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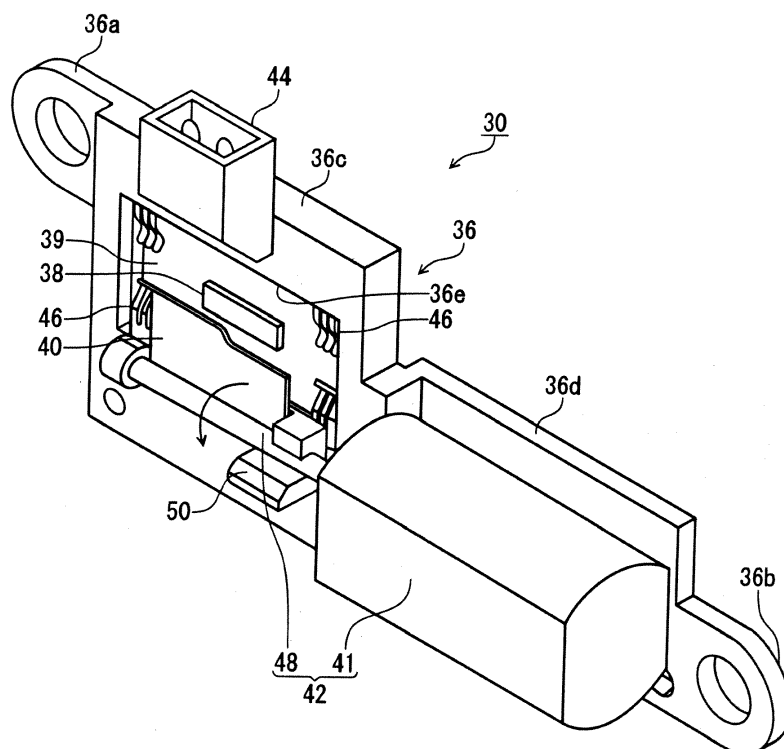
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(54) Light emitting unit and vehicle lamp

(57) A light emitting unit (30) has an attachment member (36) for attaching to a specific position on a lamp. The light emitting unit (30) comprises a light emitting element mounting portion (36c) provided on the attachment member (36); a light emitting element (38); an op-

tical member (40) provided on the attachment member (36); a drive module (42) configured to drive the optical member (40) and controls light distribution from the light emitting element (38); and a power supply module (42) configured to supply power to the light emitting element (38) and the drive module (42).

FIG. 2



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Description

[0001] Embodiments described herein relate to a light emitting unit and to a vehicle lamp employing the light emitting unit.

RELATED ART

[0002] Vehicle headlamps are known that vary the tilt and position of a shade for blocking a portion of light, so as to, depending on the tilt and position of the shade, form a far light distribution pattern for a high beam (driving beam) illuminating a long distance, or a near light distribution pattern for a low beam (passing beam) illuminating a near distance.

[0003] For example, a vehicle headlight is described in JP-A-2009-48948 that has a plate shaped shade for blocking a portion of light emitted from a light emitting diode, and shade driving means for moving the plate shaped shade in the height direction.

[0004] Patent Document 1: JP-A-2009-48948

[0005] However, providing a mechanism such as that of JP-A-2009-48948 for changing the tilt and position of the shade inside a vehicle lamp tends to result in an increase in size of the vehicle lamp.

SUMMARY

[0006] Exemplary embodiments of the present invention may provide a light emitting unit that enables a lamp to be made more compact, and to a compact vehicle lamp.

[0007] A light emitting unit according to an embodiment of the invention is a light emitting unit having an attachment member for attaching the light emitting unit to a specific position on a lamp, the light emitting unit comprising,:

- a light emitting element mounting portion provided on the attachment member;
- a light emitting element
- an optical member provided on the attachment member;
- a drive module provided on the attachment member and configured to drive the optical member and control light distribution from the light emitting element; and
- a power supply module provided on the attachment member and configured to supply power to the light emitting element and the drive module.

[0008] According to the above aspect a light emitting unit can be realized in which a light emitting element mounting portion, a light emitting member, a drive module and a power supply module are integrated to an attachment member. Employing such a light emitting unit may enable a lamp to be made more compact because the number of lamp components is reduced.

[0009] The optical member may comprise a shade configured to block a portion of light emitted from the light emitting element.

[0010] The shade may be divided into a first sub-shade and a second sub-shade, and the drive module may be configured to change the distribution of light from the light emitting element by changing an opening state of at least one of the first sub-shade and the second sub-shade.

[0011] The shade may be a rotatable shade enabling control of light emitted from the light emitting element to produce a plurality of light distribution patterns by rotating the shade, the drive module may be a motor configured to rotatably drive the rotatable shade; and the rotatable shade may be disposed with the rotation axis of the rotatable shade aligned with the rotation axis of the motor.

[0012] The optical member may comprise a mirror provided in the vicinity of the light emitting element, and the drive module may be configured to drive the mirror so as to adopt a first position reflecting light from the light emitting element and a second position not reflecting light from the light emitting element.

[0013] A vehicle lamp according to an exemplary embodiment of the invention comprises the above-mentioned light emitting unit. A compact vehicle lamp can be realized according to the above aspect.

[0014] According to the exemplary embodiments of the present invention, it may be possible to provide a light emitting unit that enables a lamp to be made more compact, and to a compact vehicle lamp.

BRIEF DESCRIPTION OF THE DRAWINGS

[0015]

Fig. 1 is a cross-section of a vehicle lamp that employs a light emitting unit according to an exemplary embodiment.

Fig. 2 is a perspective view of the light emitting unit according to the present exemplary embodiment.

Fig. 3 is a perspective view of a light emitting unit according to another exemplary embodiment.

Fig. 4 is a perspective view of a light emitting unit according to another exemplary embodiment.

Fig. 5 is a perspective view of a light emitting unit according to another exemplary embodiment of the present exemplary embodiment.

Fig. 6 is a perspective view of a light emitting unit according to another exemplary embodiment.

Fig. 7 is a perspective view of a light emitting unit according to another exemplary embodiment.

Figs. 8A to 8D are explanatory diagrams of the operation of the vehicle lamp utilizing the light emitting unit illustrated in Fig. 7.

Fig. 9 is a perspective view of a light emitting unit according to another exemplary embodiment.

Fig. 10A to Fig. 10F are explanatory diagrams of the operation of the vehicle lamp employing the light emitting unit illustrated in Fig. 9.

Fig. 11 is a cross-section of a vehicle lamp employing a light emitting unit according to one of the above exemplary embodiments.

Fig. 12 is a perspective view of a light emitting unit according to another exemplary embodiment.

DETAILED DESCRIPTION

[0016] Detailed explanation of exemplary embodiments is provided below, along with reference to the drawings.

[0017] Fig. 1 is a cross-section of a vehicle lamp that employs a light emitting unit according to an exemplary embodiment. A vehicle lamp 10 illustrated in Fig. 1 is employed as a headlamp.

[0018] As shown in Fig. 1, the vehicle lamp 10 includes a lamp body 12 having a recessed portion opening towards the lamp front; a cover 14 closing off the open face of the lamp body 12; and a lamp chamber 16 formed by the internal space formed by the lamp body 12 and the cover 14.

[0019] A lamp unit 20 is disposed inside the lamp chamber 16. The lamp unit 20 includes a projection lens 26, a lens support member 28, a light emitting unit 30, heat dissipation fins 32 and a fan 34. The lamp unit 20 is a direct illumination lamp that illuminates light emitted by the light emitting unit 30 directly forward using the projection lens 26.

[0020] As shown in Fig. 1, the lamp unit 20 is attached substantially at the center of a bracket 18. A first aiming screw 21 is attached to an upper portion of the bracket 18, and a second aiming screw 22 is attached to a lower portion of the bracket 18. The bracket 18 is supported in such a manner that the lamp body 12 can be tilted by means of the first aiming screw 21 and the second aiming screw 22. An aiming actuator 24 is provided to the lower second aiming screw 22. When the aiming actuator 24 is driven, the lamp unit 20 is tilted together with the tilting movement of the bracket 18, and optical axis adjustment (aiming adjustment) is performed on the illumination beam.

[0021] The light emitting unit 30 is provided on the front face side of the bracket 18. The light emitting unit 30 includes an attachment member 36 for attaching the light emitting unit 30 to the bracket 18, a light emitting diode 38, a base plate 39 for mounting the light emitting diode 38, and a shade 40 for blocking a portion of the light from the light emitting diode 38. The light emitting diode 38 is disposed with the light emitting face facing towards the lamp front.

[0022] In the present exemplary embodiment the shade 40 is configured so as to be moveable between a light-blocking position and an open position. A portion of the light from the light emitting diode 38 is blocked when the shade 40 is in the light-blocking position, such that light configuring a low beam is emitted from the light emitting unit 30. However, light from the light emitting diode 38 is not blocked when the shade 40 is in the open po-

sition, such that light configuring a high beam is emitted from the light emitting unit 30. Details regarding the configuration of the light emitting unit 30 are given later.

[0023] Heat dissipation fins 32 are provided on the back face side of the bracket 18 so as to make contact with the base plate 39. Heat generated when light is emitted from the light emitting diode 38 is dissipated by the heat dissipation fins 32. The fan 34 is provided behind the heat dissipation fins 32 to cool the heat dissipation fins 32.

[0024] The projection lens 26 is provided at the front of the light emitting unit 30. The projection lens 26 is supported by the lens support member 28. The projection lens 26 is configured as a planar-convex non-spherical lens with a convex front face and a flat rear face. The projection lens 26 projects an inverted image of the light source image formed at the back focal point plane onto a hypothetical vertical screen in front of the vehicle lamp 10. The projection lens 26 is disposed such that the back focal point is positioned either at the light emitting face of the light emitting diode 38, or in the vicinity of the light emitting face of the light emitting diode 38.

[0025] Fig. 2 is a perspective view of the light emitting unit 30 according to the present exemplary embodiment.

The light emitting unit 30 includes the attachment member 36, attached to a specific position on the lamp (to the bracket 18 in the present exemplary embodiment), the light emitting diode 38, the base plate 39 mounted with the light emitting diode 38, the shade 40, a drive module 42 that drives the shade 40, thereby controlling the light distribution from the light emitting diode 38, and a power supply module 44 that supplies power to the light emitting diode 38 and the drive module 42.

[0026] As shown in Fig. 2, the attachment member 36 includes a first attachment portion 36a and a second attachment portion 36b which are portions containing holes for inserting fixing bolts through, a LED base plate mounting portion 36c for mounting the light emitting diode 38 and the base plate 39, and an actuator mounting portion 36d for mounting the drive module 42.

[0027] The LED base plate mounting portion 36c is a rectangular plate shaped member, formed with a rectangular shaped hole 36e at a central portion of the LED base plate mounting portion 36c for retaining the base plate 39. The actuator mounting portion 36d is also a rectangular plate shaped member. The LED base plate mounting portion 36c and the actuator mounting portion 36d are connected to each other at mutual side portions so as to form an integrated member. The first attachment portion 36a is formed on a side portion of the LED base plate mounting portion 36c at the opposite side to the side portion of the LED base plate mounting portion 36c connected to the actuator mounting portion 36d. The second attachment portion 36b is formed on a side portion of the actuator mounting portion 36d at the opposite side to the side portion of the actuator mounting portion 36d connected to the LED base plate mounting portion 36c.

[0028] Plural spring terminals 46 are provided on the

internal wall face of the hole 36e of the LED base plate mounting portion 36c. The spring terminals 46 are provided at the four corners of the hole 36e and are electrically connected to electrodes (not shown) formed on the LED mounting face of the base plate 39 by biasing the LED mounting face of the base plate 39 towards the lamp rear. Biasing force of the spring terminals 46 also functions to retain the base plate 39 on the LED base plate mounting portion 36c.

[0029] The power supply module 44 is provided at an upper portion of the LED base plate mounting portion 36c. The power supply module 44 is electrically connected to the spring terminals 46 and supplies power to the light emitting diode 38 through the power supply module 44 and the base plate 39 when a power supply plug is inserted from outside. The power supply module 44 is also electrically connected to the drive module 42 and supplied power for driving the drive module 42.

[0030] In the present exemplary embodiment, the drive module 42 includes a DC motor 41 and a rotation shaft 48 that extends out from the rotation shaft of the DC motor 41. The shade 40 is provided on the rotation shaft 48. The DC motor 41 is fixed to the actuator mounting portion 36d of the attachment member 36.

[0031] The shade 40 has an upper edge portion shaped to configure a specific low beam light distribution pattern. The shade 40 is in the light-blocking position when the shade 40 is standing upright in front of the light emitting diode 38, as shown in Fig. 2, and the light from the light emitting diode 38 is emitted from the light emitting unit 30 with a portion of light blocked by the shade 40. When the drive module 42 is driven from the state shown in Fig. 2, the shade 40 is rotated about the rotation shaft 48 towards the lamp front, with rotation finally being stopped by engagement with a stopper 50. The shade 40 is in the open position when this occurs, and light from the light emitting diode 38 is emitted from the light emitting unit 30 without being blocked by the shade 40.

[0032] As explained above, in the light emitting unit 30 shown in Fig. 2, the light emitting diode 38 and the base plate 39, the shade 40, the drive module 42 and the power supply module 44 are integrated into a single body mounted to the attachment member 36. This enables the lamp 10 to be made more compact due to reducing the number of components in the lamp chamber 16.

[0033] Fig. 3 is a perspective view of a light emitting unit 130 according to another exemplary embodiment. Elements of the exemplary embodiment discussed below that are the same as or correspond to those of the light emitting unit 30 illustrated in Fig. 2 are assigned to the same reference numerals and duplicate explanation is omitted where appropriate.

[0034] The light emitting unit 130 illustrated in Fig. 3 differs from the light emitting unit 30 illustrated in Fig. 2 in that the drive module 42 is provided with a piezoelectric actuator 43 and a shaft 51 extending vertically upwards from the piezoelectric actuator 43. The shade 40 is attached to the shaft 51. In the present exemplary embod-

iment, as shown in Fig. 3, a lower portion of the LED base plate mounting portion 36c configures the actuator mounting portion 36d for attaching the drive module 42.

[0035] In the light emitting unit 130, the shaft 51 moves upwards or downwards when the drive module 42 is driven, and the shade 40 moves upwards or downwards to accompany this movement. The shade 40 is in the light-blocking position when the shade 40 has moved to the uppermost position, and light from the light emitting diode 38 is emitted from the light emitting unit 30 with a portion of the light blocked by the shade 40. However, the shade 40 is in the open position when the shade 40 has been moved to the lowermost position and light from the light emitting diode 38 is emitted from the light emitting unit 30 without being blocked by the shade 40.

[0036] The light emitting diode 38 and the base plate 39, the shade 40, the drive module 42 and the power supply module 44 are also integrated into a single body provided to the attachment member 36 in the light emitting unit 30 illustrated in Fig. 3. This enables the vehicle lamp 10 to be made more compact by reducing the number of components inside the lamp chamber 16.

[0037] In the light emitting unit 130 illustrated in Fig. 3 an even more compact light emitting unit is possible than that of the exemplary embodiment illustrated in Fig. 2 due to employing the piezoelectric actuator 43 in place of a DC motor.

[0038] Fig. 4 is a perspective view of a light emitting unit 230 according to another exemplary embodiment.

[0039] The light emitting unit 230 illustrated in Fig. 4 has a drive module 42 that includes a stepping motor 55, a leadscrew 52 provided extending out from the rotation shaft of the stepping motor 55 and a nut 54 that moves in the vehicle width direction by rotation of the leadscrew 52. A shade 40 is provided to the nut 54. The stepping motor 55 is attached to an actuator mounting portion 36d of the attachment member 36.

[0040] In the light emitting unit 230, when the shade 40 is in the open position not covering the front of the light emitting diode 38, light from the light emitting diode 38 is emitted from the light emitting unit 30 without being blocked by the shade 40. The light distribution pattern formed in front of the vehicle lamp 10 can be controlled by driving the drive module 42 to adjust the vehicle width direction position of the shade 40. For example, a light distribution pattern can be formed that illuminates a high beam to the traffic lane on only one side by moving the shade 40 so as to block about half of the light from the light emitting diode 38.

[0041] The light emitting diode 38 and the base plate 39, the shade 40, the drive module 42 and the power supply module 44 are also integrated into a single body provided to the attachment member 36 in the light emitting unit 230 illustrated in Fig. 4. This enables the vehicle lamp 10 to be made more compact by reducing the number of components inside the lamp chamber 16.

[0042] In the light emitting unit 230 illustrated in Fig. 4 configuration is made such that the position of the shade

40 is controlled so that the distribution of light illuminated from the light emitting unit 230 can be controlled. The vehicle lamp 10 is thus capable of forming various light distribution patterns according to traffic conditions.

[0043] Fig. 5 is a perspective view of a light emitting unit 330 according to another exemplary embodiment of the present exemplary embodiment.

[0044] The light emitting unit 330 illustrated in Fig. 5 has a shade 40 that is divided into a first sub-shade 40a and a second sub-shade 40b, and the light distribution of light from the light emitting diode 38 is varied by changing the opening state of the first sub-shade 40a and the second sub-shade 40b.

[0045] In the light emitting unit 330, the drive module 42 includes a stepping motor 55, a rotation shaft 48 provided extending out from the rotation shaft of the stepping motor 55, and a projection portion 56 provided at an intermediate position on the rotation shaft 48. The rotation shaft 48 is configured with a first rotation shaft 48a that is directly connected to the rotation shaft of the drive module 42 and a second rotation shaft 48b that is provided extending out at the distal end of the first rotation shaft 48a. The second rotation shaft 48b is configured so as to be rotatable with respect to the first rotation shaft 48a. The first sub-shade 40a is provided to the first rotation shaft 48a, and the second sub-shade 40b is provided to the second rotation shaft 48b.

[0046] As shown in Fig. 5, the shade 40 is in the light-blocking position when the first sub-shade 40a and the second sub-shade 40b are standing upright in front of the light emitting diode 38, and the light from the light emitting diode 38 is emitted from the light emitting unit 30 with a portion of the light blocked by the first sub-shade 40a and the second sub-shade 40b. A low beam is illuminated from the vehicle lamp 10 in this state.

[0047] When the drive module 42 is driven from the state shown in Fig. 5, the first sub-shade 40a is rotated about the first rotation shaft 48a towards the lamp front, but the second sub-shade 40b does not rotate. Due to light from the light emitting diode 38 only being blocked by the second sub-shade 40b when the first sub-shade 40a has been rotated to a state in which it does not block light from the light emitting diode 38, the vehicle lamp 10 can configure a light distribution pattern that illuminates a high beam to the traffic lane on one side, and illuminates a low beam to the traffic lane on the other side.

[0048] When the drive module 42 is driven further from the state in which only the first sub-shade 40a is open, the first sub-shade 40a makes contact with the projection portion 56 provided to the second rotation shaft 48b, and rotates the second rotation shaft 48b. Light from the light emitting diode 38 is emitted from the light emitting unit 30 without being blocked by either the first sub-shade 40a or the second sub-shade 40b when the second sub-shade 40b has been rotated towards the lamp front to the open position accompanying rotation of the second rotation shaft 48b, and a high beam is illuminated from the vehicle lamp 10.

[0049] The light emitting diode 38 and the base plate 39, the first sub-shade 40a and the second sub-shade 40b, the drive module 42 and the power supply module 44 are also integrated into a single body provided to the attachment member 36 in the above light emitting unit 330 illustrated in Fig. 5. This enables the vehicle lamp 10 to be made more compact by reducing the number of components inside the lamp chamber 16.

[0050] Furthermore, the light distribution from the light emitting unit 330 can be controlled by utilization of the split structure for the shade 40 in the light emitting unit 330 illustrated in Fig. 5. The vehicle lamp 10 is accordingly capable of forming various light distribution patterns according to traffic conditions.

[0051] Fig. 6 is a perspective view of a light emitting unit 430 according to another exemplary embodiment.

[0052] The light emitting unit 430 illustrated in Fig. 6 has a drive module 42 that includes a stepping motor 55, and a rotation shaft 48 that is rotatably driven by the stepping motor 55. The shade 40 is a rotation shade capable of being controlled by rotation to give plural distributions of light from the light emitting diode 38. The shade 40 is disposed with its rotation axis aligned with the rotation axis of the stepping motor 55. This enables the rotation shade to be formed to a portion of the rotation shaft 48.

[0053] The shade 40 is in the open position in Fig. 6. In this state the light from the light emitting diode 38 is not blocked by the shade 40 and a high beam is illuminated from the vehicle lamp 10. A desired light distribution pattern can be formed by controlling the drive module 42 to adjust the rotation amount of the shade 40.

[0054] The light emitting diode 38 and the base plate 39, the shade 40, the drive module 42 and the power supply module 44 are also integrated into a single body provided to the attachment member 36 in the above light emitting unit 430 illustrated in Fig. 6. This enables the vehicle lamp 10 to be made more compact by reducing the number of components inside the lamp chamber 16.

[0055] In the light emitting unit 430 illustrated in Fig. 6 a compact light emitting unit 430 can be realized by forming the rotation shade as a portion of the rotation shaft 48.

[0056] Fig. 7 is a perspective view of a light emitting unit 530 according to another exemplary embodiment.

[0057] In the light emitting unit 530 illustrated in Fig. 7 there is a mirror 58 provided as an optical member in the vicinity of a light emitting diode 38. More specifically, the mirror 58 is provided adjacent to the horizontal direction end portion of a light emitting face 38a of the light emitting diode 38.

[0058] The mirror 58 is driven by an actuator (not shown in the drawings) provided to an actuator mounting portion 36d between a first position reflecting light from the light emitting diode 38, and a second position not reflecting light from the light emitting diode 38.

[0059] Fig. 7 illustrates the mirror 58 in the first position state. When the mirror 58 is in the first position, a reflection surface 58a of the mirror 58 stands upright and perpendicular to the light emitting face 38a of the light emit-

ting diode 38. When an actuator drives the mirror 58 from the first position state, the mirror 58 is rotated about a rotation axis 58b, with the mirror 58 finally adopting a state tilted away from the light emitting face 38a. The mirror 58 thereby adopts a second position, not reflecting light from the light emitting diode 38.

[0060] Figs. 8A to 8D are explanatory diagrams of the operation of the vehicle lamp 10 utilizing the light emitting unit 530 illustrated in Fig. 7. Fig. 8A illustrates a light distribution pattern 60 projected onto a hypothetical vertical screen 62 in front of the vehicle when the mirror 58 is in the first position. Fig. 8B is a view from substantially overhead the vehicle lamp 10 when the mirror 58 is in the first position.

[0061] The light emitting unit 530 of the present exemplary embodiment is, as shown in Fig. 8B, mounted to the vehicle lamp 10 such that the horizontal direction end portion of the light emitting diode 38 is positioned in the vicinity of an optical axis Ax of a projection lens 26. The rotation axis 58b of the mirror 58 is positioned on the optical axis Ax of the projection lens 26.

[0062] When the mirror 58 is in the first position as described above, the reflection surface 58a of the mirror 58 stands upright and perpendicular to the light emitting face 38a of the light emitting diode 38. A ray of light L1 emitted forwards and diagonally to the left from the light emitting diode 38 is reflected by the reflection surface 58a of the mirror 58, then passes through the projection lens 26, before being projected onto a region of the hypothetical vertical screen 62 further to the right hand side than the optical axis Ax. The ray of light L1 can be considered as light emitted from a virtual light emitting diode 64 (shown by a broken line) positioned symmetrical to the light emitting diode 38 about the optical axis Ax. A ray of light L2 emitted straight ahead from the light emitting diode 38 passes through the projection lens 26 and is projected onto a region of the hypothetical vertical screen 62 further to the left hand side than the optical axis Ax. Accordingly, when the mirror 58 is in the first position, a light distribution pattern 60 is formed as a high beam on the hypothetical vertical screen 62 as illustrated in Fig. 8A due to the light from the light emitting diode 38 being projected to both the left and right sides of the optical axis Ax.

[0063] Fig. 8C illustrates a light distribution pattern 61 projected onto the hypothetical vertical screen 62 in front of the vehicle when the mirror 58 is in the second position. Fig. 8D is a view from substantially overhead the vehicle lamp 10 when the mirror 58 is in the second position.

[0064] As shown in Fig. 8D, the ray of light L1 emitted forward and diagonally to the left from the light emitting diode 38 when the mirror 58 is in the second position is not reflected by the mirror 58, passes through the projection lens 26, and is then projected onto a region of the hypothetical vertical screen 62 further to the left hand side than the optical axis Ax. The ray of light L2 emitted straight ahead from the light emitting diode 38 passes through the projection lens 26 and is projected onto a

region of the hypothetical vertical screen 62 further to the left hand side than the optical axis Ax. Accordingly, when the mirror 58 is in the second position, the light distribution pattern 61 is formed with illumination onto a region of the hypothetical vertical screen 62 further to the left hand side than a perpendicular line V-V illustrated in Fig. 8C due to the light emitted from the light emitting diode 38 being projected to the left side of the optical axis Ax.

[0065] While in the above explanation an example is given in which the mirror 58 adopts an upright position, perpendicular to the light emitting face 38a of the light emitting diode 38, and a tilted away position, an alternative configuration may be made such that various light distribution patterns can be formed by adjusting the angle of tilt of the mirror 58.

[0066] The light emitting diode 38 and the base plate 39, the mirror 58, the drive module (not shown in the drawings), and the power supply module 44 are also integrated into a single body provided to the attachment member 36 in the light emitting unit 530 illustrated in Fig. 7. This enables the vehicle lamp 10 to be made more compact by reducing the number of components inside the lamp chamber 16.

[0067] Fig. 9 is a perspective view of a light emitting unit 630 according to another exemplary embodiment.

[0068] The light emitting unit 630 illustrated in Fig. 9 is also provided in the vicinity of the light emitting diode 38 with a mirror 58 capable of rotation about a rotation axis 58b, similar to the light emitting unit 530 illustrated in Fig. 7. The mirror 58 is driven between a first position reflecting light from the light emitting diode 38 and a second position not reflecting light from the light emitting diode 38 by an actuator (not shown in the drawings) provided to an actuator mounting portion 36d.

[0069] The light emitting unit 630 of the present exemplary embodiment is configured such that the mirror 58 is movable in the horizontal direction in front of the light emitting diode 38 by the drive module 42. In the light emitting unit 630, a shade 65 parallel to the light emitting face 38a of the light emitting diode 38 is attached to a rotation axis 58b of the mirror 58. The shade 65 is also movably together with the mirror 58 by the drive module 42. The drive module 42 includes a stepping motor 55, a leadscrew 52 provided extending out from the rotation shaft of the stepping motor 55, and a nut 54 to which the mirror 58 and the shade 65 are attached.

[0070] Fig. 10A to Fig. 10F are explanatory diagrams of the operation of the vehicle lamp 10 employing the light emitting unit 630 illustrated in Fig. 9. As shown in Fig. 10B, the light emitting unit 630 of the present exemplary embodiment is mounted to the vehicle lamp 10 such that a portion at one end of the light emitting diode 38 is disposed in the vicinity of an optical axis Ax of a projection lens 26.

[0071] Fig. 10A illustrates a light distribution pattern 60 projected onto a hypothetical vertical screen 62 in front of a vehicle when the mirror 58 is standing upright along the optical axis Ax. Fig. 10B is a view from substantially

overhead the vehicle lamp 10 when the mirror 58 is standing upright along the optical axis Ax. As shown in Fig. 10B, a ray of light L1 emitted forwards and diagonally to the left from the light emitting diode 38 is reflected by the reflection surface 58a of the mirror 58, then passes through the projection lens 26, before being projected onto a region of a hypothetical vertical screen 62 further to the right hand side than the optical axis Ax. A ray of light L2 emitted straight ahead from the light emitting diode 38 passes through the projection lens 26 and is projected onto a region of the hypothetical vertical screen 62 further to the left hand side than the optical axis Ax. Accordingly, since the light emitted from the light emitting diode 38 is projected to both the left and right sides of the optical axis Ax, the light distribution pattern 60 is formed as a high beam on the hypothetical vertical screen 62 as illustrated in Fig. 10A.

[0072] Fig. 10C illustrates a light distribution pattern 61 projected onto the hypothetical vertical screen 62 in front of the vehicle when the mirror 58 is tilted away from the light emitting face 38a. Fig. 10D is a view from substantially overhead the vehicle lamp 10 when the mirror 58 is tilted away from the light emitting face 38a. The mirror 58 and a shade 65 accordingly adopt a superimposed state, as shown in Fig. 10D. As shown in Fig. 10D, the ray of light L1 emitted forwards and diagonally to the left from the light emitting diode 38 is accordingly not reflected by the mirror 58, passes through the projection lens 26, and is then projected onto a region of the hypothetical vertical screen 62 further to the left hand side than the optical axis Ax. The ray of light L2 emitted straight ahead from the light emitting diode 38 passes through the projection lens 26 and is projected onto a region further to the left hand side than the optical axis Ax of the hypothetical vertical screen 62. Accordingly, due to light emitted from the light emitting diode 38 being projected to the left hand side of the optical axis Ax, the light distribution pattern 61 is formed as illumination onto a region of the hypothetical vertical screen 62 further to the left hand side than a perpendicular line V-V illustrated in Fig. 10C.

[0073] Fig. 10E illustrates a light distribution pattern 63 projected onto the hypothetical vertical screen 62 in front of a vehicle when the mirror 58 and the shade 65 have been moved so as to cover a portion of the light emitting face 38a of the light emitting diode 38. Fig. 10F is a view from substantially overhead the vehicle lamp 10 when the mirror 58 and the shade 65 have been moved so as to cover a portion of the light emitting face 38a of the light emitting diode 38. In the present exemplary embodiment, as shown in Fig. 10F, when the mirror 58 is in a second position state, namely the mirror 58 is in a tilted state and superimposed on the shade 65, the mirror 58 and the shade 65 are moved in a horizontal direction in front of the light emitting diode 38. As shown in Fig. 10F, a ray of light L3 emitted from the light emitting face 38a of the light emitting diode 38 that is not covered by the shade 65 passes through the projection lens 26 and is projected

onto a region of the hypothetical vertical screen 62 further to the left hand side than the optical axis Ax. Due to a portion of light from the light emitting diode 38 being blocked by the shade 65, the light distribution pattern 63 formed on the hypothetical vertical screen 62 suppress illumination to a region in the vicinity of the vertical line V-V in comparison to the light distribution pattern 61 of Fig. 10C.

[0074] While in the present exemplary embodiment the mirror 58 and the shade 65 are separate bodies in a structure coupled together by the rotation axis 58b, configuration may be made without provision of the shade 65 and with a non-reflecting surface formed on the mirror 58 on the opposite side of the mirror 58 to that of the reflection surface 58a. Similar operation can be achieved in such a case to that explained with reference to Fig. 10A to Fig. 10F.

[0075] The light emitting diode 38 and the base plate 39, the optical members of the mirror 58 and the shade 65, the drive module 42 and the power supply module 44 are also integrated into a single body provided to the attachment member 36 in the light emitting unit 630 illustrated in Fig. 9. This enables the vehicle lamp 10 to be made more compact by reducing the number of components inside the lamp chamber 16.

[0076] Fig. 11 is a cross-section of a vehicle lamp employing a light emitting unit according to one of the above exemplary embodiments. A vehicle lamp 100 illustrated in Fig. 11 is employed as a parabolic headlamp. The vehicle lamp 100 illustrated in Fig. 11 includes heat dissipation fins 32, the light emitting unit 30 explained with respect to Fig. 2, a reflector 70, and a cover 14. In Fig. 11, components such as the lamp body are omitted from illustration.

[0077] As shown in Fig. 11, the light emitting unit 30 is fixed above a base member 32a of the heat dissipation fins 32 so that the light emitting face of the light emitting diode 38 faces upwards.

[0078] The reflector 70 is provided above the light emitting unit 30 and includes a reflective surface 71 that is substantially parabolic in shape. A bottom edge portion of the reflector 70 is fixed to the heat dissipation fins 32. In the present exemplary embodiment the reflective surface 71 of the reflector 70 is configured with a low reflection region 71a for reflecting light from the light emitting diode 38 towards an illumination region in front of a vehicle and below the horizontal, and a high reflecting region 71b for reflecting light from the light emitting diode 38 towards an illumination region above the horizontal.

[0079] Explanation follows regarding operation of the vehicle lamp 100. As shown in Fig. 11, when the shade 40 of the light emitting unit 30 is in a tilted state so as to cover a portion of the light emitting face of the light emitting diode 38, a portion of the light from the light emitting diode 38 is blocked by the shade 40, and light is only incident to the low reflection region 71a, and light is not incident to the high reflecting region 71b. The vehicle lamp 100 accordingly illuminates a low beam.

[0080] However, when the shade 40 is rotated to stand upright in a direction perpendicular to the light emitting face of the light emitting diode 38, the light from the light emitting diode 38 is not blocked by the shade 40 and is incident to both the low reflection region 71 a and the high reflecting region 71 b. The vehicle lamp 100 accordingly illuminates a high beam.

[0081] While the light emitting unit 30 is employed in the vehicle lamp 100 illustrated in Fig. 11, any of the various light emitting units described above may be installed in the vehicle lamp 100.

[0082] The external profile of the vehicle lamp 100 is different for each type of vehicle in which the vehicle lamp 100 is installed. Configuration may be made such that configuration components of the vehicle lamp 100 are standardized apart from the reflector 70, and the reflector 70 is changed on application to each type of vehicle. Configuration may also be made such that a low reflector configured with the low reflection region 71a and a high reflector configured with the high reflecting region 71b are separate bodies, configuration components of the vehicle lamp 100 are standardized apart from the high reflector, and the high reflector is changed on application to each type of vehicle. A reduction in cost can be achieved by standardizing configuration components in this manner.

[0083] Fig. 12 is a perspective view of a light emitting unit 730 according to another exemplary embodiment. The light emitting unit 730 illustrated in Fig. 12 differs from the light emitting unit 30 of Fig. 2 in that an intermittent illumination circuit 80 of the light emitting diode 38 is also integrated into a single body together with a light emitting diode 38, a base plate 39, a shade 40, a drive module 42 and a power supply module 44, and the single body provided to the attachment member 36. A mounting portion 36f is provided to the attachment member 36 for mounting the intermittent illumination circuit 80. By also installing the intermittent illumination circuit 80 of the light emitting diode 38 to the attachment member 36 an even more compact vehicle lamp can be achieved by reducing the number of components.

[0084] Explanation has been given of exemplary embodiments. However, the exemplary embodiments are merely examples and various modifications are possible by appropriate combinations of elements configurations and operation procedures, and such modification examples would be seen as being within the scope of embodiments described herein by a person of ordinary skill in the art.

[0085] Whereas in the above exemplary embodiments a light emitting diode is employed as the light source for the light emitting units, the light source is not limited to a light emitting diode. Furthermore, whereas in the above exemplary embodiments shades and mirrors are given as example of optical members for light distribution control, optical members are not limited thereto.

Claims

1. A light emitting unit having an attachment member (36) for attaching the light emitting unit to a specific position on a lamp (10), the light emitting unit being **characterized by** comprising:

a light emitting element mounting portion (36c) provided on the attachment member (36);
a light emitting element (38);
an optical member provided on the attachment member (36);
a drive module (42) provided on the attachment member (36) and configured to drive the optical member (40, 58) and control light distribution from the light emitting element (38); and
a power supply module (44) provided on the attachment member (36) and configured to supply power to the light emitting element (38) and the drive module (42).

2. The light emitting unit of claim 1, wherein the optical member (40) comprises a shade (40) configured to block a portion of light emitted from the light emitting element (38).

3. The light emitting unit of claim 2, wherein:

the shade (40) is divided into a first sub-shade (40a) and a second sub-shade (40b); and
the drive module (42) is configured to change the distribution of light from the light emitting element (38) by changing an opening state of at least one of the first sub-shade (40a) and the second sub-shade (40b).

4. The light emitting unit of claim 2 or 3, wherein:

the shade (40) is a rotatable shade that enables control of light emitted from the light emitting element (38) to produce a plurality of light distribution patterns of by rotating the shade (40);
the drive module (42) is a motor configured to rotatably drive the rotatable shade(40); and
the rotatable shade (40) is disposed with the rotation axis of the rotatable shade (40) aligned with the rotation axis of the motor (42).

5. The light emitting unit of any one of claims 1 to 4, wherein:

the optical member (58) comprises a mirror (58) provided in the vicinity of the light emitting element (38); and
the drive module (42) is configured to drive the mirror (58) so as to adopt a first position reflecting light from the light emitting element (38) and a second position not reflecting light from the

light emitting element (38).

6. A vehicle lamp **characterized by** comprising the light emitting unit of any one of claim 1 to claim 5.

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FIG. 1

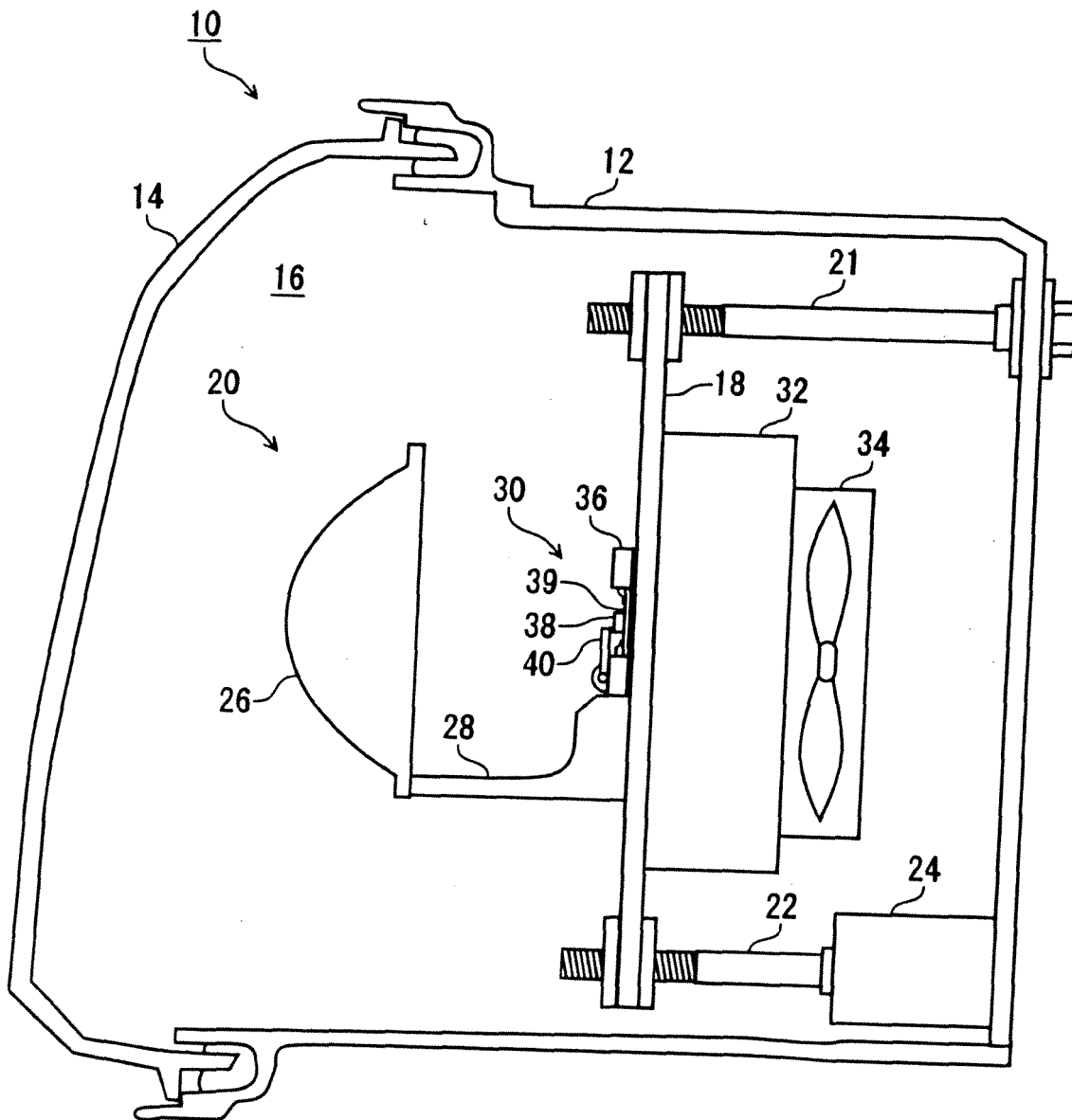


FIG. 2

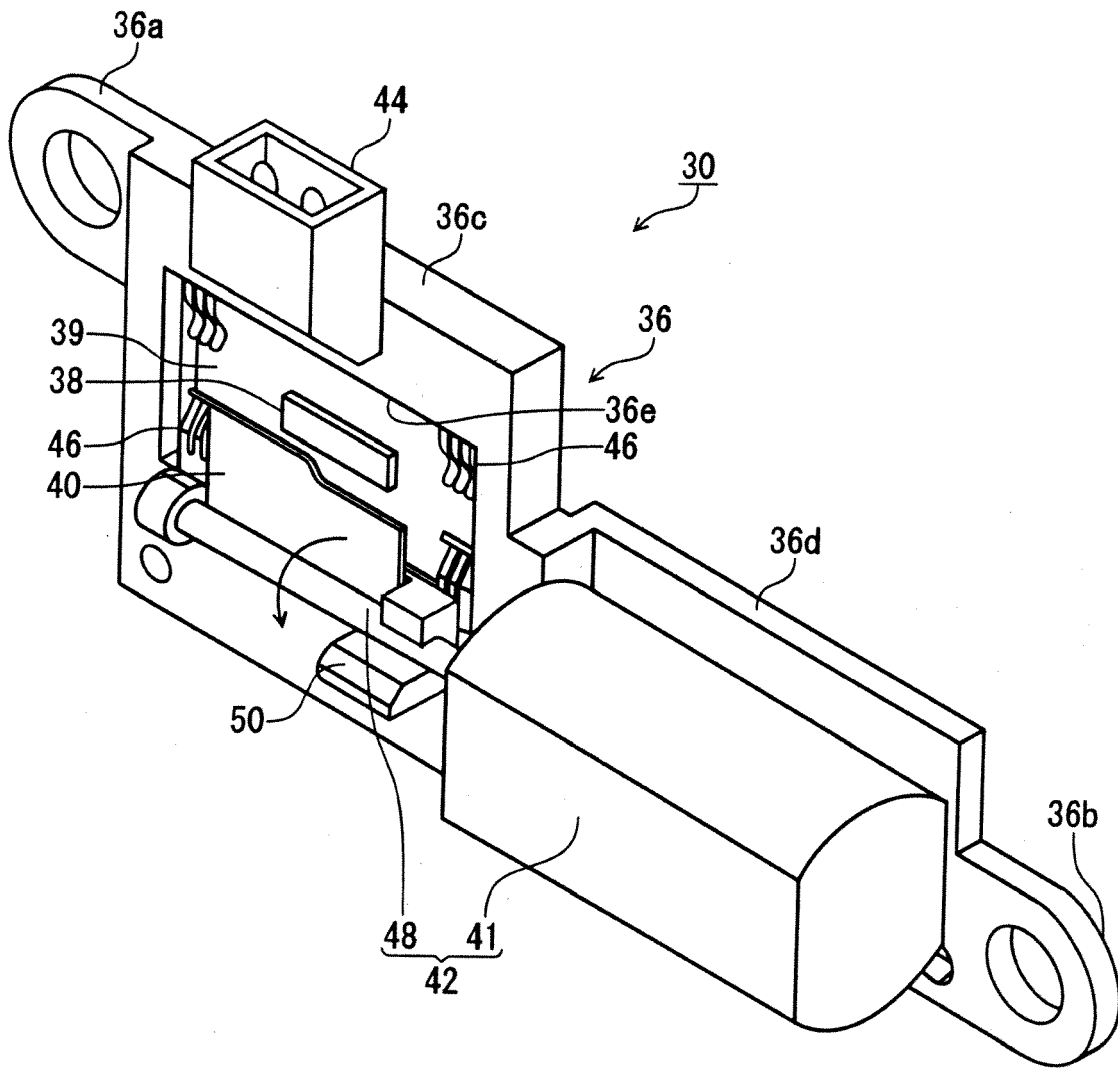


FIG. 3

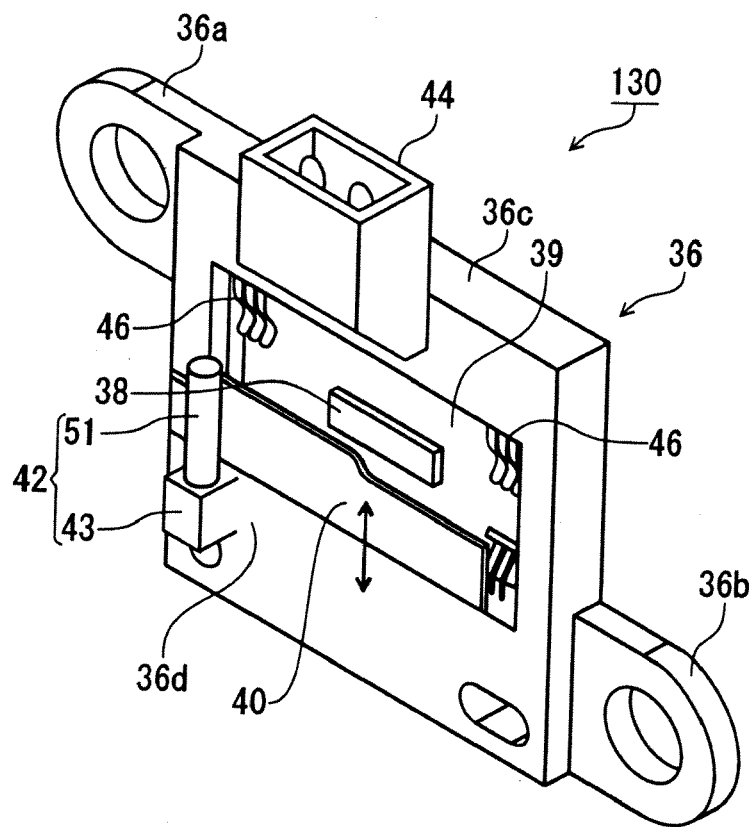


FIG. 4

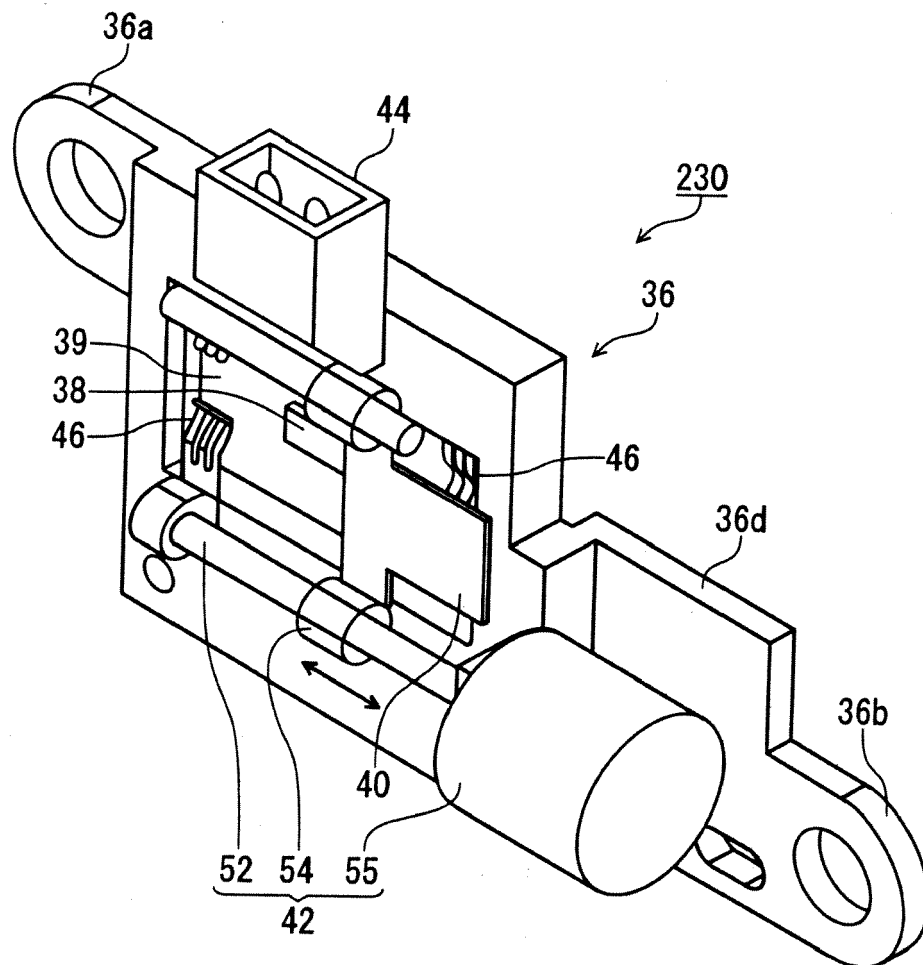


FIG. 5

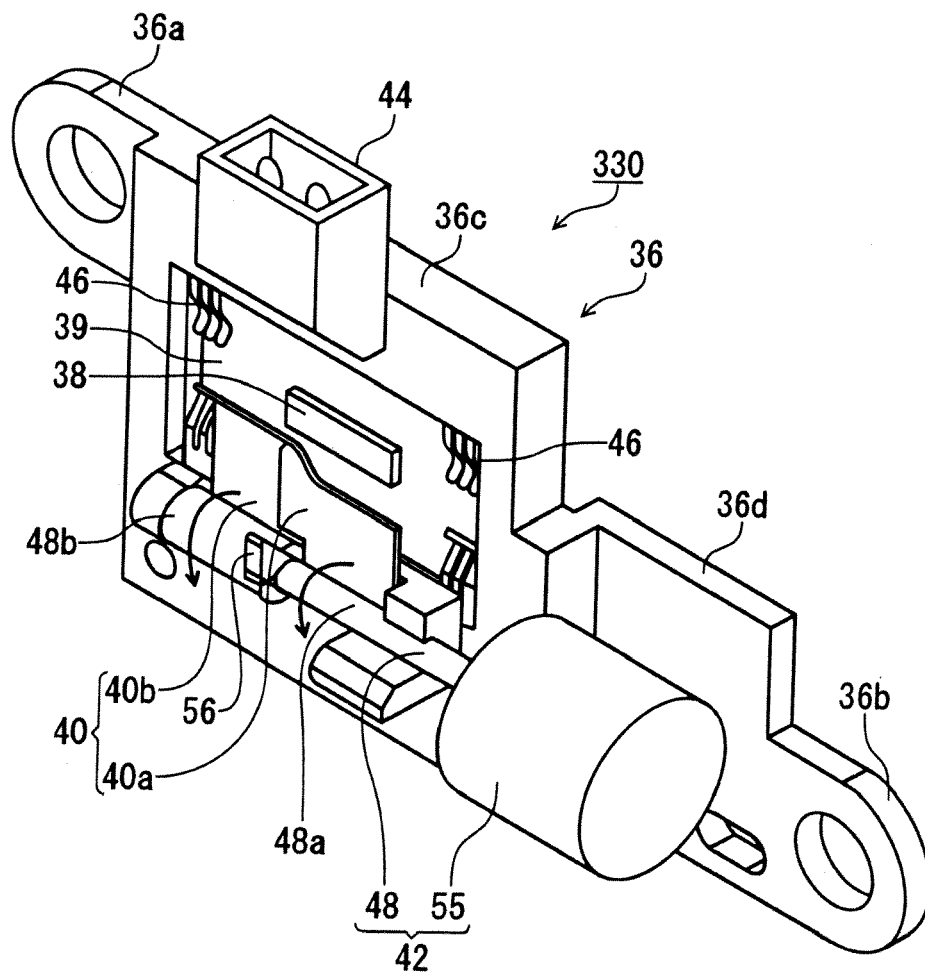


FIG. 6

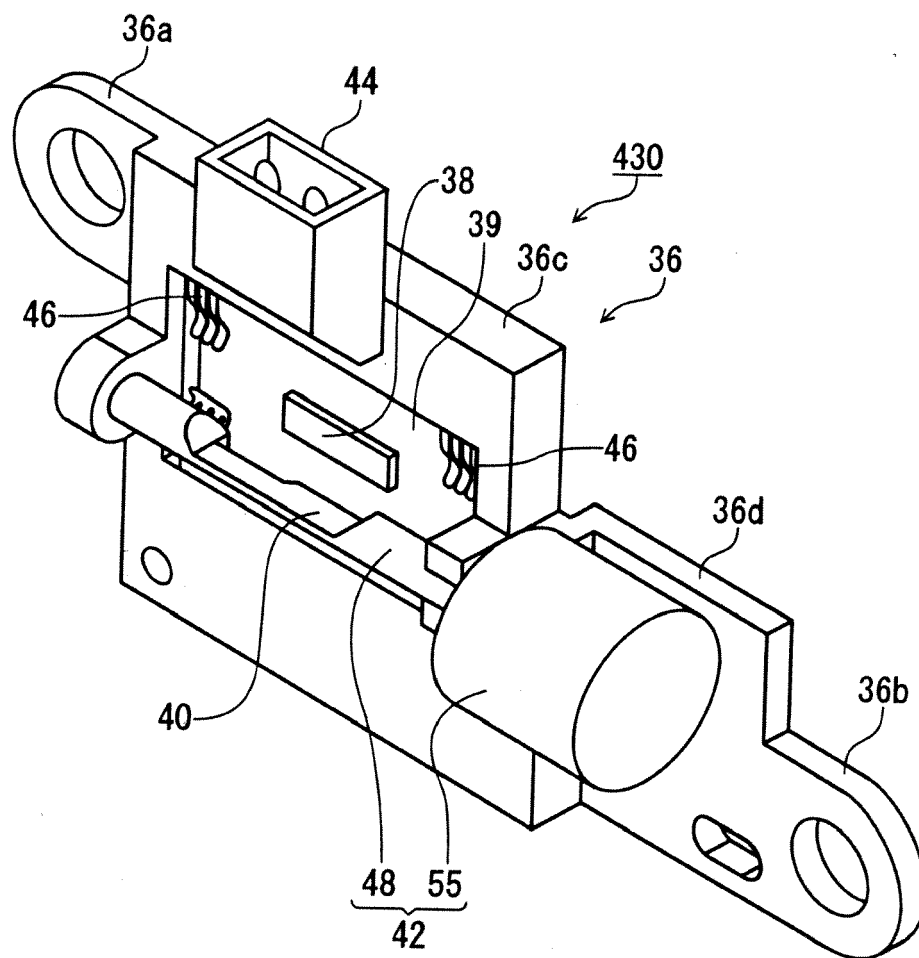


FIG. 7

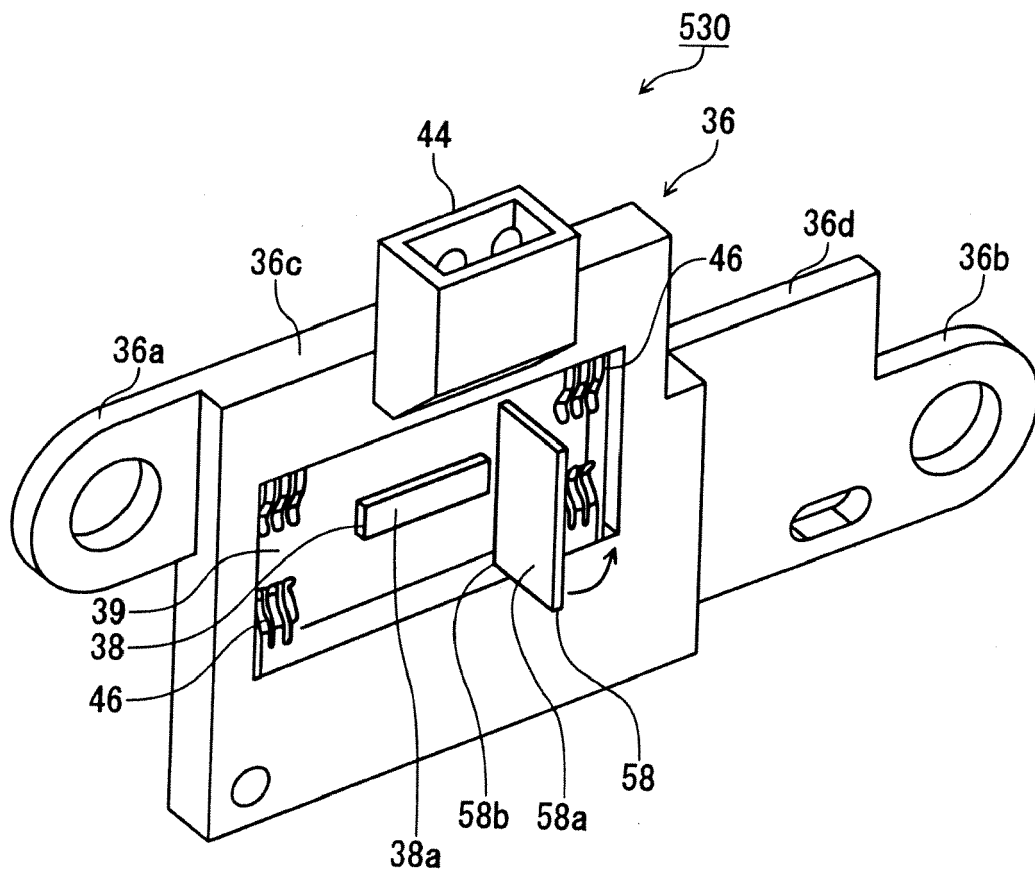


FIG. 8A

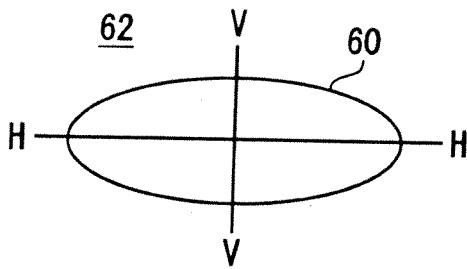


FIG. 8C

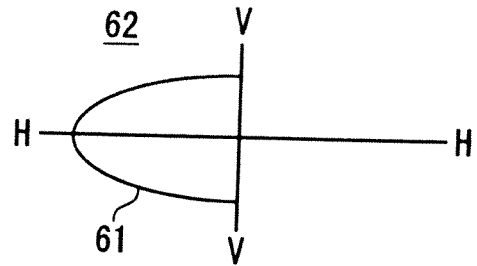


FIG. 8B

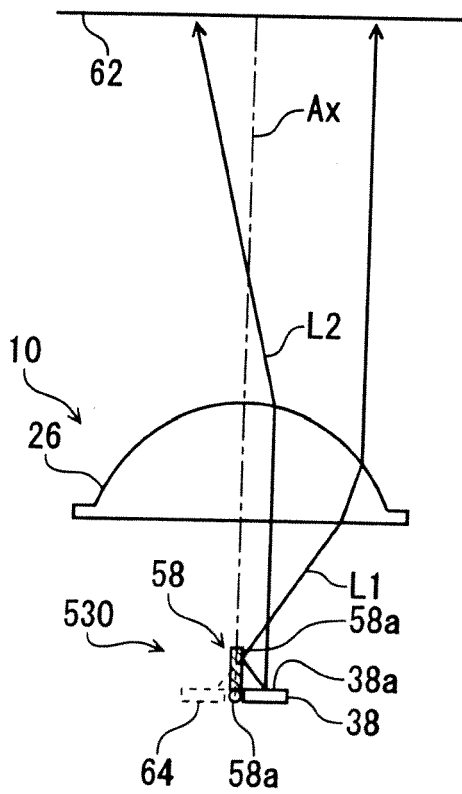


FIG. 8D

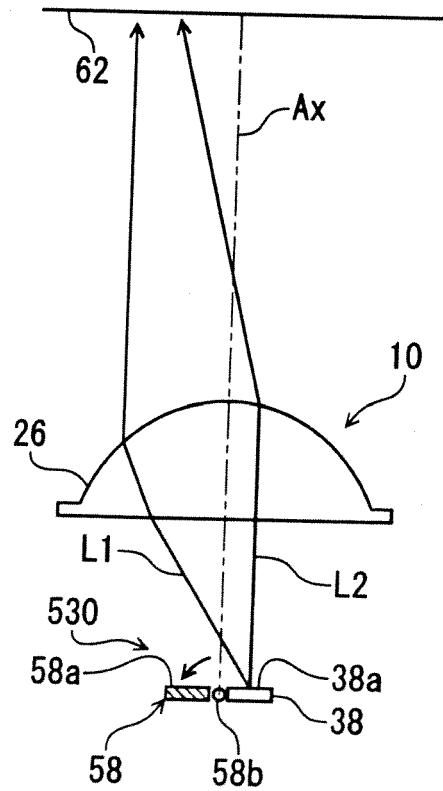
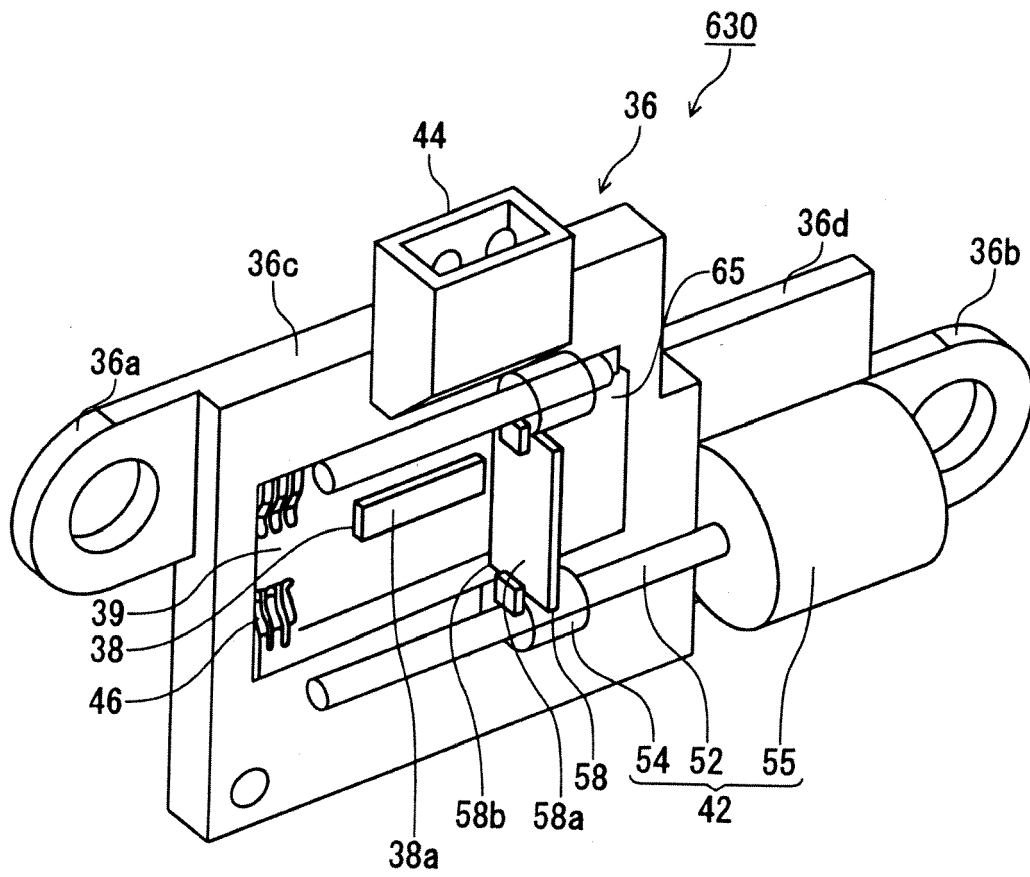


FIG. 9



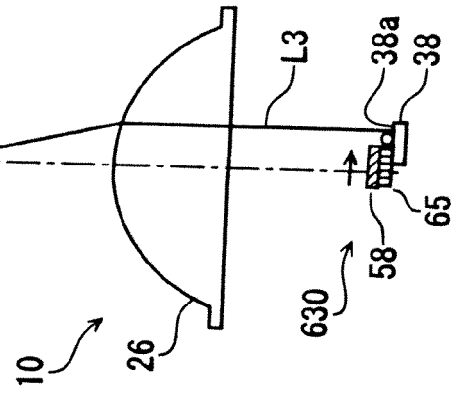
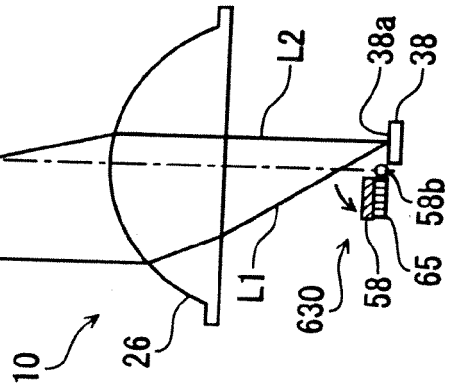
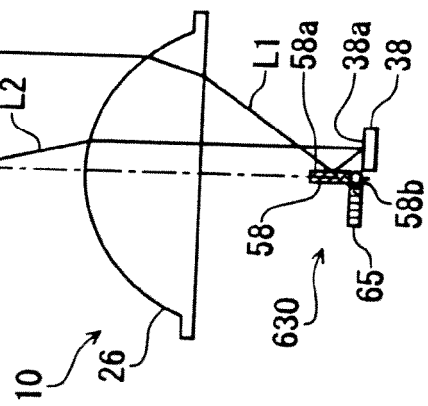
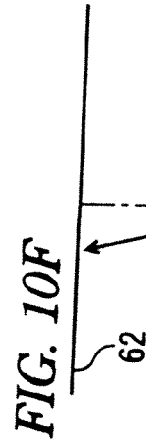
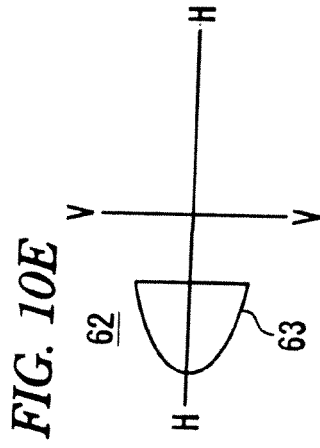
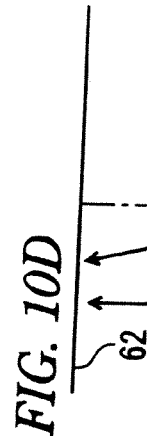
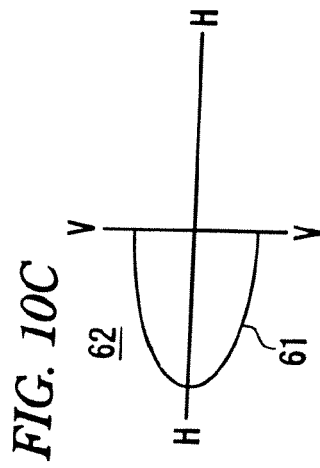
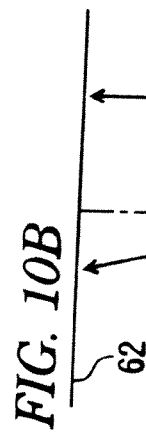
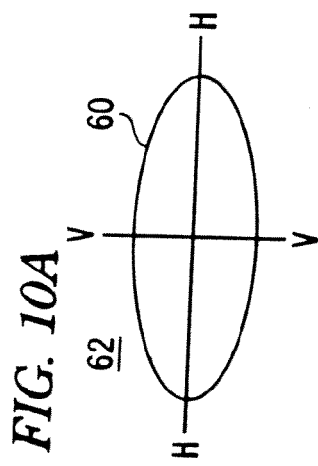


FIG. 11

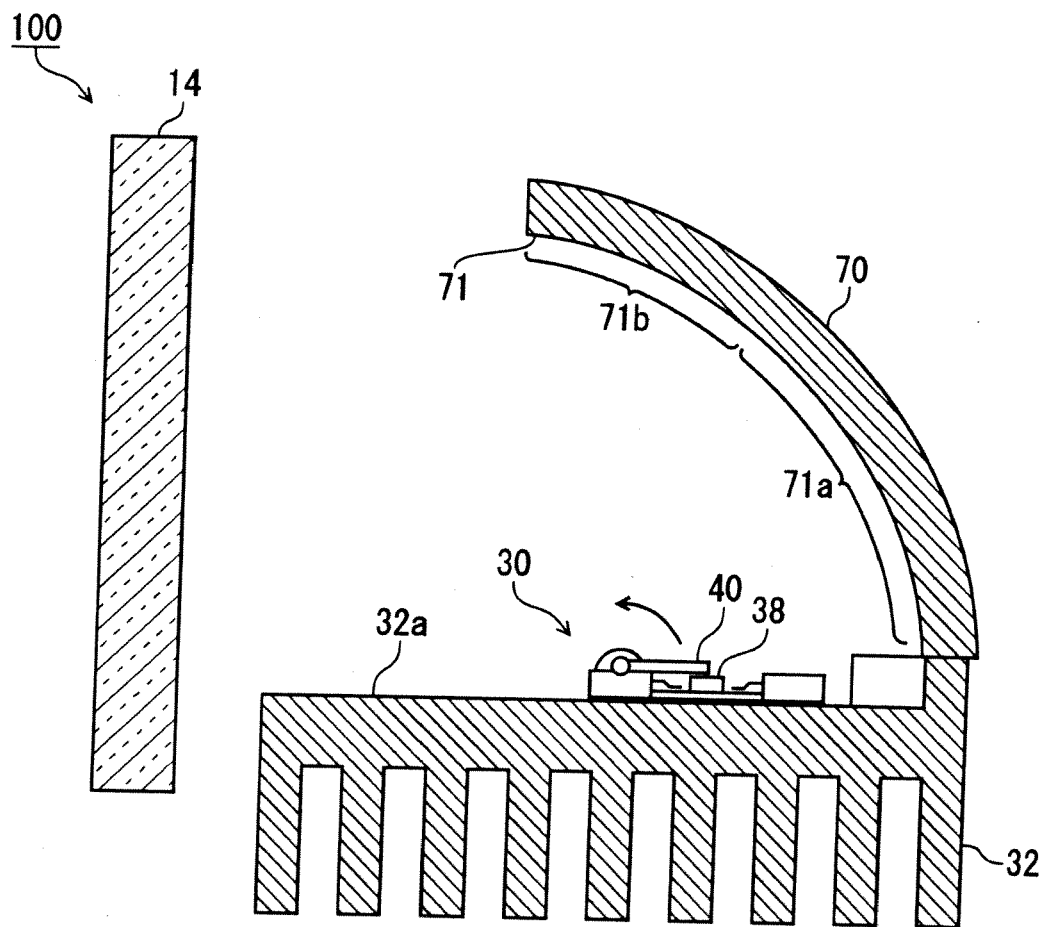
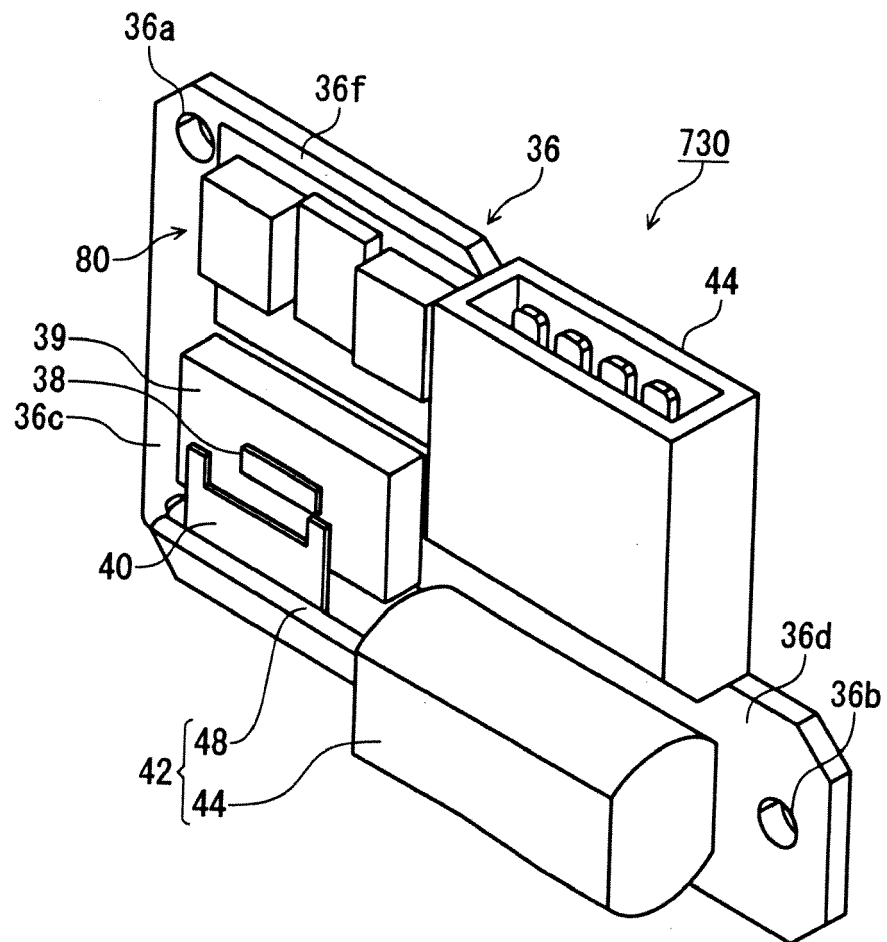


FIG. 12





EUROPEAN SEARCH REPORT

Application Number
EP 11 17 3013

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Place of search Munich		Date of completion of the search 8 September 2011	Examiner Goltes, Matjaz
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