting-light-sources 52. Similarly, the emitting-light-sources 52 may also serve as the irradiating-light-sources 51.

Although the stable emitting of light from the light emitting portion 70 has been described in detail, the concept "stable emitting of light" includes not only emitting light whose luminance is stable, but emitting light which is uniform in luminance. In addition, the "stable emitting of light" includes emitting light such that the stereoscopic visibility obtained by, e.g., somewhat darkening an upper part of each meter 20 and somewhat lighting up a lower part thereof is stable.

The present application is based on Japanese Patent Application No. 2011-237657 filed on October 28, 2011, the contents of which are incorporated herein by reference.

### **Industrial Applicability**

Emitting light from the visor 30 is enabled using a molded article made of a material of the light guiding member as the visor 30, similarly to the light emitting portion 70. In addition, the uniformity in luminance of emitting light can be enhanced using a light-permeable material or a light diffusing material as the material of the light guiding member.

### **Reference Signs List**

- 10 meter
- 20 meter units
- 30 visor
- 40 wiring board
- 50 light source
- 51 irradiating-light-source
- 52 emitting-light-source
- 60 light guiding member
- 61 light-source-side surface
- 62 emitting-light-side surface
- 70 light emitting portion



## CLAIMS

1. A meter comprising:
  - a meter unit;
  - a visor arranged around the meter unit;
  - a wiring board;
  - a light source mounted on the wiring board;
  - an annular light guiding member provided within the visor at a side of a light emitting surface of the light source so as to surround the meter unit; and
  - a light emitting portion forwardly emitting light emitted by the light source and transmitted through the light guiding member and annularly provided along an edge portion of the visor so as to surround the meter unit;wherein a protruding-length of the light guiding member is displaced to a longitudinal direction of the meter.
2. The meter according to claim 1, wherein a light-source-side surface of the light guiding member has a portion which corresponds to the light source, formed substantially flat.
3. The meter according to claim 2, wherein a light-emitting-side surface of the light guiding member that is opposed to the light-source-side surface, is unevenly and continuously formed.
4. The meter according to one of claims 1 to 3, wherein the light source includes a plurality of irradiating-light-sources irradiating the meter unit and a

plurality of emitting-light-sources for causing the light emitting portion to emit light, and the light guiding member is provided at a side of a light emitting surface of the emitting-light source.

Fig.1

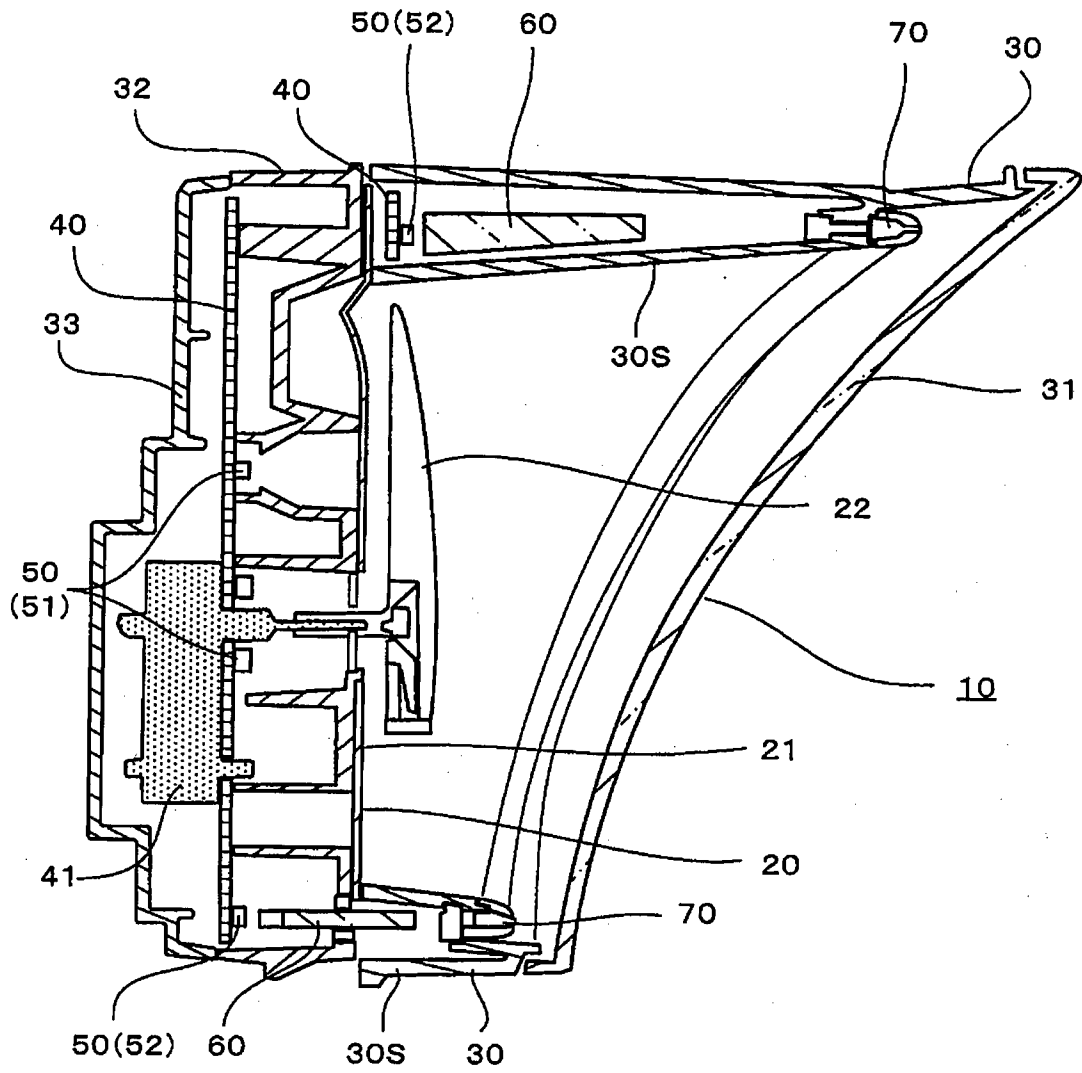


Fig.2

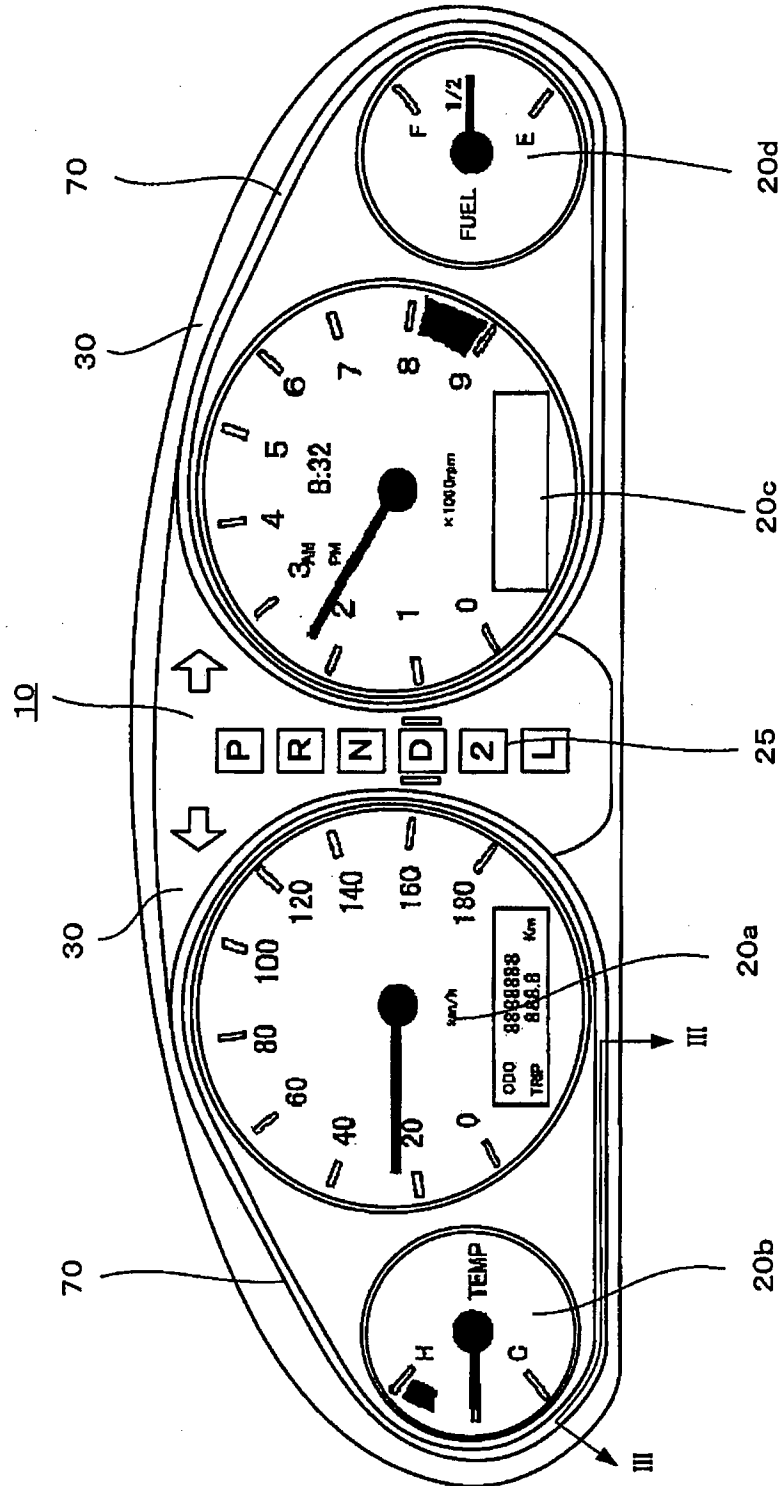


Fig.3

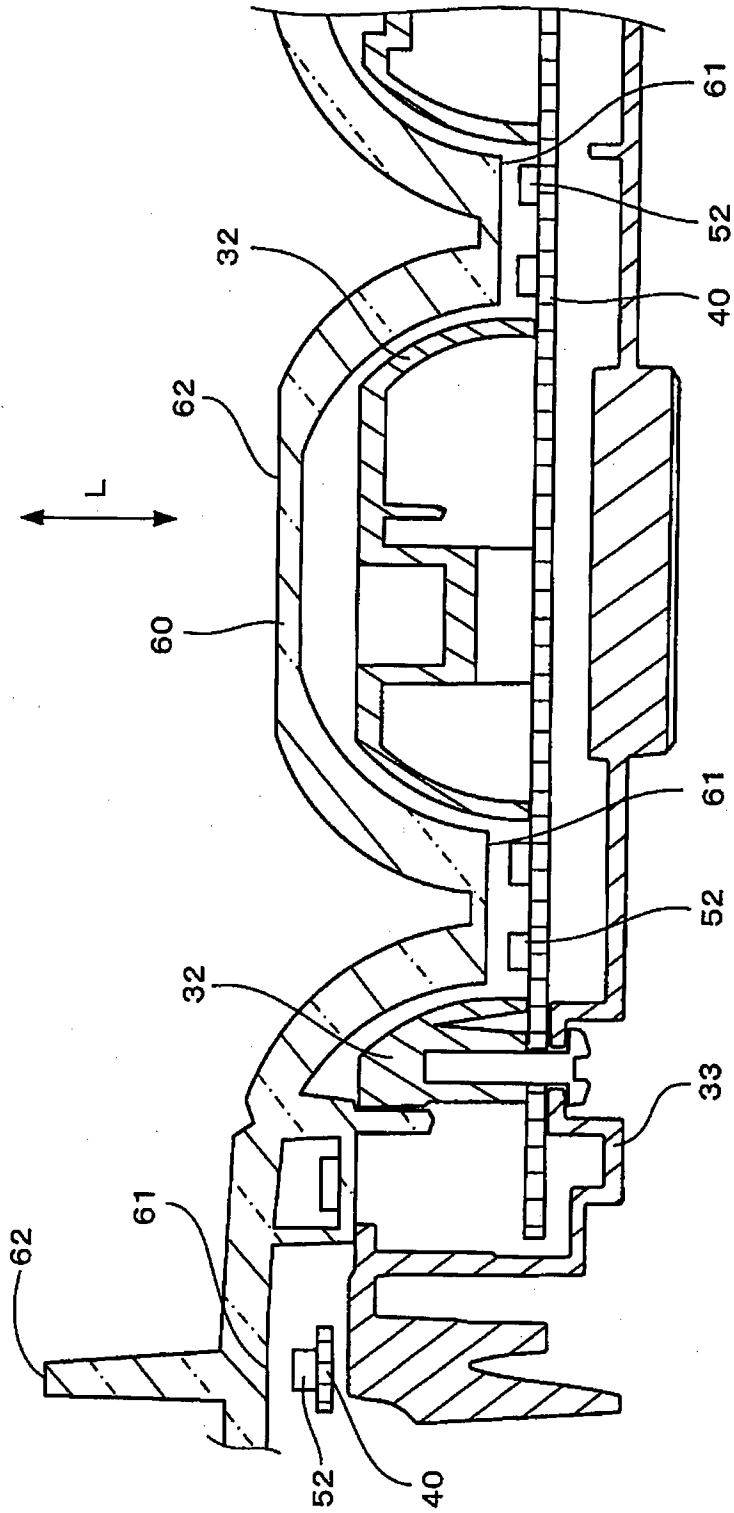


Fig.4A

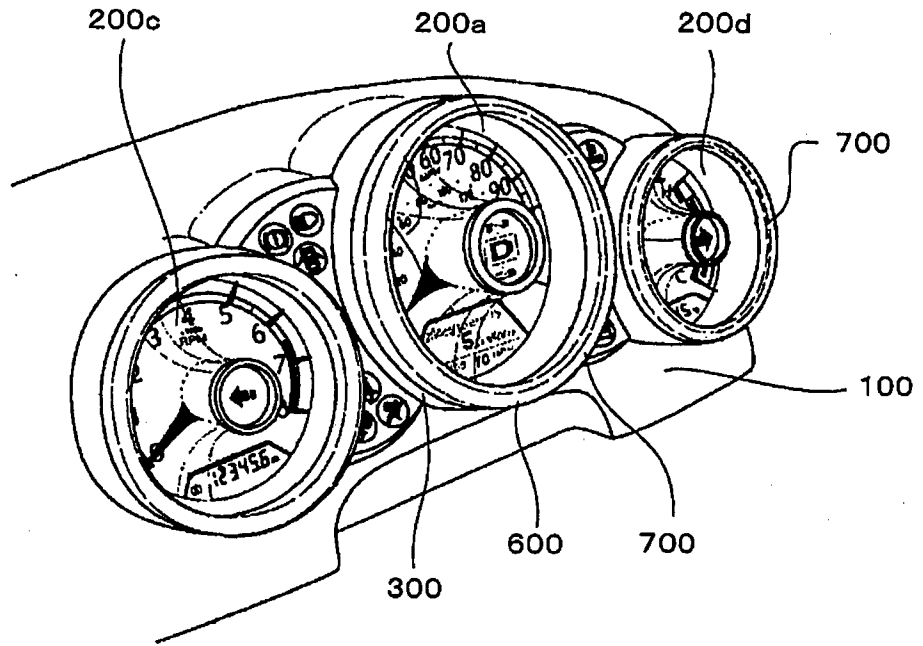
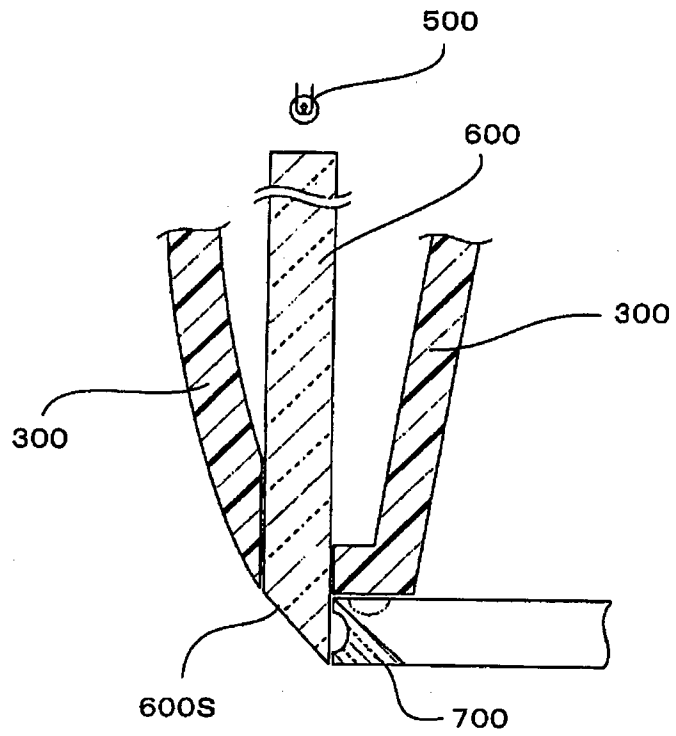


Fig.4B



INTERNATIONAL SEARCH REPORT

International application No  
PCT/JP2012/078409

A. CLASSIFICATION OF SUBJECT MATTER  
INV. G01D11/28 B60K37/02  
ADD.  
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)  
G01D B60K

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

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

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 2004/129197 A1 (NAKAGAWA YASUYUKI [JP] ET AL) 8 July 2004 (2004-07-08)	1-4
Y	paragraph [0027] - paragraph [0057]; figures 1,3,4,5	1-4
	-----	
X	US 2007/186843 A1 (TSURUMI SHUNYA [JP]) 16 August 2007 (2007-08-16)	1-4
Y	paragraph [0024] - paragraph [0043]; figures 1,2,5	1-4
	-----	

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
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- "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
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- "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  
17 January 2013

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28/01/2013

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# INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/JP2012/078409

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
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