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(54) Sealed casing and luminaire

(57) According to one embodiment, a sealed casing (11) includes a main body (12), a lid (45), a waterproof packing (61), and a plurality of screws (69). The main body (12) includes an opening (41) with a plurality of threaded holes (42). The lid (45) has a size sufficient for closing the opening (41) and includes a plurality of screw through holes (49) in the peripheral portion (47). The waterproof packing (61) is attached to the lid (45) so as to enwrap the peripheral portion (47) from a side facing the opening (41) to the opposite side, and includes screw through holes (66) which communicates with the screw through holes (49). The screws (69) fasten the lid (45) to the main body (12).

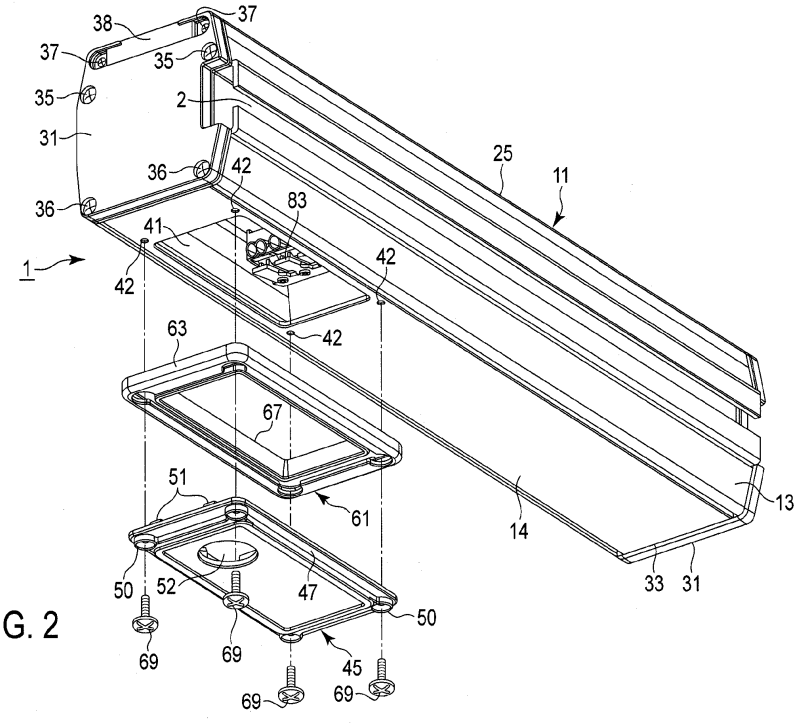

FIG. 2

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Description

FIELD

[0001] Embodiments described herein relate generally to a sealed casing required to be waterproofed and a luminaire having a sealed casing with a translucent member mounted thereon as an enclosure.

BACKGROUND

[0002] A lighting device of the related art includes a closed casing including a base portion and a hood portion. One of edge portions of the base portion and the hood portion joined to each other is an insertion portion and the other one is a receiving portion. The receiving portion has a U-shaped cross-section which is inserted the insertion portion, and a sealing member formed of elastomer foam housed in the back thereof. The casing is sealed between the base portion and the hood portion by the insertion portion inserted into the receiving portion so as to bite into the sealing member.

[0003] In order to connect an external wire to components stored in the waterproofed sealed casing -- electric components, for example -- or in order to inspect the components stored in the sealed casing, or in order to replace the component stored in the sealed casing, or the like, the sealed casing may have a lid to be able to open and close. In this case, a fitting portion of the lid has to be waterproofed.

[0004] In general, a waterproof packing -- an O-ring, for example, which is a flexible sealing member, is used for waterproofing. In a structure in which the waterproof packing is fitted to an annular mounting groove or the like provided on the sealed casing, the waterproof packing may be displaced from a home position or may come off and drop off, when the lid is removed.

[0005] In order to prevent the waterproof packing from coming off unintentionally, the waterproof packing may be adhered to the mounting groove. However, in this case, since the adhesive agent is used, the cost is increased. In particular, the sealed casing for outdoor use, weather resistance properties are required for a long time, and hence a waterproof packing formed of a silicone resin which is high in material cost may be used. However, a special adhesive agent is required for bonding the waterproof packing formed of a silicone resin, and hence the cost is further increased.

BRIEF DESCRIPTION OF THE DRAWINGS

[0006]

FIG. 1 is a perspective view illustrating a luminaire according to Example 1;
FIG. 2 is an exploded perspective view illustrating a periphery of a lid of the luminaire in FIG. 1;
FIG. 3 is a cross-sectional view of the luminaire in FIG. 1 taken along the line passing through the lid;
FIG. 4 is a bottom view illustrating part of the luminaire in FIG. 1;
FIG. 5 is a cross-sectional view taken along the line F5-F5 in FIG. 4;
FIG. 6 is a perspective view of the lid and a waterproof packing provided in the luminaire in FIG. 1 viewed obliquely from above;
FIG. 7 is a perspective view of the lid and the waterproof packing provided in the luminaire in FIG. 1 viewed obliquely from below;
FIG. 8 is a cross-sectional view illustrating the luminaire according to Example 2; and
FIG. 9 is a cross-sectional view illustrating the luminaire according to Example 3.

DETAILED DESCRIPTION

[0007] In general, according to one embodiment, a sealed casing expected to inhibit a waterproof packing attached to a lid from coming apart, and a luminaire which employs the sealed casing as a housing are provided. A sealed casing according to Embodiment 1 includes a main body, a lid, a waterproof packing, and a plurality of screws. The main body includes an opening having a plurality of threaded holes in the periphery thereof. The lid has a size enough to close the opening, and is provided with a plurality of screw through holes in the periphery thereof. The waterproof packing is formed into an annular shape of a resiliently deformable sealing member, is attached to the lid so as to enwrap a peripheral portion from the side facing the opening to the opposite side, and includes the plurality of screw through holes communicating with the screw through holes in the lid. The plurality of screws are screwed into the threaded holes of the main body through the screw through holes of the lid and the waterproof packing communicating with each other, and fasten the lid to the main body.

[0008] In the sealed casing in Embodiment 1, the waterproof packing includes a first surrounding portion positioned between an periphery of the opening and a peripheral portion of the lid, a second surrounding portion configured to cover the peripheral portion continuously from an outer peripheral edge of the first surrounding portion to a side opposite from the opening, and the plurality of screw through holes penetrating through the first surrounding portion and also communicating with the screw through holes of the lid.

[0009] In Embodiment 1, the opening of the main body may be a circle or a polygon, for example, a tetragon. When the opening is square, it is preferable to provide the threaded holes at each position in the vicinity of the four corners thereof. In Embodiment 1, elastomer or synthetic rubber is employed as a sealing material which forms the waterproof packing. In particular, silicone resin is preferably used as the sealing material, in the case of the sealed casing which is required to have weather resistance properties for a long time. The sealed casing of

Embodiment 1 may be preferably implemented as a housing of a luminaire installed at a place such as outdoor or at a site where may be exposed to moisture. The sealed casing of Embodiment 1 is not limited hereto, and may be applied to all the casings having a sealed structure which is required to have a waterproof function.

[0010] In the sealed casing of Embodiment 1, the lid is fastened to the main body with the plurality of screws. A portion between the lid and the main body is waterproofed when the lid is mounted on the main body, because the first surrounding portion of the waterproof packing is positioned between the periphery of the opening of the main body and the peripheral portion of the lid and is clamped by tightening forces of the plurality of screws inserted through the lid and the first surrounding portion of the waterproof packing. Then, the operation required for components assembled in the main body may be performed through the opening by removing the lid and releasing the opening when it is needed.

[0011] The annular waterproof packing enwraps the peripheral portion of the lid with the first surrounding portion and the second surrounding portion, is mounted on the lid, and hence is handled integrally with the lid. The waterproof packing is not only inhibited from dropping off from the lid but also inhibited from being displaced from a predetermined position with respect to the lid despite being removed from the main body together with the lid. In addition, it is not necessary to bond the waterproof packing to the lid with the adhesive agent to prevent the displacement or dropping-off as described above. The waterproof packing is inhibited from coming off at low cost with the provision of the above-described configuration, even when the waterproof packing is formed of a silicone resin superior in weather resistance properties.

[0012] In the sealed casing of Embodiment 2, the lid includes an annular groove opened toward the opening, and the waterproof packing includes an annular third surrounding portion which is tightly fitted into the annular groove.

[0013] According to Embodiment 2, the third surrounding portion of the waterproof packing gets hung up on the annular groove of the lid even when an external force acts in the direction of removing the waterproof packing from the peripheral portion of the lid in a state in which the lid is removed. The third surrounding portion functions as a stopper, and the state in which the waterproof packing enwraps the peripheral portion of the lid is maintained. Therefore, the waterproof packing is reliably held at a predetermined position on the lid removed from the main body.

[0014] Furthermore, in Embodiment 2, in addition to the fact that the degree of tight contact between the third surrounding portion and the annular groove is enhanced by the tightening forces of the screws, approach path between the lid and the waterproof packing is bent and secured to be long by fitting and engaging the third surrounding portion and the annular groove. Therefore, leakage through between the lid and the waterproof packing is blocked with higher reliability.

[0015] In the sealed casing in Embodiment 3, the lid includes stopper protrusions which bite into the first surrounding portion when the screws are tightened on the peripheral portion thereof.

[0016] In Embodiment 3, the following advantages are expected in addition to the case of Embodiment 1 or 2. When the lid is secured to the main body with the screws, portions tightened by the screws are compressed to a maximum extent, in the region located between the adjacent screws in the first surrounding portion. In contrast, intermediate portions located between these screw mounting portions tend to warp in the direction away from the periphery of the opening of the main body. In Embodiment 3, the stopper protrusions provided on the peripheral portion of the lid bite into the first surrounding portion and hold the intermediate portions. Therefore, the warp of the waterproof packing is prevented, and the degree of tight contact of the first surrounding portion with respect to the portion in the periphery of the opening of the main body is increased. Hence, leakage through between the portion in the periphery of the opening of the main body and the waterproof packing is blocked with higher reliability.

[0017] In the sealed casing of Embodiment 4, the opening and the lid are both formed into a rectangular shape. The stopper protrusions are arranged at both end portions of the lid in the longitudinal direction respectively and the screw through holes of the lid are arranged in inner area than the stopper protrusions in the longitudinal direction.

[0018] In Embodiment 4, there are advantages as followings when the lid is secured to the main body with the screw in addition to the case of Embodiment 3. The position of tightening of the screws is defined by the positions of the screw through holes of the lid. When the screws are tightened and the stopper protrusions bite into the first surrounding portion, the tightening forces of the screws acts with the stopper protrusions as supporting points due to the positional relationship between the screw tightened position and the stopper protrusions in the longitudinal direction of the lid. Consequently, the intermediate portions of the peripheral portion of the lid extending in the longitudinal direction are pressed positively against the portion in the periphery of the opening of the main body. Therefore, the intermediate portions without securing with screws at the peripheral portion extending in the longitudinal direction bring the first surrounding portion of the waterproof packing into tight contact with the periphery of the opening of the main body with high reliability only by the tightening forces of the screws screwed into the four corners of the lid. The waterproof properties between the lid and the main body are secured.

[0019] In the sealed casing of Embodiment 5, an inner diameter of the screw through hole of the waterproof packing is smaller than the diameter of a shaft portion of the screw to be inserted into the screw through hole.

[0020] In Embodiment 5, further, there are the following advantages in addition to the cases of Embodiments 1 to 4. In Embodiment 5, the shaft portions of the plurality of screws penetrate through the screw through holes of the waterproof packing while resiliently deforming the same. The waterproof packing takes a state of being mated with the lid by the first surrounding portion and the second surrounding portion when the lid is removed from the main body. The screws are constrained in the screw through holes by the resilient force of the waterproof packing, and are maintained in the captured state. In other words, when the lid is removed, the screws are inhibited from dropping off from the lid and becoming lost. Therefore, a mounting work which reassembles the lid to the main body can be performed easily.

[0021] The luminaire in Embodiment 6 includes an enclosure, a light-emitting portion, and electric components. The luminaire employs the sealed casing described in any one of Embodiments 1 to 5 as the enclosure. The enclosure includes a translucent member mounted on a part of the main body. The light-emitting portion is housed in the enclosure and emits light toward the translucent member. Electric components are arranged inside the enclosure exposed from an opening formed on the enclosure, and supplies power to the light-emitting portion.

[0022] In Embodiment 6, it is expected that inhibiting the waterproof packing mounted on the lid from coming off may be executed at low cost. In other words, the luminaire which achieves reduction of expense for a maintenance service which involves opening and closing operations of the lid is provided.

[Example 1]

[0023] In Example 1, the luminaire having the enclosure, which is the sealed casing, will be described in detail with reference to FIG. 1 to FIG. 7 below.

[0024] Reference symbol 1 in FIG. 1 to FIG. 3 indicates a luminaire. The luminaire 1 is supported by a holder, for example. The holder and the luminaire 1 constitute a lighting device. In the drawing, reference symbol 2 indicates a channel, which is part of a coupling unit for coupling the holder and the luminaire 1. The coupling unit includes bolts, bolt holders which prevent the bolts from rotating, and so on. The bolts and the bolt holders are arranged at predetermined positions of the channel 2 in the longitudinal direction.

[0025] The luminaire 1 is arranged outdoor together with the holder in order to emit light upward and illuminate an object to be irradiated -- a wall surface of a building, for example. The luminaire 1 includes an enclosure 11 that is a sealed casing and will be described below. The enclosure 11 includes a case 12 as a main body, a waterproof ring 21, a translucent member 23, a pair of holding edges 25, two side panels 31, a lid 45, and a waterproof packing 61.

[0026] The case 12 is obtained by cutting a metal mold material -- an extrusion of aluminum alloy, for example -- into a predetermined length that is an elongated member. As illustrated in FIG. 3, the case 12 includes side walls 13 and a bottom wall 14. The side walls 13 oppose in the width direction (short side direction) orthogonal to the longitudinal direction of the case 12. The bottom wall 14 is flat and is formed continuously from lower ends of the side walls 13 as shown in FIG. 2 and FIG. 4. Between the side walls 13 are opened at the both ends of the case 12 in the longitudinal direction and upward, respectively. The side walls 13 each include a supporting projecting ridge 15 formed on the inner surface thereof so as to project therefrom and extend in the entire length thereof in the longitudinal direction. One of the side walls 13 has the channel 2 on an outer surface thereof.

[0027] The side walls 13 opposed as illustrated in FIG. 3 each include a coupling end portion 16. The coupling end portions 16 are provided in parallel to upper end portions of the side walls 13 with respect to each other, and are formed into a mirror-image form in the width direction of the case 12. The coupling end portions 16 each include a sealing groove 17, a plurality of threaded hole, and so on. The sealing groove 17 extends over the entire length of the coupling end portion 16 in the longitudinal direction, and is opened upward. A plurality of the respective threaded holes are provided at positions away from the sealing groove 17 outward in the width direction of the coupling end portion 16 and are provided at a distance of the coupling end portion 16 in the longitudinal direction.

[0028] The case 12 illustrated in FIG. 3 includes upper tapping holes 18 and lower tapping holes 19. The upper tapping holes 18 are formed integrally with the side walls 13 at positions beneath the coupling end portions 16 and closer to the coupling end portions 16 between the supporting projecting ridges 15 and the coupling end portions 16. The lower tapping holes 19 are formed at corners where the side walls 13 and the bottom wall 14 continue, respectively.

[0029] The waterproof ring 21 is supported by the case 12 as illustrated in FIG. 3. The waterproof ring 21 is formed of a resiliently deformable sealing materiala silicone resin superior in weather resistance properties, for example -- and is formed into a tetragonal ring-shape -- a rectangular ring-shape, for example -- which matches the size of the case 12. A longer portion of the waterproof ring 21 is fitted into the sealing groove 17 and is supported by the coupling end portions 16. A shorter portion of the waterproof ring 21 is bridged between the end portions of the coupling end portions 16 extending in parallel.

[0030] The translucent member 23 is formed of a translucent material -- a glass plate, for exampleand has a tetragonal shape -- a rectangular shape, for example -- one size larger than the waterproof ring 21. The translucent member 23 extended between the parallel coupling end portions 16 is supported by the waterproof ring 21 which is in contact with the peripheral portion of the translucent member 23 from below.

[0031] The straight two holding edges 25 are metal

mold materials -- aluminum alloy extrusion, for examplecut into the same length as the case 12, and each include a tapping hole 26 illustrated in FIG. 3. The tapping hole 26 penetrates through the holding edges 25 in the longitudinal direction. The holding edges 25 each include a plurality of coupling holes 27 as shown in FIG. 1 and FIG. 3. The coupling holes 27 are provided at intervals of each of the holding edges 25 in the longitudinal direction, and penetrate through the holding edges 25 orthogonal to the tapping hole 26 in the vertical direction.

[0032] The holding edges 25 are coupled to the coupling end portions 16 respectively by coupling screws inserted into the respective coupling holes 27 from above and screwed into the respective threaded holes of the coupling end portions 16. Consequently, longer edge portions of the translucent member 23 are clamped between the holding edges 25 and the waterproof ring 21 in the thickness direction. The waterproof ring 21 is compressed and resiliently deforms, and is brought into tight contact with the sealing groove 17 and the lower surface of the translucent member 23, respectively. Waterproof condition at the periphery of the translucent member 23 is secured. Reference symbol 28 in FIG. 3 is a shock absorbing member formed of rubber or elastomer, and is adhered to the holding edges 25 facing to the translucent member 23. An excessive stress applied to the translucent member 23 when the holding edges 25 are secured by screws is inhibited by a function of the shock absorbing member 28 and the translucent member 23 is prevented from becoming damaged.

[0033] The side panels 31 are formed of metal -- diecast products of aluminum alloy, for example. The side panels 31 are coupled to the end portions of the case 12 in a state in which waterproof members 33 are inserted between end surfaces of the case 12, the translucent member 23, and the holding edges 25 in the longitudinal direction and the side panels 31.

[0034] The coupling is assumed by screws 35 screwed into the upper tapping holes 18 of the case 12 through the side panels 31 and the waterproof members 33, screws 36 screwed into the lower tapping holes 19 of the case 12 through the side panels 31 and the waterproof members 33, and screws 37 screwed into tapping holes 26 of the holding edges 25 through the side panels 31 and the waterproof members 33 as shown in FIG. 1 and FIG. 2.

[0035] The waterproof member 33 is formed of a resiliently deformable sealing material -- a silicone resin superior in the weather resistance properties, for example. The side panels 31 and waterproof members 33 have recess portions for releasing ends of the channel 2 in the longitudinal direction as shown in FIG. 1 and FIG. 2. Reference symbol 38 in FIG. 1 and FIG. 3 indicates a cover member secured to the case 12 with the screws 37 together with the side panels 31 and the waterproof members 33. The cover members 38 cover and protect end portions of the translucent member 23 in the longitudinal direction.

[0036] The case 12 has an opening 41 as illustrated in FIG. 2. The opening 41 has a rectangular shape, is provided so that the longitudinal direction thereof matches the longitudinal direction of the case 12, and is arranged at a position close to one end of the bottom wall 14. The case 12 includes a plurality of threaded holes 42 in a periphery of the opening 41. These threaded holes 42 are positioned on the bottom wall 14 in the vicinity of four corners of the opening 41 as illustrated in FIG. 2 in the Example 1.

[0037] The lid 45 closing the opening 41 is fastened by the screws so as to be removed from the case 12. The lid 45 is attached and detached together with the waterproof packing 61 which is described later. The lid 45 is a metal product -- an aluminum diecast product, for example -- for securing its strength. When the high strength is not required for the lid 45, the lid 45 may be formed of a hard synthetic resin.

[0038] The lid 45 is similar to the opening 41 in shape in plan view, and has a rectangular shape larger than the opening 41. The lid 45 includes annular wall 46a rectangular frame, for instance -- projecting toward the interior of the case 12. A peripheral portion 47 of the lid 45 is formed continuously outward from the annular wall 46.

[0039] The peripheral portion 47 includes a thick portion 47a continuing to the annular wall 46 and an area surrounded thereby and a thin portion 47b continuing to the thick portion 47a. A front surface of the thin portion 47b is deviated toward the case 12 with respect to a front surface, where is an area facing toward externally from the case 12, of the thick portion 47a. A back surface, where is the surface facing the case 12, of the thick portion 47a and the back surface, where is the surface facing the case 12, of the thin portion 47b are flush with each other. The lid 45 has an annular groove 48 opened toward the case 12. The annular groove 48 is formed between the annular wall 46 and the thick portion 47a.

[0040] The peripheral portion 47 has screw through holes 49 at corners respectively. The plurality of screw through holes 49 penetrate through the thin portion 47b at the corners. Reference symbol 50 in FIG. 7 designates a short sleeve provided integrally with a front surface of the peripheral portion 47 so as to surround the screw through holes 49.

[0041] As illustrated in FIG. 6, pair of stopper protrusions 51 is arranged on the portions respectively where are the peripheral portions 47 at both end portions of the lid 45 in the longer direction and face the case 12. The stopper protrusions 51 may be provided so as to extend continuously in the shorter direction of the lid 45. The screw through holes 49 are provided between the stopper protrusions 51 provided at the both end portions of the lid 45 in the longitudinal direction. In other words, the screw through holes 49 are provided at positions little deviated toward the center of the lid 45 in the longitudinal direction with reference to the stopper protrusions 51. As a detailed example, the screw through holes 49 are provided between the annular groove 48 and the stopper

protrusions 51, respectively, as shown in FIG. 6. Reference symbols A in FIG. 4 and FIG. 6 show a dimension of deviation of the screw through holes 49 with respect to the stopper protrusions 51.

[0042] As illustrated in FIGS. 2, 4, 6, and 7, the lid 45 is formed with a wire passage hole 52 at an area surrounded by the annular wall 46. The wire passage hole 52 allows passage of a wire holder including a flange portion which comes into contact with a back surface of an area surrounded by the annular wall 46 and a holder cylindrical portion projecting integrally from the flange portion. The wire holder is configured to allow a nut member to be screwed on an outer periphery of the holder cylindrical portion. The holder cylindrical portion has a plurality of opened incision grooves at distal ends thereof to allow reduction of the diameter thereof. The holder cylindrical portion includes a waterproof cylinder which is capable of deforming resiliently inwardly. The wire holder is fastened on the lid 45 in a watertight manner, and the holder cylindrical portion is reduced in diameter when the nut member is tightened onto the holder cylindrical portion. The holder cylindrical portion comes into tight contact with an outer peripheral surface of a wire for power distribution which is passed through the wire holder because the diameter of the holder cylindrical portion is reduced. The holder cylindrical portion has a structure which can secure water-tightness of a wire passage portion in this manner.

[0043] The waterproof packing 61 is formed of a resiliently deformable sealing material -- silicone resin superior in the weather resistance properties, for example -- and is formed into a size which matches the lid 45 and is formed a rectangular frame shape, for example. The waterproof packing 61 includes a first surrounding portion 62, a second surrounding portion 63, a third surrounding portion 64, a tight-contact bead 65, and a plurality of screw through holes 66.

[0044] The first surrounding portion 62 is a portion coming into contact with an outer surface of a periphery of the opening 41 as illustrated in FIG. 3 and FIG. 5, and is formed a continuous annular shape without disconnection as illustrated in FIG. 6 and other figures. The first surrounding portion 62 integrally includes the tight-contact bead 65 projecting toward the outer surface of the peripheral portion of the opening 41. The tight-contact bead 65 also has a continuous annular shape without disconnection. The second surrounding portion 63 is formed into a continuous annular shape on an outer periphery of the first surrounding portion 62, and is folded back so as to cover the peripheral portion 47 of the lid 45 from the front side. The waterproof packing 61 is held on the lid 45 because the first surrounding portion 62 and the second surrounding portion 63 are enwrapping the peripheral portion 47 of the lid 45.

[0045] The third surrounding portion 64 is integrally formed on an inner periphery of the first surrounding portion 62 as illustrated in FIG. 3 and FIG. 5. The third surrounding portion 64 continues at substantially right angle with respect to the first surrounding portion 62, and is formed into a continuous annular shape also in the circumferential direction. The third surrounding portion 64 is fitted tightly into the annular groove 48. The waterproof packing 61 integrally includes a back-side protrusion 67 projecting in the direction opposite from the third surrounding portion 64 with respect to the first surrounding portion 62 on the inner periphery of the first surrounding portion 62. The back-side protrusion 67 is formed continuously with the third surrounding portion 64. The back-side protrusion 67 is also formed into a continuous annular shape. The third surrounding portion 64 and the back-side protrusion 67 are formed so as to come into tight contact with an outer peripheral surface of the annular wall 46 of the lid 45. The back-side protrusion 67 is formed into a tapered shape so as to facilitate insertion into the opening 41.

[0046] The screw through holes 66 are located at four corners of the tight-contact bead 65, and penetrate through the waterproof packing 61 in the thickness direction. The respective screw through holes 66 are overlapped with the positions of the screw through holes 49 of the lid 45 in a state in which the waterproof packing 61 covers the peripheral portion 47 of the lid 45, and are brought into communication with each other.

[0047] The lid 45 is attached to the bottom wall 14 of the case 12 with a plurality of screws 69 (see FIG. 2) together with the waterproof packing 61 mounted so as to enwrap the peripheral portion 47. The screws 69 pass through the screw through holes 49 of the lid 45 and the screw through holes 66 of the waterproof packing 61 communicating with the screw through holes 49, and are removably screwed into the threaded holes 42 of the bottom wall 14. When heads of the respective screws 69 are embedded with the sleeves 50 respectively, it is not only difficult to sight heads of screws 69, but also difficult to influence entering of water because the sleeves 50 facilitate draining of water when the screw heads are watered.

[0048] The diameter of the screw through holes 66 of the waterproof packing 61 is smaller than the diameter of the shaft portions of the screws 69. Therefore, shaft portions of the screws 69 penetrate through the screw through holes 66 in a state of causing the screw through holes 66 of the waterproof packing 61 to resiliently deform.

[0049] In addition, the enclosure 11 having the configuration as described above is equipped with a light-source unit 71, a power-supply unit 81, and other electric components such as a terminal base 83, a surge protector 85, or the like.

[0050] The light-source unit 71 includes a base 72, light-emitting modules 74 (e.g. a plurality of the light-emitting modules 74 exists, but only one of the light-emitting modules 74 is illustrated in FIG. 3), and lenses 77 by the same number as the light-emitting modules 74.

[0051] The base 72 is a metal mold material, e.g. aluminum alloy extrusion, cut to have a slightly smaller

length than the case 12. The base 72 includes engaging grooves 72a opened respectively to both sides in the width direction thereof and a groove portion 72b opened upward. The engaging grooves 72a and the groove portion 72b extend over the entire length of the base 72 in the longitudinal direction.

[0052] The light-emitting module 74 includes a rectangular substrate 75, a plurality of light-emitting portions 76 mounted on the substrate 75, and a pair of wire connectors. The entire length of the substrate 75 is shorter than the entire length of the base 72.

[0053] FIG. 3 illustrates a cross-sectional view of the substrate 75 in the width direction orthogonal to the longitudinal direction thereof.

[0054] The respective light-emitting portions 76 are located at a center of the substrate 75 in the width direction and are mounted at regular intervals of the substrate 75 in the longitudinal direction. The plurality of the light-emitting portions 76 are electrically connected in series via a wiring pattern that the substrate 75 has. LEDs, which are configured with LED package for example, are employed as the light-emitting portions 76. Therefore, the light-emitting modules 74 in this case are LED light-emitting modules and the luminaire 1 provided with the LED light-emitting module is an LED luminaire.

[0055] The LED package includes a base provided with electrodes, LED chips mounted thereon, reflectors having a frustum cone-shaped hollow configured to store the LED chips, and a translucent sealing resin including fluorescent material filled in the depression. The LED package employs the LED chips which emit blue light. Therefore, the LED package employs a yellow fluorescent material in order to obtain white illumination light.

[0056] The light emission from the LED is realized by feeding electricity through a p-n joint of a semiconductor in the normal direction. In other words, the LED is a solid-state device which converts electric energy directly to light. Semiconductor light-emitting elements which emit light on the basis of such a light-emitting principle brings about an energy saving effect in comparison with an incandescent lamp which emits visible light caused by thermal irradiation when a filament is glowed with electric current.

[0057] The wire connectors are mounted respectively to both end portions of the substrate 75 in the longitudinal direction. The wire connectors are electrically connected to ends of a row formed by the plurality of light-emitting portions 76 disposed therebetween.

[0058] When the luminaire 1 includes the plurality of the light-emitting modules 74, the adjacent light-emitting modules 74 are electrically connected to each other in series via a wire wired between the wire connectors. The respective light-emitting modules 74 are placed into the groove portion 72b from above. The light-emitting modules 74 are placed with the light-emitting portions 76 faced upward, and fastened to the base 72 with screws which pass through the substrate 75 and are screwed into the base 72. The light-emitting modules 74 are arranged at a distance, preferably at regular intervals, along the longitudinal direction of the base 72 by being secured with screws.

[0059] Each of lenses 77 is an integral mold formed of a translucent synthetic resin, and includes an optical portion and legs projecting from both sides of the optical portion in the width direction by a plurality of number each. The optical portion has a length which includes the plurality of light-emitting portions 76 that the single light-emitting module 74 has, and a light-incident surface. The shapes of the lens 77 in the cross-sections orthogonal to the longitudinal direction are all the same. The respective lenses 77 cover the light-emitting modules 74 from above and are fastened to the base 72 with screws screwed into the base 72 through the legs thereof. The light incident surfaces of the lenses 77 are arranged right above the light-emitting portions 76.

[0060] The power-supply unit 81 illustrated in FIG. 3 is in charge of power distribution to the respective light-emitting modules 74, and causes the respective light-emitting portions 76 to emit light. The power-supply unit 81 is secured with screws to a lower surface of the base 72. Reference symbol 83 in FIG. 2, FIG. 3, and FIG. 5 designates a terminal base for power distribution. The terminal base 83 is attached to a lower surface of the base 72 and is electrically connected to the power-supply unit 81. A wire for power distribution to be drawing through the opening 41 is connected to the terminal base 83 by insertion. In addition, the luminaire 1 is also provided with a surge protector 85 (see FIG. 5) and the like for absorbing a surge voltage on a lower surface of the base 72.

[0061] When the light-source unit 71 configured as described above is assembled to the enclosure 11, the light-source unit 71 is inserted from one end toward the other end of the case 12 in the longitudinal direction by fitting the engaging grooves 72a onto the supporting projecting ridges 15 of the case 12 respectively. Consequently, the light-source unit 71 is held between the opposed side walls 13 of the case 12. The base 72 of the light-source unit 71 assembled into the enclosure 11 is clamped by the waterproof members 33 in the longitudinal direction. The terminal base 83 is arranged so as to be exposed from the opening 41 as illustrated in FIG. 2 and FIG. 5.

[0062] The luminaire 1 configured as described above is installed outdoor as a projector in a substantially horizontal posture with the translucent member 23 faced upward in order to illuminate the outer wall of the building. When the light-emitting portions 76 of the light-source unit 71 that the luminaire 1 has emit light beams, the light beams radiated from the light-emitting portions 76 enter firstly into the lenses 77. The light beams are widened a lighting angle in the width direction of the enclosure 11 by the lenses 77, and are emitted out from upper surfaces, which is the light emitting surfaces, of the lenses 77. The emitted light beams pass through the translucent member 23 located right above the lenses 77 and illuminates the outer wall upward.

[0063] Heat generated when the LED chips that the light-emitting portions 76 have illuminate the light beams is transferred to the base 72 via the metallic base 72 through the substrate 75. Then, the heat is transferred from the base 72 to the metallic case 12, and emitted from the outer surface of the case 12 to the outside. Therefore, the temperatures of the LED chips are prevented from rising excessively, and hence lowering of the light-emitting efficiency of the light-emitting portions 76 is inhibited.

[0064] A procedure of securing the lid 45 to the case 12 with screws at a final process when assembling the luminaire 1 will be described below. In the lid 45 mounted on the case 12, a side facing the case 12 may be referred to as "back" and a side facing outward from the case 12 may be referred to as "front".

[0065] First of all, the peripheral portion 47 of the lid 45 is covered with the waterproof packing 61. In this case, the peripheral portion 47 is covered with the first surrounding portion 62 and the second surrounding portion 63 of the waterproof packing 61 from the back to the front. Giving a detailed description, the first surrounding portion 62 is overlapped with the entire back surface of the peripheral portion 47, and the second surrounding portion 63 is overlapped with the outer peripheral end surface and the front surface of the thin portion 47b of the peripheral portion 47. Consequently, the entire part of the peripheral portion 47 is enwrapped with the first surrounding portion 62 and the second surrounding portion 63, and the annular shaped waterproof packing 61 is supported by the peripheral portion 47 of the lid 45.

[0066] At this time, the third surrounding portion 64 is inserted into the annular groove 48 of the lid 45, covers the inner peripheral side of the peripheral portion 47, and the back-side protrusion 67 continuing to the third surrounding portion 64 comes into contact with the outer peripheral surface of the annular wall 46 of the lid 45 together with the third surrounding portion 64. The screw through holes 49 located at the four corners of the lid 45 and the screw through holes 66 located at four corners of the waterproof packing 61 are communicated with each other.

[0067] Subsequently, an insulating coated wire for supplying power source passed through the nut member is passed through the holder, after a wire passage holder is attached to the wire passage hole 52 of the lid 45. When the nut member is screwed with the wire passage holder, the wire passed through the lid 45 is temporarily held.

[0068] Then, a distal end portion of the wire is passed through the opening 41 of the case 12, and is connected to the terminal base 83 faced to the opening 41 being inserted thereto. When the lid 45 holding the waterproof packing 61 on the peripheral portion 47 is secured to the bottom wall 14 with screws and then the nut member is finally tightened, the wire passage portion is waterproofed.

[0069] The lid 45 is fastened by screwing the screws 69 inserted into the screw through holes 66 and the screw through holes 49 into the threaded holes 42 of the bottom wall 14, respectively. The luminaire 1 in which the lid 45 is secured to the case 12 with screws in the procedure described above is illustrated in FIG. 3 and FIG. 5.

[0070] Since the lid 45 secured to the case 12 with screws, the first surrounding portion 62 of the waterproof packing 61 is clamped between the back side of the peripheral portion 47 of the lid 45 and the peripheral portion of the opening 41 of the bottom wall 14 and is compressed thereby. In this case, the first surrounding portion 62 within a range where the stopper protrusions 51 are located is pressed against the peripheral portion of the opening 41 stronger than the first surrounding portion 62 having no stopper protrusion part 51. A portion between the peripheral portion of the opening 41 of the bottom wall 14 and the first surrounding portion 62 is waterproofed.

[0071] When the lid 45 is fastened to the bottom wall 14 with screws as described above, the first surrounding portion 62 is compressed to the maximum at the four corners of the lid 45 tightened by the screws 69. At this time, intermediate portions of the first surrounding portion 62 located between the adjacent screws 69 in the width direction of the lid 45 and intermediate portions of the first surrounding portion 62 located between the adjacent screws 69 in the longitudinal direction of the lid 45 tend to deform in the direction away from the peripheral portion of the opening 41 provided on the bottom wall 14.

[0072] As the lid 45 is tightened by the screws 69, the stopper protrusions 51 bite into the intermediate portions of the first surrounding portion 62 along the width direction of the lid 45, and hence the intermediate portions are inhibited from deforming. The degree of tight contact of the first surrounding portion 62 with respect to the peripheral portion of the opening 41 provided on the bottom wall 14 is enhanced. Leakage through between the periphery of the opening 41 of the bottom wall 14 and the waterproof packing 61 is blocked further reliably.

[0073] The stopper protrusions 51 are located respectively at the both end portions of the rectangular lid 45 in the longitudinal direction, and the screw through holes 49 of the lid 45 are arranged between the stopper protrusions 51. In other words, the screw through holes 49 are provided on the center side in the longitudinal direction of the lid 45 with respect to the stopper protrusions 51. Therefore, leakage through between the periphery of the opening 41 provided on the bottom wall 14 and the waterproof packing 61 is blocked further reliably.

[0074] Giving a detailed description, when the lid 45 is secured to the bottom wall 14 with screws in the procedure described above, the tightening positions of the screws 69 defined by the screw through holes 49 of the lid 45 and the stopper protrusions 51 have the positional relationship as described above in the longitudinal direction. Therefore, the tightening forces of the screws 69 act to press longitudinally extending portions of the peripheral portion 47 of the lid 45 against the peripheral portion of the opening 41 provided on the bottom wall 14 as the

fulcrum in the stopper protrusions 51 when the screws 69 are tightened and the stopper protrusions 51 bite into the first surrounding portion 62. In other words, the intermediate portions of the peripheral portion 47 of the lid 45 in the longitudinal direction deform so as to move toward the bottom wall 14. Since the portions of the peripheral portion 47 of the lid 45 extending in the longitudinal direction and the portion of the periphery of the opening 41 provided on the bottom wall 14 clamps the portions of the first surrounding portion 62 of the waterproof packing 61 extending in the longitudinal direction and disposed therebetween strongly, whereby the degree of tight contact of the waterproof packing 61 corresponding to the bottom wall 14 and the peripheral portion 47 of the lid 45 is enhanced.

[0075] Therefore, even when the intermediate portions of the peripheral portion 47 of the lid 45 extending in the longitudinal direction are not screwed, the first surrounding portion 62 of the waterproof packing 61 comes into tight contact with the periphery of the opening 41 provided on the bottom wall 14 reliably only with the tightening forces of the screws 69 arranged at the four corners in the lid 45, the attaching portion of the lid 45 is waterproofed. The number of screwing points may be minimized irrespective of the rectangular shape of the lid 45 and the assembling operation of the lid 45 with the waterproof packing 61 can be facilitated.

[0076] The degree of tight contact between the annular groove 48 of the lid 45 and the third surrounding portion 64 of the waterproof packing 61 inserted thereto is enhanced by tightening the screws 69 as described above. In addition, as the annular groove 48 and the third surrounding portion 64 are provided, the leak path between the peripheral portion 47 of the lid 45 and the waterproof packing 61 becomes a bent complex structure and is elongated. Therefore, leakage into the enclosure 11 through between the lid 45 and the waterproof packing 61 can be blocked further reliably.

[0077] Since the portion where the lid 45 is mounted to the bottom wall 14 is waterproofed and leakage through the opening 41 is restricted as described above, the electric components such as the terminal base 83 installed into the enclosure 11 are protected from water. In addition, since the waterproof packing 61 is formed of silicone resin and is superior in the weather resistance properties, the luminaire used outdoor is maintained in a waterproofed state for a long timefor a period as long as the service life of the light-emitting portions, for example.

[0078] When it is necessary to open the opening 41 after the lid 45 is mounted -- a reconnection of the power feeding wire to the terminal base 83 is needed, for example, -- the respective screws 69 may be loosened and removed from the threaded holes 42, and the lid 45 may be removed from the bottom wall 14 together with the waterproof packing 61 in order to open the opening 41. Thus, the operation required to the terminal base 83 in the case 12 may be performed through the opening 41.

[0079] The tetragonal annular waterproof packing 61 enwraps the peripheral portion 47 of the lid 45 with the first surrounding portion 62 and the second surrounding portion 63 and is held by the lid 45 when the lid 45 is assembled to or disassembled from the bottom wall 14 in the procedure as described above. Therefore, the waterproof packing 61 may be handled together with the lid 45.

[0080] The waterproof packing 61 disassembled from the case 12 of the enclosure 11 together with the lid 45 is inhibited from being displaced with respect to the lid 45 and from coming off from the lid 45.

[0081] The waterproof packing 61 includes the third surrounding portion 64 fitted into the annular groove 48 opened on the back side of the lid 45. Therefore, even when an external force acts on the waterproof packing 61 in the direction away from the center of the lid 45 along the front surface or the back surface of the peripheral portion 47 of the lid 45 in a state in which the lid 45 is removed from the case 12, the third surrounding portion 64 stuck in the annular groove 48. The waterproof packing 61 is maintained in a state of enwrapping the peripheral portion 47 of the lid 45 and is maintained reliably at a predetermined position with lid 45 in the removed state.

[0082] It is not necessary to bond the waterproof packing 61 to the lid 45 in order to avoid displacement or coming off of the waterproof packing 61 with respect to the lid 45. Even when the waterproof packing 61 formed of the silicone resin which is superior in weather resistance properties is employed, the waterproof packing 61 is maintained at a predetermined position reliably and is prevented from coming off from the lid 45 by having a described structure.

[0083] The inner diameter of the screw through holes 66 of the waterproof packing 61 is smaller than the diameter of the shaft portion of the screws 69 to be inserted into the screw through holes 66. In other words, the screws 69 are inserted into the screw through holes 66 in a state of causing the periphery of the screw through holes 66 of the waterproof packing 61 to resiliently deform. When the waterproof packing 61 is removed from the case 12 together with the lid 45, the screws 69 is maintained in a state of being gripped in the screw through holes 66. Therefore, the screws 69 are prevented from dropping off from the removed lid 45 without using a member for preventing dropping such as a retaining ring. The operation to reassemble the lid 45 to the bottom wall 14 is facilitated.

[Example 2]

[0084] FIG. 8 illustrates Example 2. Example 2 is different from Example 1 in the points described below, and the others are the same as Example 1. Therefore, the same reference symbols as in Example 1 are assigned to configurations which achieve the same function as the configurations of the luminaire 1 in Example 1 and the descriptions thereof are to be referred to Example 1.

[0085] The luminaire 1 in Example 2 has a different structure which attaches the translucent member 23 to the case 12 from Example 1, and further includes a louvre 91 for controlling luminous intensity distribution. Detailed description will be described below.

[0086] The coupling end portions 16 of the case 12 each include a hollow portion 16a, a claw receiving portion 16b, a groove formed portion 16c having a sealing groove 17. The sealing grooves 17 are opened outward along the lateral direction, that is, in the width direction of the case 12, in other words, the direction crossing a light flux emitted from the light-emitting portions 76 and the longitudinal direction. The claw receiving portions 16b and the groove formed portion 16c are apart from each other, and a portion between the claw receiving portion 16b and the groove formed portion 16c communicates with the hollow portion 16a from above. The claw receiving portions 16b are arranged on the outside of the case 12, and the groove formed portions 16c are arranged on the inner side the case 12. The waterproof ring 21 is fitted to the sealing grooves 17, and part of the waterproof ring 21 projects into a portion between the claw receiving portion 16b and the groove formed portion 16c.

[0087] The translucent member 23 is formed of a translucent resin such as a transparent acrylic resin or the like. The translucent member 23 has the same length as the case 12, and the dimension in the width direction orthogonal to the longitudinal direction is substantially the same as the width dimension of the case 12. The both end portions of the translucent member 23 in the width direction respectively include locking claws 24 integrally projecting from the back surface thereof facing the case 12. The locking claws 24 extend across the entire length of the translucent member 23 in the longitudinal direction.

[0088] The translucent member 23 is mounted on the case 12 so as to close a portion between the coupling end portions 16 of the case 12. When the locking claws 24 are aligned with slits between the claw receiving portions 16b and the groove formed portions 16c and pushed inward, the locking claws 24 entered into the interior of the hollow portion 16a hooked on the claw receiving portions 16b from below, the translucent member 23 is fastened.

[0089] When the translucent member 23 is assembled to the case 12, a portion of the waterproof ring 21 fitted into the sealing grooves 17 projecting from the sealing grooves 17 is returned back into the sealing grooves 17 and is compressed. The waterproof ring 21 comes into tight contact with the side surfaces of the locking claws 24 which are inserted between the claw receiving portions 16b and the groove formed portions 16c, and waterproofs portions between the coupling end portions 16 and the translucent member 23. The resilient force of the waterproof ring 21 reinforces a constraining force which causes the locking claws 24 to be locked by the claw receiving portions 16b. Also, the force of the waterproof ring 21 pressing the locking claws 24 is received by the claw receiving portions 16b. Since the locking claws 24 are prevented from deforming by the repulsive force of the waterproof ring and a stress concentrating on the proximal of the locking claws 24 is alleviated, so that the durability performances of the locking claws 24 are improved.

[0090] According to the structure in which the translucent member 23 is mounted to the case 12 as described above, the translucent member 23 can be attached easily to the case 12 by inserting the locking claws 24 between the claw receiving portions 16b and the groove formed portions 16c. The luminaire 1 in Example 2 does not need the pair of holding edges 25 and the screws for fastening the holding edges 25 to the case 12 described in Example 1, in comparison with the luminaire 1 in Example 1. Since the holding edges 25 are not needed, the screws 37 to be coupled to the holding edges 25 via the side panels 31 are not needed as well. Therefore, the luminaire 1 in Example 2 achieves reduction in number of components and number of assembly steps.

[0091] The louvre 91 is a pressed metal plate and includes a plurality of -- two, for example,luminous intensity distributing strips 91a and a plurality of leg portions 91b. The luminous intensity distributing strips 91a are formed by bending opening portions cut out for emitting light beams upward in which the light beams are emitted. The length of the louvre 91 is substantially the same as the length of a single light-emitting module 74. The louvre 91 may be formed as a unit having the same length as the entire length of the case 12.

[0092] The louvre 91 is mounted so as to cover the lenses 77 and the leg portions 91b of the louvre 91 are fastened to the base 72 with screws 92 together with the legs of the lenses 77. The luminous intensity distributing strips 91a of the louvre 91 are formed so as to form a right angle with respect to the light emitting surfaces of the lenses 77.

[0093] In the luminaire 1 in Example 2, portions other than the structure described above are the same as Example 1 including the structure not illustrated in FIG. 8. Therefore, in Example 2, the enclosure (sealed casing) 11 in which the waterproof packing 61 attached to the lid 45 is inhibited from coming off from the lid 45 even when the lid 45 is removed from the case 12, and the luminaire 1 having the same are provided in low cost. The luminaire 1 in Example 2 is used preferably for an application in which the weather resistance properties may be low, or an application in which the service life may be short even when high weather resistance properties are required, for example, for an application of illuminating indoor where being subjected to the moisture.

[Example 3]

[0094] FIG. 9 illustrates Example 3. Example 3 is different form Example 2 in the points described below, and other points are the same as Example 2. Therefore, the same reference symbols as in Example 2 are assigned to configurations which achieve the same functions as

the configurations of the luminaire 1 in Example 2 and the descriptions thereof are to be referred to Example 2.

[0095] The luminaire 1 in Example 3 is different from Example 2 in following points. The groove formed portions 16c of the coupling end portions 16 are arranged on the outside of the case 12 in the width direction, and the claw receiving portions 16b are arranged on the inner side of the case 12. The sealing grooves 17 of the groove formed portions 16c are opened inward in the width direction of the case 12.

[0096] In the luminaire 1 in Example 3, portions other than the structure described above are the same as Example 2 including the structure not illustrated in FIG. 9. Therefore, in Example 3, the enclosure (sealed casing) 11 in which the waterproof packing 61 attached to the lid 45 is inhibited from coming off from the lid 45 even when the lid 45 is removed from the case 12, and the luminaire 1 having the same are provided in low cost.

[0097] While certain embodiments have been described, these embodiments have been presented by way of example only, and are not intended to limit the scope of the inventions. Indeed, the novel embodiments described herein may be embodied in a variety of other forms; furthermore, various omissions, substitutions and changes in the form of the embodiments described herein may be made without departing from the spirit of the inventions. The accompanying claims and their equivalents are intended to cover such forms or modifications as would fall within the scope and spirit of the inventions.

Claims

1. A sealed casing (11) **characterized by** comprising:

   a main body (12) having an opening (41) provided with a plurality of threaded holes (42) in a periphery thereof;
   a lid (45) having a size sufficient for closing the opening (41) and having a plurality of screw through holes (49) in a peripheral portion (47) thereof;
   a waterproof packing (61) formed into an annular shape of a resiliently deformable sealing member, attached to the lid (45) so as to enwrap the peripheral portion (47) from a side facing the opening (41) to an opposite side, and having a plurality of screw through holes (66) communicating with the screw through holes (49); and
   a plurality of screws (69) screwed into the threaded holes (42) through the screw through holes (49, 66) of the lid (45) and the waterproof packing (61) communicating with each other and fastening the lid (45) to the main body (12).

2. The sealed casing (11) of Claim 1, **characterized in that**
   the waterproof packing (61) comprises:
   a first surrounding portion (62) having the plurality of the screw through holes (66), and located at a position between a periphery of the opening (41) and the peripheral portion (47); and
   a second surrounding portion (63) configured to cover the peripheral portion (47) continuously from an outer peripheral edge of the first surrounding portion (62) to a side opposite from the opening (41).

3. The sealed casing (11) of Claim 1 or Claim 2, **characterized in that**
   the lid (45) includes an annular groove (48) opened toward the opening (41), and
   the waterproof packing (61) includes an annular third surrounding portion fitting tightly into the annular groove (48).

4. The sealed casing (11) of any one of Claims 1 to 3, **characterized in that**
   the lid (45) includes stopper protrusions (51) on the peripheral portion (47), stopper protrusions (51) which bite the first surrounding portion (62) when tightening the screws (69).

5. The sealed casing (11) of Claim 4, **characterized in that**
   the opening (41) and the lid (45) have a rectangular shape;
   the stopper protrusions (51) are arranged at both end portions of the lid (45) in the longitudinal direction respectively; and
   the screw through holes (49) of the lid (45) are arranged inner side of the stopper protrusions (51) in the longitudinal direction.

6. The sealed casing (11) of any one of Claim 1 to 5, **characterized in that**
   the inner diameter of the screw through holes (66) of the waterproof packing (61) is smaller than the diameter of shaft portions of the screws (69) to be passed through the screw through holes (66).

7. A luminaire (1) **characterized by** comprising:

   an enclosure (11) having a translucent member mounted on part of a main body (12);
   a light-emitting portion housed in the enclosure and configured to emit light toward the translucent member; and
   an electric component arranged in the interior of the casing body adjacent to an opening formed on the casing body and configured to supply a electric power to the light-emitting portion, wherein
   the enclosure (11) comprising:

   the main body (12) having an opening (41)

provided with a plurality of threaded holes (42) in a periphery thereof;
a lid (45) having a size sufficient for closing the opening (41) and having a plurality of screw through holes (49) in a peripheral portion (47) thereof;
a waterproof packing (61) formed into an annular shape of a resiliently deformable sealing member, attached to the lid (45) so as to enwrap the peripheral portion (47) from a side facing the opening (41) to the opposite side, and having a plurality of screw through holes (66) communicating with the screw through holes (49); and
a plurality of screws (69) screwed into the threaded holes (42) through the screw through holes (49, 66) of the lid (45) and the waterproof packing (61) communicating with each other and fastening the lid (45) to the main body (12).

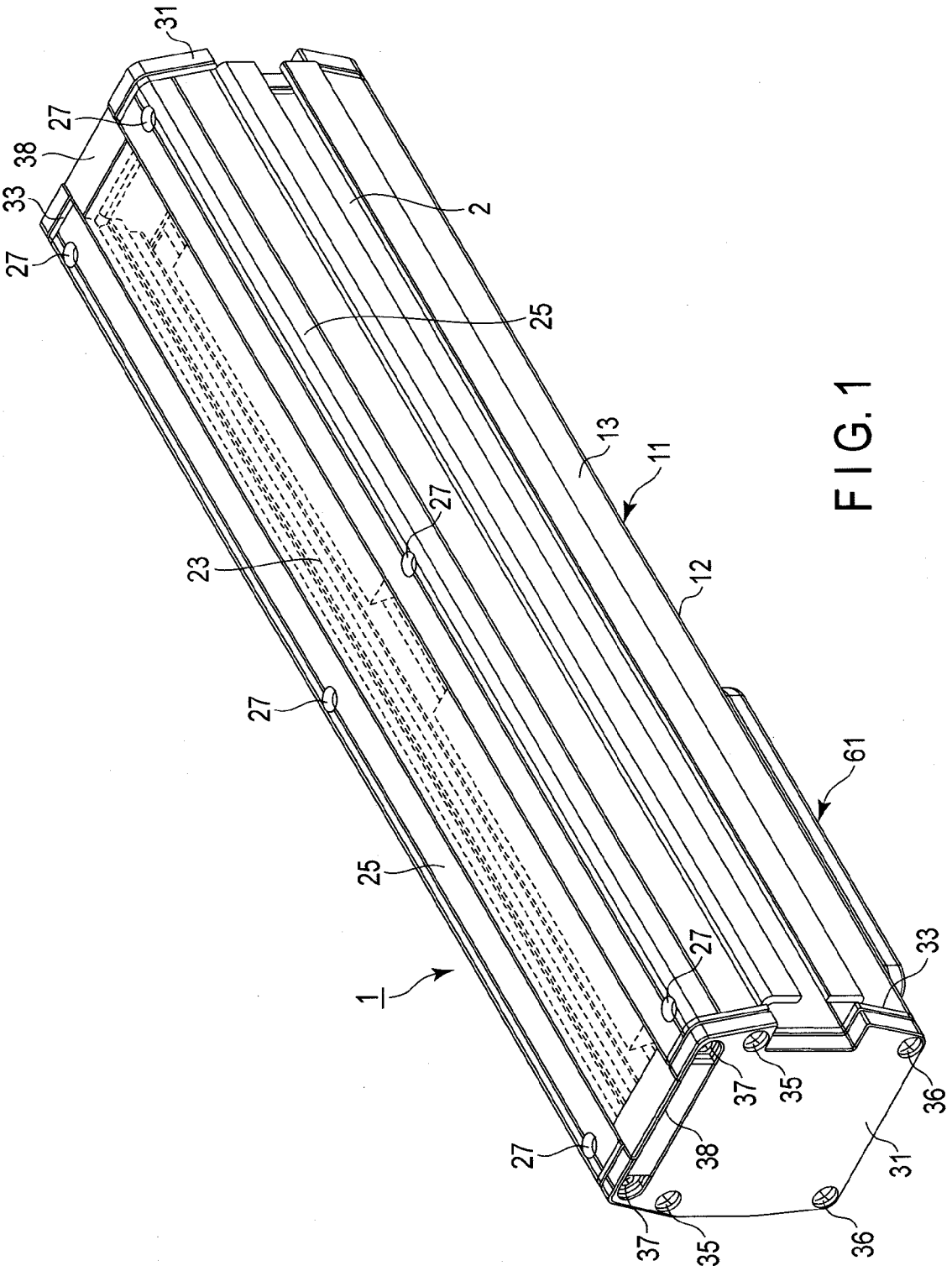
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FIG. 1

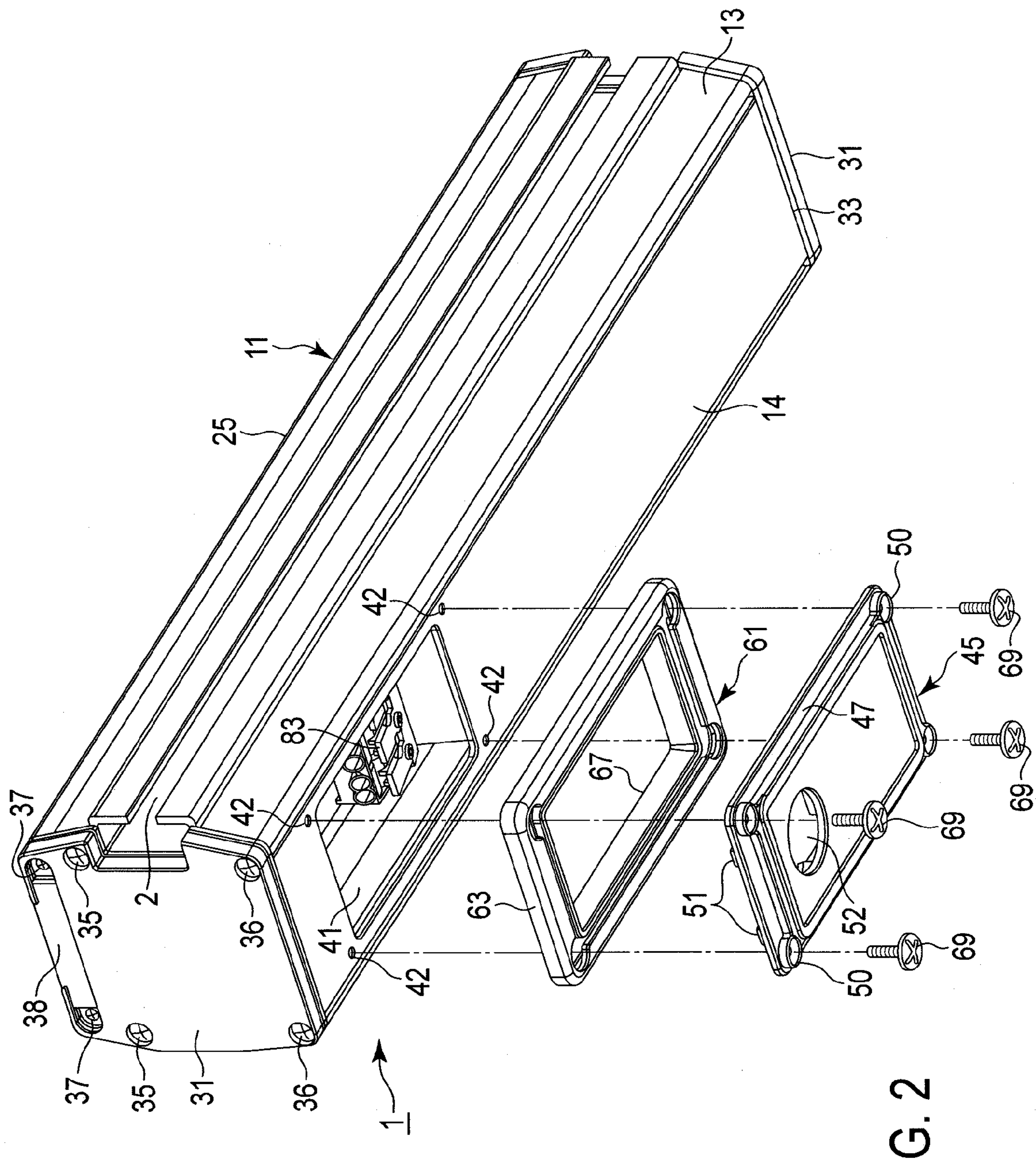

FIG. 2

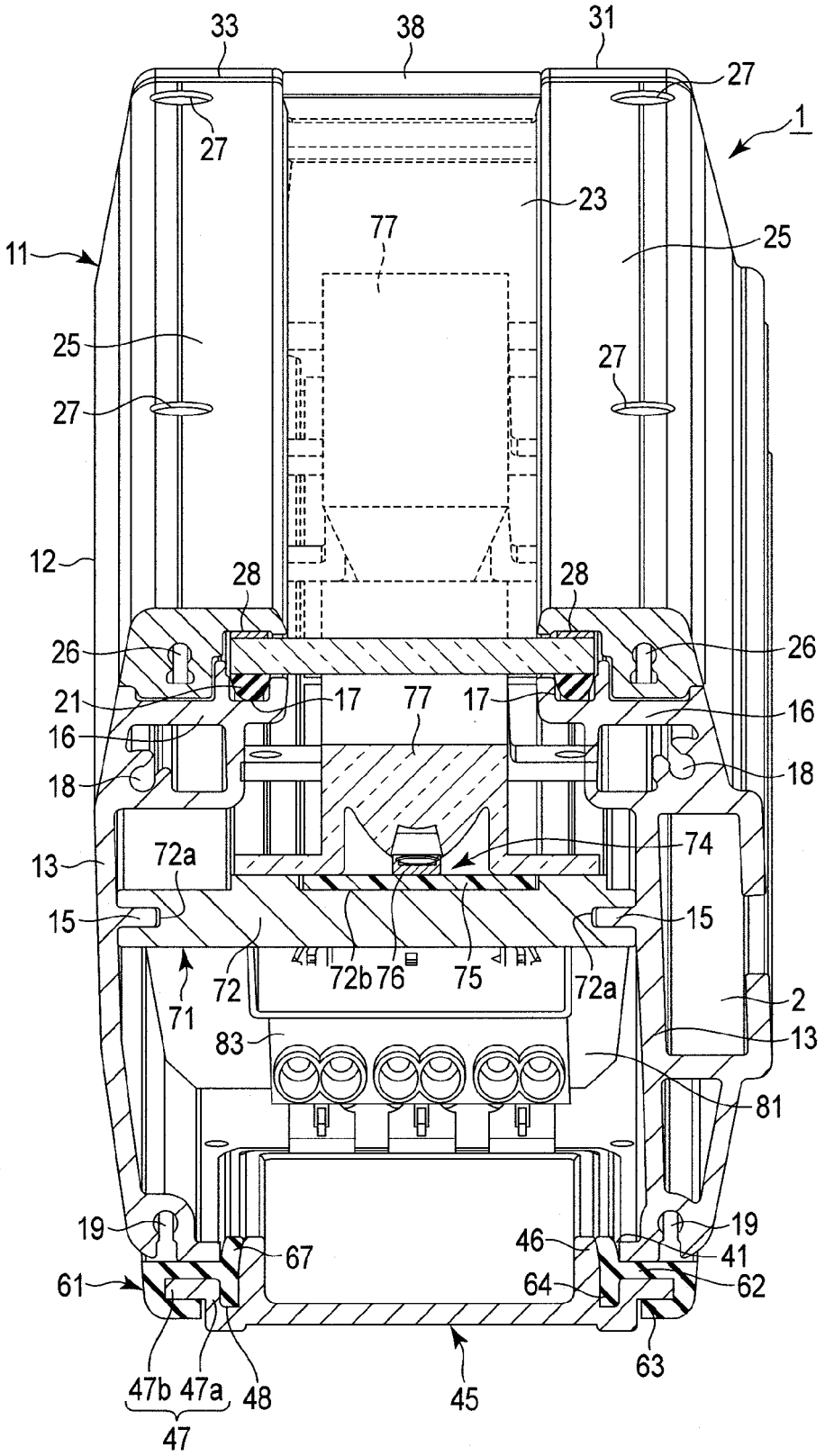
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FIG. 3

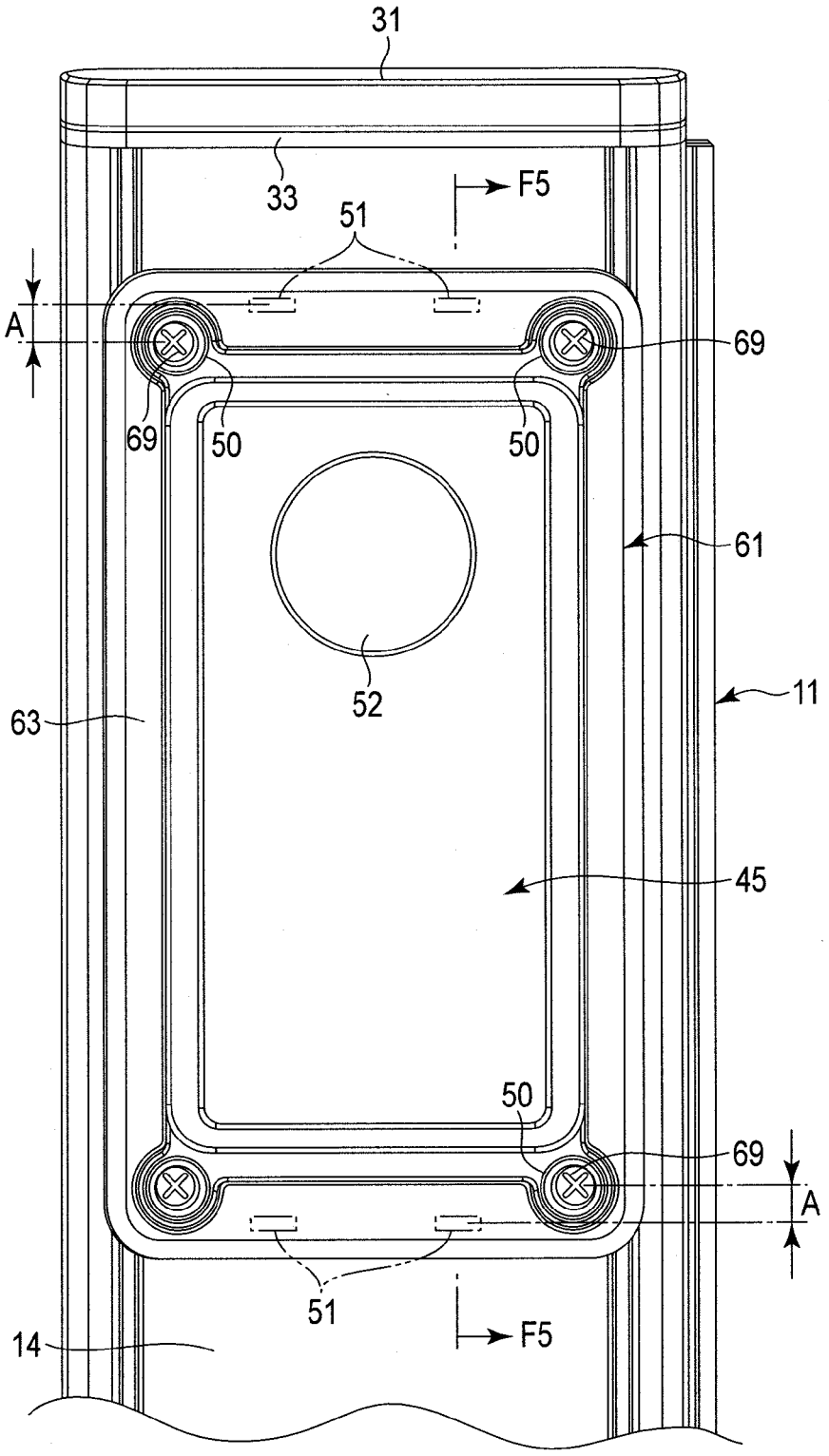

FIG. 4

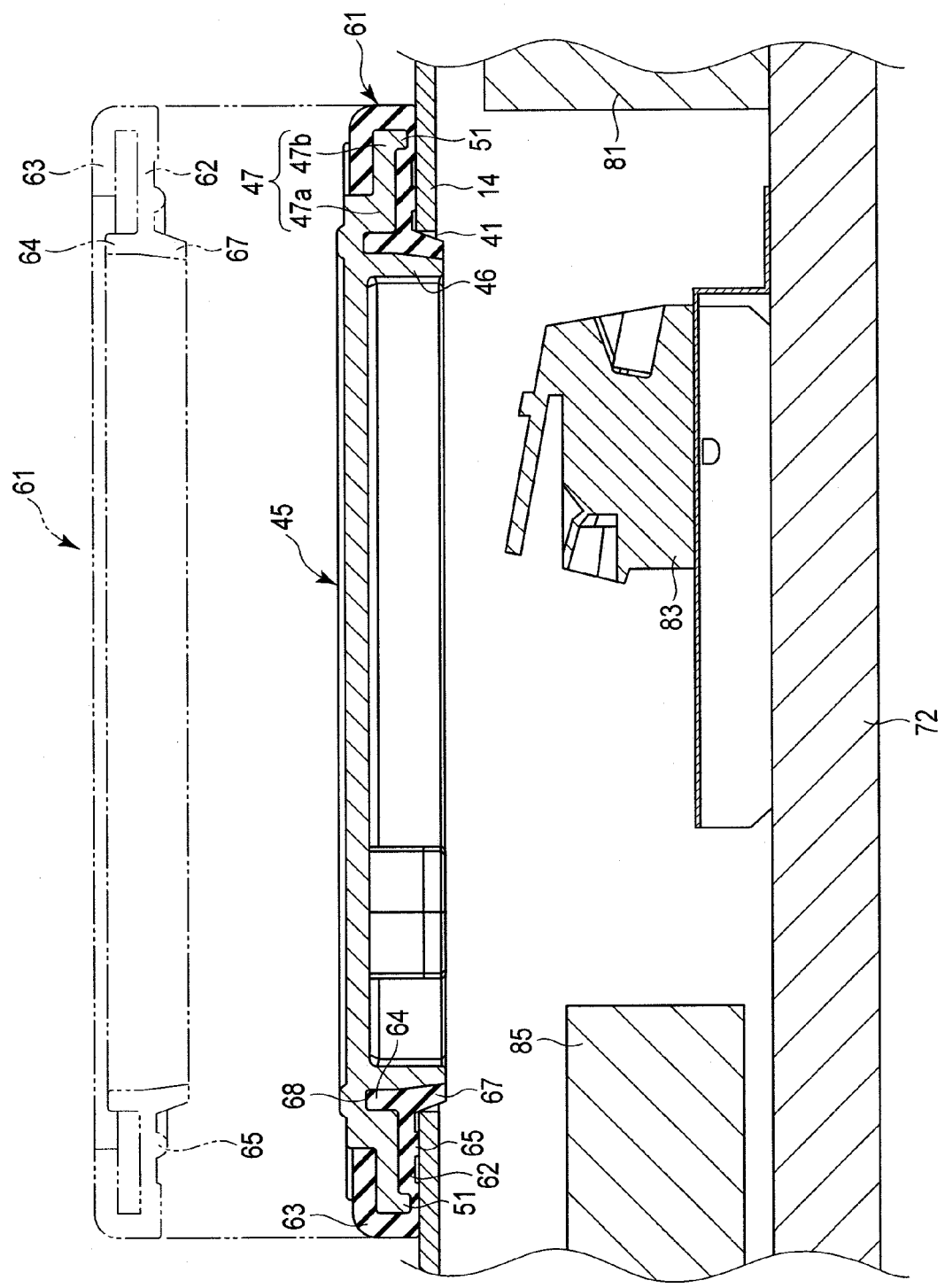
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FIG. 5

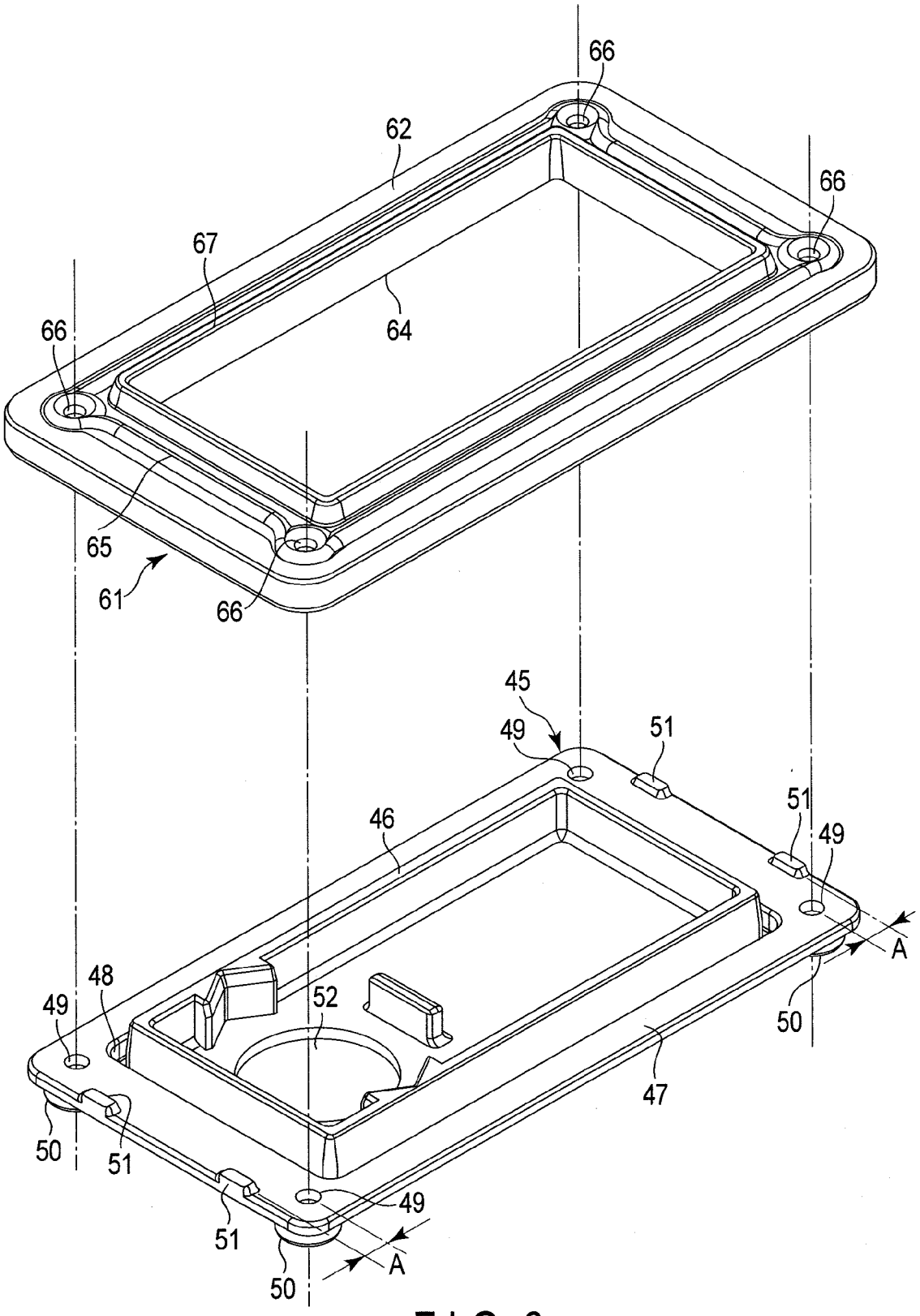
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FIG. 6

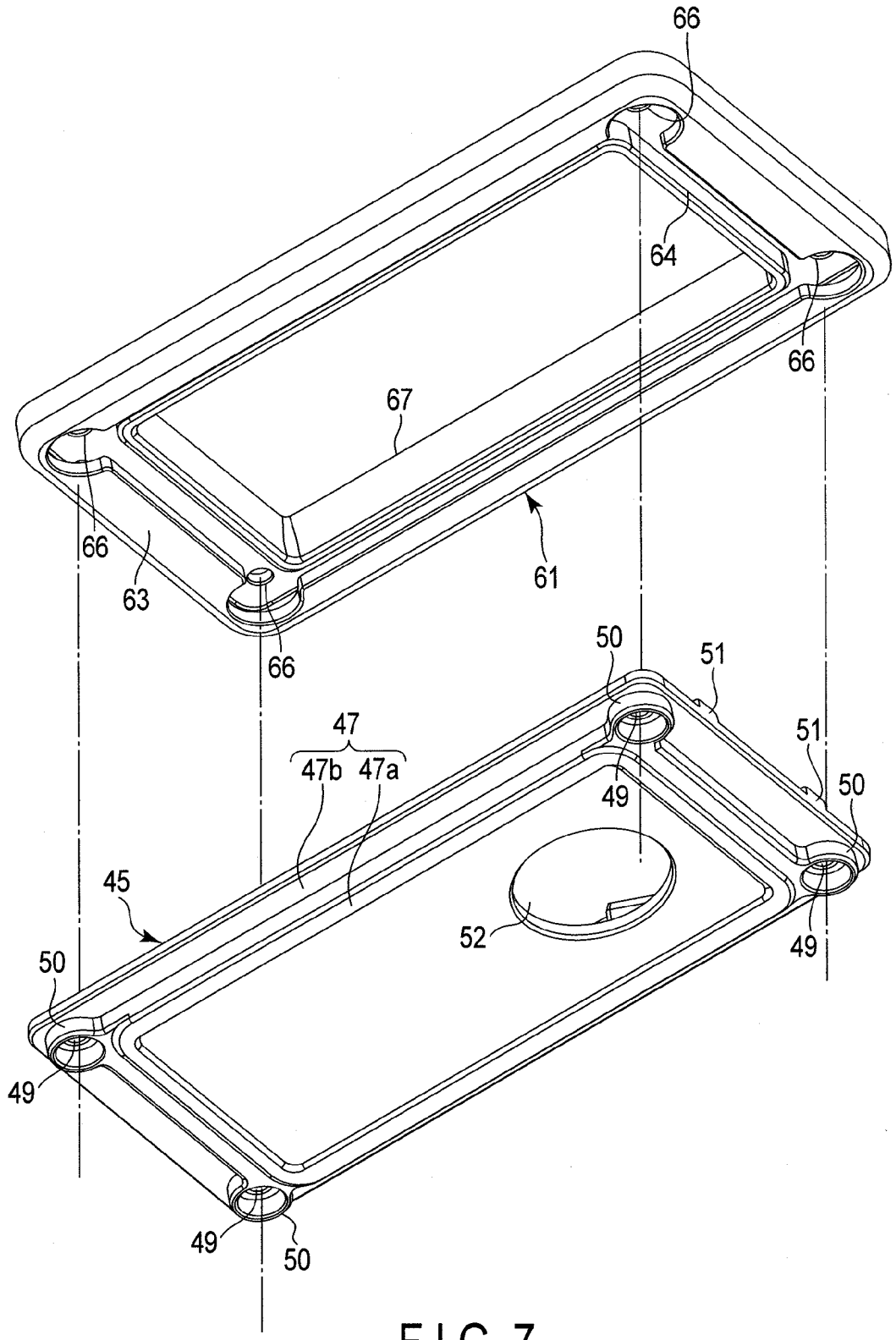
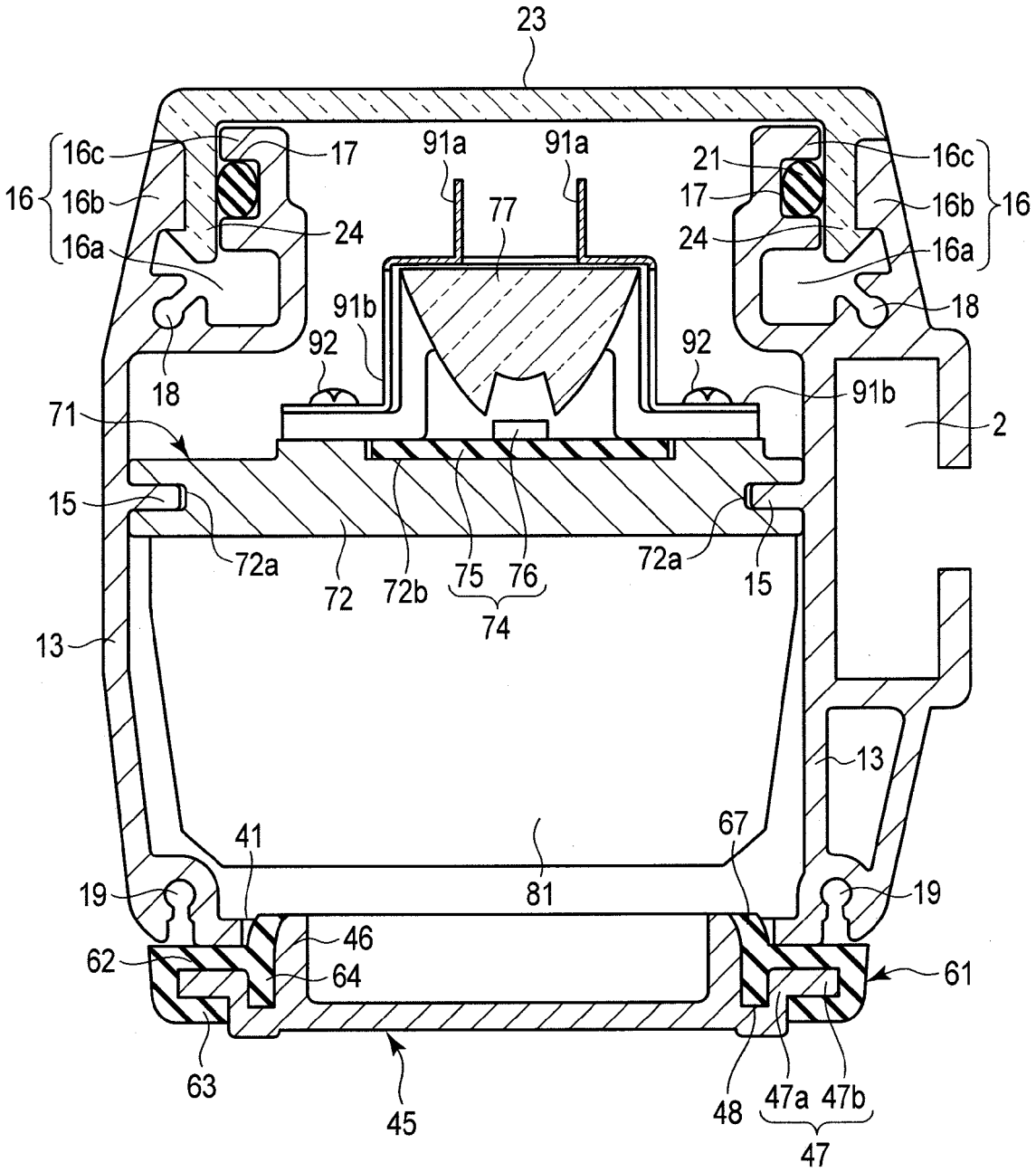


FIG. 7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72b
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76
74
72a
15
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41
81
67
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62
64
61
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91b
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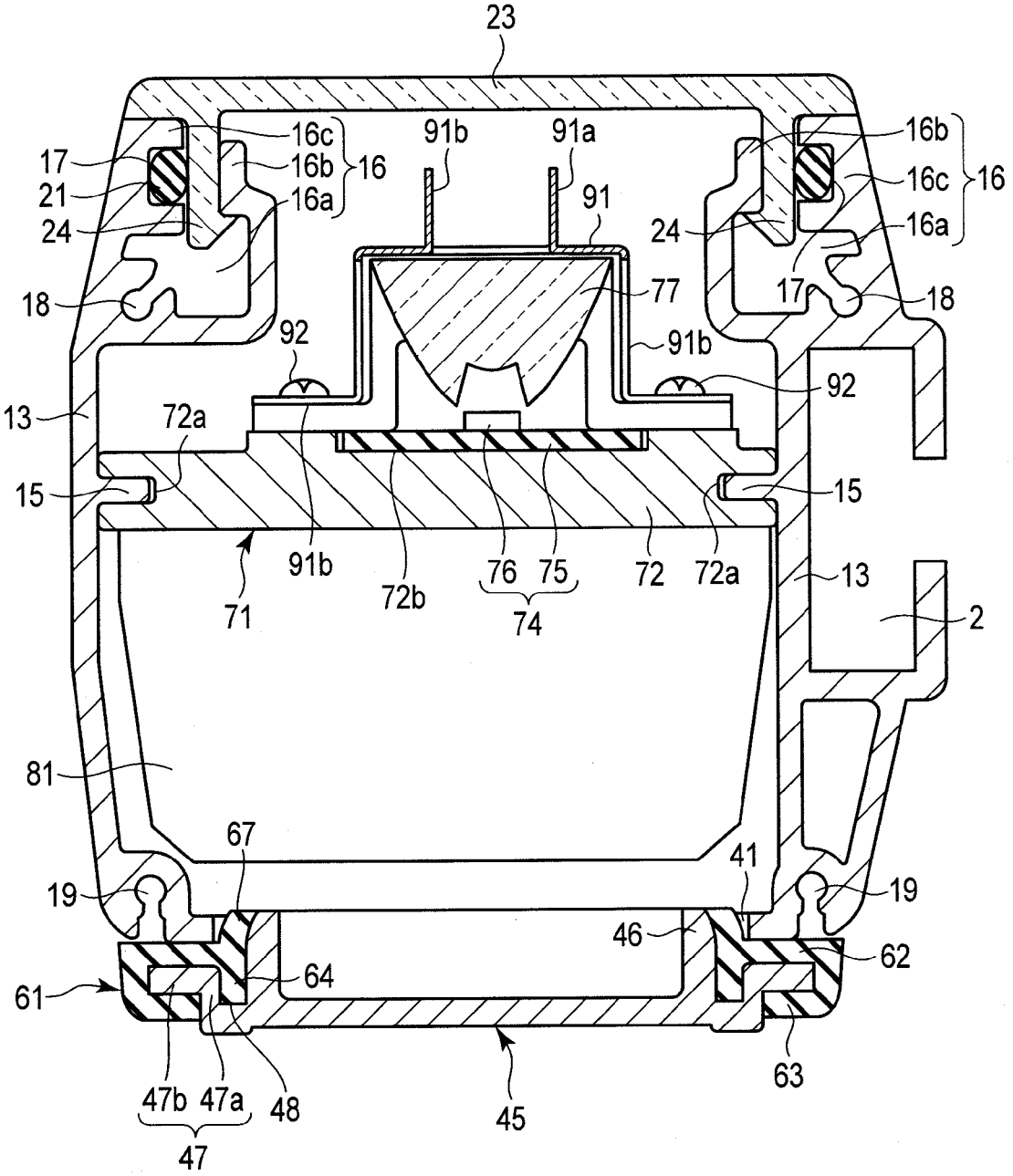
13

FIG. 8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72a
2
81
67
19
41
46
62
61
64
47b
47a
48
47
45
63

FIG. 9