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Description

The present invention relates to a water-proof connector, more in particular to a water-proof connector using a water-proof sealing ring ("0" ring) in the coupling of a female connector housing and a male connector housing.

Four types of construction of water-proof sealing ring- holding arrangements shown in Figures 1A to ID of the accompanying drawings are well known for conventional water-proof connectors. In Figure 1A, a sealing ring 3 is fitted on the lip 1b formed at the forward end 1a of a female connector housing 1, a holder 4 for preventing separation of the sealing ring 3 is mounted at the forward end 1a of the female connector housing, and the female connector housing 1 is coupled with a male connector housing 2. Reference numeral 7 designates a male connector. A female connector is not shown in the drawing.

In Figure 1B, on the other hand, an annular slot 5 for the sealing ring 3 is formed near the forward end 1a of a female connector housing 1, and the sealing ring 3 is fitted in the annular slot 5.

The construction of the water-proof connector shown in Figure 1C is such that a sealing ring 3 is fitted in a recess 6 in the rear portion 2b of a male connector housing 2, the front portion 2a of the male connector housing 2, doubling as a member for preventing separation of the sealing ring 3, is bought into contact with the sealing ring 3, and the outer peripheries of the front and rear portions are welded to each other thereby to retain the sealing ring 3.

The water-proof connector of Figure 1D is so constructed that an annular engaging protrusion 8 is formed in the recess 6 of the male housing 2, and a sealing ring 3 is fixedly fitted between the bottom and the engaging protrusion 8 of the recess 6.

The above-described conventional constructions have the disadvantages mentioned below respectively.

The construction of Figure 1A requires a considerable number of parts, resulting in a high cost and involves more construction steps due to the requirement of the holder to be fixed by welding or like means. In the construction of Figure 1B, the annular slot 5 is required to be moulded integrally with the female housing 1 by use of a pair of vertically-split dies, which unavoidably causes a burr along the parting line separating the upper and lower dies, thus reducing the sealing performance. The waterproof connector of Figure 1C is bulkier than those of Figure 1A or 1B, and also, because of the requirement of welding equipment such as an ultrasonic welder, is impractically high in cost. Lastly, in the construction of Figure 1D, the height of the engaging protrusion 8 is limited to 0.3 to 0.5 mm for processing reasons, so that the sealing ring is liable to come off during transportation, and, upon mounting or demounting of the female connector housing 1, the sealing ring 3 is sometimes reversed and peeled or separated off by the fitting or separation resistance respectively. Further, the sealing rings 3 of the constructions of Figures 1A and 1B are exposed at the outer periphery, and therefore often damaged by contact with other members. In the constructions of Figures 1C and 1D, by contrast, in spite of the advantage of the sealing ring 3 being built in and protected from damage, the sealing ring 3 cannot be visually inspected from the outside.

US Patent US-A- 3,937,545 describes a water-proof connector comprising a sealing ring in a coupling between a female connector housing having a female connector and a male connector housing having a male connector, the female connector housing being inserted into the male connector housing and the sealing ring being retained in the male connector housing such that it forms a seal both against the inside of the male connector housing and against the outside of the female connector housing, wherein said sealing ring includes a basically cylindrical portion with annular protrusions on the inside and the outside thereof and an engaging portion, including an engaging protrusion, a corresponding sealing ring retaining recess being formed in a peripheral wall of said male connector housing for receiving the engaging protrusion of said sealing ring.

According to the present invention, such a connector is modified in that the recess comprises at least two circumferentially spaced slots extending through the wall to permit visual inspection of the engaging protrusions which are arranged to circumferentially correspond with the slots.

Some embodiments of the present invention will now be described, by way of examples, with reference to the accompanying drawings, in which:

Figures 1A to 1D are sectional views of conventional water-proof connector constructions;

Figure 2 is a sectional view of a water-proof connector according to a first embodiment of the present invention;

Figure 3A is a front view of a sealing ring used in the above embodiment, Figure 3B a plan view, and Figure 3C a side view of the same sealing ring;

Figure 4A is a front view, Figure 4B a plan view, and Figure 4C a side view of a male connector housing of the same embodiment;

Figure 5 is a diagram showing, partially enlarged, the coupling of the male connector housing and the sealing ring;

Figure 6 is a sectional view showing a general

configuration of a second embodiment of the present invention;

Figure 7A is a front view of a male connector housing according to a third embodiment of the present invention, Figure 7B a plan view, and Figure 7C a side view of the same male connector housing;

Figure 8 is a diagram showing, partially enlarged, the coupling of the male connector housing and a sealing ring according to the third embodiment;

Figure 9 is a sectional view of a water-proof connector according to the third embodiment;

Figure 10 is a diagram showing, partially enlarged, the coupling of a male connector housing and a sealing ring according to a fourth embodiment of the present invention;

Figure 11 is a front view of a male connector housing according to a fifth embodiment of the present invention;

Figure 12 is a diagram showing a partial sectional view of a male connector housing according to a fifth embodiment taken along the line XII-XII indicated in Figure 11;

Figure 13A is a front view of a male connector housing according to a sixth embodiment of the present invention, Figure 13B a top sectional view,

and Figure 13C a side sectional view respectively of the same male connector housing;

Figure 14 is a sectional view of a water-proof connector according to the sixth embodiment; and

Figure 15 is a diagram showing, partially enlarged, the coupling of the male connector housing and a sealing ring according to the sixth embodiment.

Embodiments of the present invention will now be described with reference to the drawings. Figure 2 is a diagram generally showing a water-proof connector according to a first embodiment of the present invention. Reference numeral 10 designates a female connector housing, numeral 11 a female connector, numeral 20 a male connector housing, and numeral 21 a male connector. Numeral 30 designates a water-proof sealing ring. In this drawing, the water-proof sealing ring 30 is mounted on the male connector housing 20, while the female connector housing 10 is not mounted thereon.

The various parts of the connector will be explained. Numeral 12 designates the front portion of the female connector housing 10, and numeral 13 the forward end thereof. Numeral 22 designates the front portion of the male connector housing, and numeral 23 the rear end thereof. In similar fashion, numeral 24 is defined as a recess of the male connector housing, and numeral 25 as a peripheral wall thereof. Numeral 31 designates a cylindrical body of the sealing ring, and numeral 32 an engaging portion.

Figures 3A to 3C show details of the sealing ring 30. The sealing ring 30 includes a cylindrical portion 31 formed on a tubular rubber ring with a through hole 33 to be fitted on the body of the female connector housing 10, and an engaging portion 32. The internal front end of the engaging portion 32 is formed with a taper 34 for guiding the female connector housing 10 as the latter is inserted. The inner surface of the cylindrical member 32 is provided with annular protrusions 35A, 35B which in use are pressed against the body of the female connector housing 10. In similar manner, the exterior surface of the cylindrical portion 32 is formed with annular protrusions 36A, 36B which in use are hermetically sealed against the peripheral wall 25 of the recess 24 of the male connector housing 20.

A pair of engaging protrusions 37A, 37B are respectively engaged with the sealing ring retaining slots 26A, 26B of the male connector housing 20, and are provided for the purpose of holding the sealing ring 30 in position. The side portion 38 of the engaging portion 33, as shown in Figure 5, forms a slope of outwardly progressive greater thicknesses along the gradient of the sealing ring retaining slot 26A as explained later.

The male connector housing 20 is illustrated in detail in Figures 4A to 4C. Ring retaining slots 26A, 26B for engagement with the engaging protrusions 37A, 37B are formed in the peripheral wall 25 of the recess 24 at the rear end 23 of the male connector housing 20 in order to receive the front portion 12 of the female connector housing 10. The inner wall of the sealing ring retaining slots 26A, 26B is progressively outwardly widened (at gradient angle θ of about 10 degrees) in such a manner as to form a sharp edge at the coupling rims 26A', 26B' between the seal ring retaining slots 26A, 26B and the peripheral wall 25. Numeral 27 in the drawing designates an engaging portion which is engaged by a part of the housing 10 when the female and male connector housings 10 and 20 are fully engaged in the coupled position.

The function of the first embodiment will now be explained. A water-proof connector comprising a holding construction including the engaging protrusions 37A, 37B of the sealing ring 30 and sealing ring retaining slots 26A, 26B of the male connector housing 27 is used as mentioned below.

With reference to Figures 2 and 5, the sealing ring 30 is fitted in advance in the recess 24 of the male connector housing 20 so that the engaging protrusions 37A, 37B are fitted in the sealing ring retaining slots 26A, 26B thereby to keep the sealing ring 30 engaged in the recess 24. The female

connector housing 10 is then inserted into the front portion 22, that is, the inlet of the recess 24. The female connector housing 10, guided by the taper 34 of the sealing ring 30 fitted already, is fitted in the sealing ring 30. The male connector unit 21 of the male connector housing 20 is coupled with the female connector unit 11 in the female connector housing 10. The female connector housing thus inserted is pressed against the annular protrusions 35A, 35B on the inner surface of the sealing ring 30. The peripheral wall 25 of the recess 24 of the male connector housing 20, on the other hand, is contacted by the annular protrusions 36A, 36B on the outer periphery of the sealing ring 30, both being hermetically pressed to secure the sealing performance of the particular portions.

In the water-proof connector according to this embodiment, which has a holding arrangement of the above-mentioned construction, the sealing ring 30 when inserted occupies a very stable position. At the time of insertion or separation of the female connector housing 10, the sharp edges of the coupling rims 26A', 26A", 26B', 26B" of the sealing ring retaining slots 26A, 26B slightly bite into the base of the engaging protrusions 37A, 37B thereby to increase the resistance, hence, the engaging force. As a result, the sealing ring 30 is prevented from coming off, i.e. the cylindrical portion of the sealing ring 30 is prevented from reversing out of position, and therefore these parts are kept in position thereby to improve the stability of the sealing function.

In the water-proof connector according to the embodiment under consideration, the water-proof connector is simple in construction and the sealing ring 30 thereof can be easily mounted or removed. Further, it is low in cost and easy to operate, with the sealing ring 30 built in for protection from external damage. Furthermore, visual identification of the sealing ring 30 is possible through the sealing ring retaining slots 26A, 26B, thus preventing the sealing ring 30 from being left out or a faulty sealing ring from being used.

A second embodiment of the present invention is shown in Figure 6, in which the male connector housing makes up a lamp socket 40. A sealing ring 30 having the same annular protrusions 35A, 35B, 36A, 36B and engaging protrusions 37A, 37B as in the first embodiment is fitted in a bottom recess of the male connector housing 20 for receiving the female connector housing 50. The engaging protrusions 37A, 37B are arranged for engagement with the respective sealing ring retaining slots 26A, 26B formed on the peripheral wall 25 of the male connector housing 20, thereby making up a holding arrangement similar to that of the first embodiment. The above-mentioned lamp socket 40 has the same effect and functions as the male connector unit of the first embodiment. Numeral 41 in the drawing designates a lamp.

Although a sealing ring 30 formed of rubber is used in the above-mentioned embodiments, the sealing ring may be formed of any other suitable material which is subject to deformation under pressure and usable with equal effect.

According to the invention, there are desirably a pair of engaging protrusions 37A, 37B arranged symmetrically with each other for stabilization of the sealing ring. Depending on the circumstances, however, three or more engaging protrusions may be used.

A third embodiment of the present invention will now be described below with reference to Figures 3A to 3C and Figures 7A to 9.

Figures 7A to 7C illustrate a male connector housing 20a of the third embodiment in detail. In order to receive a front portion 12 of a female connector housing 10a, sealing ring retaining slots 50A, 50B which receive the engaging protrusions 37A, 37B of the sealing ring 30 are formed in the peripheral wall 25 of the smaller diameter rear end portion 24 of the male connector housing 20a. On the outside of the sealing ring retaining slots 50A, 50B, cover extensions 51A, 51B are arranged to extend from the rims of the sealing ring retaining slots 50A, 50B in cantilever fashion. The cover extensions 51A, 51B cover the upper rims of the engaging protrusions 37A, 37B fitted in the sealing ring retaining slots 50A, 50B but a small gap is left between the forward ends of the cantilevered cover extensions 51A, 51B and the other rim of the sealing ring stopper slots 50A, 50B. The male connector housing 20a including the cover extensions 51A, 51B may be formed integrally.

The construction of the sealing ring 30 is the same as that of the first embodiment.

With reference to Figures 8 and 9, an explanation will be made of the functions of the holding arrangement including the engaging protrusions 37A, 37B of the sealing ring 30 and the sealing ring retaining slots 50A, 50B of the male connector housing 20a explained with reference to the third embodiment above.

The sealing ring 30 is inserted fixedly in the recess 23 of the male connector housing 20a in advance, and the engaging protrusions 37A, 37B are fitted in the sealing ring retaining slots 50A, 50B thereby to bring the sealing ring 30 into engagement with the recess 23. In the process, the upper rims of the engaging portions 37A, 37B of the sealing ring 30 come into contact with the cover extensions 51A, 51B, while a small gap is formed with the side rim of the sealing ring 30.

By inserting the female housing connector 10a into the male housing connector 20a, the female connector 11 and the male connector 21 are coup-

led to each other. By way of the annular protrusions 35A, 35B, 36A, 36B formed on the sealing ring 30, the male connector housing 20a and the female connector housing 10a are pressed against each other through the sealing ring 30 to secure the sealing performance as in the first embodiment.

In the water-proof connector according to the third embodiment provided with the holding arrangement of the above-mentioned construction, the inserted sealing ring 30 settles very stably in position. It is difficult for the sealing ring 30 to come off or the cylindrical portion 32 of the sealing ring 30 to reverse out of position, thereby stabilizing the sealing functions. Further, the cover extensions 51A, 51B covering the engaging protrusions 37A, 37B of the sealing ring 30 provided over the sealing ring retaining slots 50A, 50B prevent the sealing ring 30 from coming off when the engaging protrusions 37A, 37B are in contact with other members or with other external forces such as those applied by an operator's hand, thus further improving the stability of the sealing ring 30.

With reference to Figure 10, a fourth embodiment of the present invention will be explained. The water-proof connector comprising a sealing ring 30, engaging protrusions 37A', 37B', and sealing ring retaining slots 50A, 50B of the male connector housing 20a and cover extensions 51A, 51B identical to those of the third embodiment, has the maximum width B_1 of the head of the engaging protrusions 37A', 37B' slightly larger than the width B_2 of the sealing ring retaining slots 50A, 50B, the engaging protrusions 37A' and 37B' of the sealing ring 30 being press-fitted into the sealing ring retaining slots 50A, 50B. The structure of the engaging protrusions 37A', 37B' press-fitted into the sealing ring retaining slots 50A, 50B further improves the engaging force of the sealing ring 30 as compared with the third embodiment.

A fifth embodiment will be explained with reference to Figure 12. According to this embodiment, protective ribs 52 extend outwardly from the longitudinal rims of the sealing ring retaining slots 50A, 50B formed in the male connector housing 20a of the third embodiment. Figure 12 shows a partial sectional view taken in the line XII-XII in Figure 11. The engaging protrusions 37A, 37B of the sealing ring 30 are contained in the cover extensions 51A, 51B and the protective ribs 52 and thus the sealing ring is completely prevented from being separated under an external force to which the engaging protrusions 37A, 37B may be subjected.

In the above-described third, fourth and fifth embodiments, the cover extension 51A, 51B may not necessarily be a single member covering the sealing ring retaining slots 50A, 50B but may take a form of a plurality of laterally aligned plates with notches at predetermined positions thereby to facilitate the identification of the sealing ring 30.

A sixth embodiment of the present invention will be explained with reference to Figure 3 and Figures 13 to 15. The construction of the sealing ring 30 is the same as that of the first or third embodiment. Figures 13A to 13C show a male connector housing 20b, Figure 14 a sectional view of the water-proof connector of the embodiment under consideration, and Figure 15 a part detail of the construction shown in Figure 14. First, the male connector housing 20b will be explained.

In order to receive the first half portion of the female connector housing 10b, the male connector housing 20b is provided with sealing ring retaining slots 60A, 60B to receive the engaging protrusions 37A, 37B of the sealing ring 30 in the peripheral wall 25 of the recess 23 of the male connector housing 20b. Further, thin tongues 61A, 61B are integrally formed with the base 23' of the recess 23 at a small distance from the peripheral wall 25, inwardly of the sealing ring retaining slots 60A, 60B and within the recess 23. The forward ends of the thin tongues 61A, 61B extend to a point near the sealing ring retaining slots 60A, 60B and thus face the entrance of the recess 23. Specifically, the thin tongues 61A, 61B are for preventing the sealing ring 30 from separation or peeling off as it is inserted into the recess 23. The gap L_1 between the thin tongues 61A, 61B and the inner surface of the recess 23 is smaller than the distance L_2 from the base of the engaging protrusions 37A, 37B to the forward end of the sealing ring 30 as shown in Figure 15. The thin tongues 61A, 61B are arranged to be received in grooves 12A, 12B formed in the head of the female connector housing 10b when the female connector housing 10b is inserted into the recess 23. Each thin tongue 61A, 61B is not necessarily a single plate, but may take a form of a protruded plate divided to have longitudinal slits or notches. Also, the forward end of the thin tongues 61A, 61B need not extends under the sealing ring retaining slots 60A, 60B. Numeral 27 in Figure 14 designates engaging portions of the female and male connector housings in the coupled state.

The holding arrangement of the water-proof connector according to the sixth embodiment including the engaging protrusions 37A, 37B of the sealing ring 30, the sealing ring retaining slots 60A, 60B of the male connector housing 20b and the thin tongues 61A, 61B, secures the sealing ring 30 stably in position while at the same time improving the sealing functions thereof.

Further, in view of the fact that the thin tongues 61A, 61B are provided with the clearance L_1 on the inside of the sealing ring retaining slots 60A, 60B, the engaging protrusions 37A, 37B of the sealing ring 30 are prevented from projecting from the

sealing ring retaining slots 60A, 60B. Furthermore, the engaging protrusions 37A, 37B are protected from contact with other members or from an external force. What is more, even if the sealing ring 30 is tilted in the recess 23 of the male connector housing 20b as shown by a dotted line of Figure 15, the resulting contact of the end of the sealing ring 30 with the thin tongues 61A, 61B prevents the sealing ring 30 or the engaging protrusions 37A, 37B from being separated. In addition, the tendency to reversal or separation of the sealing ring by the contact resistance between the female connector housing 10b and the annular protrusions 35A, 35B upon mounting or demounting of the female connector housing 10b is reduced by the thin tongues 61A, 61B. It is therefore unnecessary to increase the hardness of the sealing ring 30 or increase the engaging force for forcible insertion of the engaging protrusions 37A, 37B into the sealing ring retaining slots 60A, 60B to an unnecessary degree. As a consequence, the sealing ring 30 may be formed with proper shape and hardness for mounting of the sealing ring 30 to secure stable sealing effect thereof.

The thin tongues 61A, 61B have also the function of guiding the female connector housing 10b as it is inserted as shown in Figure 14, and therefore prevent the female connector housing 10b from tilting as it is inserted or from being inserted reversely.

Claims

1. A water-proof connector comprising a sealing ring (30) in a coupling between a female connector housing (10, 10a, 10b) having a female connector (11) and a male connector housing (20, 20a, 20b) having a male connector (21), the female connector housing (10, 10a, 10b) being inserted into the male connector housing (20, 20a, 20b) and the sealing ring (30) being retained in the male connector housing such that it forms a seal both against the inside of the male connector housing (20, 20a, 20b) and against the outside of the female connector housing (10, 10a, 10b), wherein said sealing ring (30) includes a basically cylindrical portion (31) with annular protrusions (35A, 35B; 36A, 36B) on the inside and the outside thereof and an engaging portion (32), including an engaging protrusion (37A, 37B; 37A', 37B'), a corresponding sealing ring retaining recess (26A, 26B; 50A, 50B; 60A, 60B) being formed in a peripheral wall (25) of said male connector housing (20, 20a, 20b) for receiving the engaging protrusion of said sealing ring (30), characterised in that the recess (26A, 26B; 50A, 50B; 60A, 60B) comprises at least two circumferentially spaced slots (26A, 26B; 50A, 50B; 60A, 60B) extending through the wall (25) to permit visual inspection of the engaging protrusions (37A, 37B; 37A', 37B') which are arranged to circumferentially correspond with the slots (26A, 26B; 50A, 50B; 60A, 60B).

2. A water-proof connector as claimed in claim 1, in which the engaging protrusions (37A, 37B; 37A', 37B') increase in axial thickness in the outward direction.

3. A water-proof connector as claimed in claim 1 or claim 2, wherein the axially inner wall of each slot (26A, 26B; 50A, 50B; 60A, 60B) is sloped to form a sharp edge with the inside of the peripheral wall (25).

4. A water-proof connector as claimed in any preceding claim, in which said sealing ring (30) is formed of a material subject to deformation under pressure.

5. A water-proof connector as claimed in claim 4, in which said sealing ring (30) is formed of rubber.

6. A water-proof connector as claimed in any preceding claim, in which said male connector housing is coupled with a lamp socket (40).

7. A water-proof connector as claimed in any preceding claim, in which said male connector housing includes cover extensions (51A, 51B) for partially covering the rims of said engaging protrusions (37A, 37B) of said sealing ring (30) on the outside of said sealing ring retaining slots (50A, 50B) of said male connector housing (20a).

8. A water-proof connector as claimed in claim 7, in which the width B_2 of each sealing ring retaining slot (50A, 50B) is smaller than the maximum width B_1 of said engaging protrusion (37A', 37B') of said sealing ring (30) along the direction of connector insertion.

9. A water-proof connector as claimed in claim 7, further comprising protective ribs (52) at the longitudinal ends of said sealing ring retaining slots (60A, 60B) of said male connector housing (20b).

10. A water-proof connector as claimed in any preceding claim, further comprising thin tongues (61A, 61B) extending from the base of said male connector housing (20b) inwardly of said sealing ring (30).

Revendications

1. Connecteur étanche à l'eau comprenant une bague (30) d'étanchéité placée dans un ensemble de raccord entre un boîtier (10, 10a, 10b) de connecteur femelle ayant un connecteur femelle (11) et un boitier (20, 20a, 20b) de connecteur mâle ayant un connecteur mâle (21), le boitier (10, 10a, 10b) de connecteur femelle étant inséré dans le boitier (20, 20a, 20b) de connecteur mâle et la bague (30) d'étanchéité étant maintenue dans le boîtier de connecteur mâle de façon à former un joint d'étanchéité à la fois contre la face intérieure du boîtier (20, 20a, 20b) de connecteur mâle et contre la face extérieure du boîtier (10, 10a, 10b) de connecteur femelle, dans lequel ladite bague (30) d'étanchéité comprend une partie (31) essentiellement cylindrique pourvue de saillies annulaires (35A, 35B; 36a, 36B) sur les faces intérieure et extérieure de cette partie, ainsi qu'une partie (32) d'engagement comportant des extensions (37A, 37B; 37A', 37B') à emboîter, des retraits correspondants (26A, 26B; 50A, 50B; 60A, 60B) de retenue de la bague d'étanchéité étant réalisés dans une paroi périphérique (25) du dit boîtier (20, 20a, 20b) de connecteur mâle, qui sont destinés à recevoir les extensions à emboîter de ladite bague (30) d'étanchéité, caractérisé en ce que les retraits (26A, 26B; 50A, 50B; 60A, 60B) comprennent au moins deux fentes (26A, 26B; 50A, 50B; 60A, 60B) espacées sur la circonférence et traversant la paroi (25), de façon à permettre une inspection visuelle des extensions (37A, 37B; 37A', 37B') qui sont agencées dans le sens de la circonférence de façon à coïncider avec les fentes (26A, 26B; 50A, 50B; 60A, 60B).

2. Connecteur étanche à l'eau selon la revendication 1, caractérisé en ce que l'épaisseur axiale des extensions (37A, 37B; 37A', 37B') à emboîter augmente vers l'extérieur.

3. Connecteur étanche à l'eau selon l'une des revendications 1 ou 2, caractérisé en ce que la paroi axialement intérieure de chacune des fentes (26A, 26B; 50A, 50B; 60A, 60B) est inclinée de façon à former une arête vive avec la face intérieure de la paroi périphérique (25).

4. Connecteur étanche à l'eau selon l'une quelconque des revendications précédentes, caractérisé en ce que ladite bague (30) d'étanchéité est réalisée en une matière qui se déforme sous l'effet d'une pression.

5. Connecteur étanche à l'eau selon la revendication 4, caractérisé en ce que ladite bague (30) d'étanchéité est réalisée en caoutchouc.

6. Connecteur étanche à l'eau selon l'une quelconque des revendications précédentes, caractérisé en ce que ledit boîtier de connecteur mâle est relié à une douille (40) de lampe.

7. Connecteur étanche à l'eau selon l'une quelconque des revendications précédentes, caractérisé en ce que ledit boîtier de connecteur mâle comporte des extensions (51A, 51B) de recouvrement destinées à couvrir partiellement les bords des dites extensions (37A, 37B) à emboîter de ladite bague (30) d'étanchéité à l'extérieur des dites fentes (50A, 50B) de retenue de la bague d'étanchéité du boîtier (20a) de connecteur mâle.

8. Connecteur étanche à l'eau selon la revendication 7, caractérisé en ce que la largeur B_2 de chaque fente (50A, 50B) de retenue de la bague d'étanchéité est inférieure à la largeur maximale B_1 des dites extensions (37A', 37B') à emboîter de ladite bague (30) d'étanchéité, vue dans le sens d'insertion du connecteur.

9. Connecteur étanche à l'eau selon la revendication 7, caractérisé en ce qu'il comporte en outre, aux extrémités longitudinales des dites fentes (60A, 60B) de retenue de la bague d'étanchéité du boitier (20b) de connecteur mâle, des nervures (52) de protection.

10. Connecteur étanche à l'eau selon l'une quelconque des revendications précédentes, caractérisé en ce qu'il comporte aussi des languettes minces (61A, 61B), qui s'étendent depuis le fond du dit boîtier (20b) de connecteur mâle, intérieurement par rapport à ladite bague (30) d'étanchéité.

Patentansprüche

1. Wasserdichtes Verbindungsstück mit einem Dichtungsring (30) in einer Verbindung zwischen einem weiblichen Verbindungsstückgehäuse (10, 10a, 10b) mit einem weiblichen Verbindungsstück (11) und einem männlichen Verbindungsstückgehäuse (20, 20a, 20) mit einem männlichen Verbindungsstück (21), wobei das weibliche Verbindungsstückgehäuse (10, 10a, 10b) in das männliche Verbindungsstückgehäuse (20, 20a, 20b) eingesetzt ist und der Dichtungsring derart in dem männlichen Verbindungsstückgehäuse zurückgehalten wird, daß er eine Dichtung sowohl zur Innenseite

des männlichen Verbindungsstuckgehäuses (20, 20a, 20b) hin als auch zur Außenseite des weiblichen Verbindungsstückgehäuses (10, 10a, 10b) hin bildet, wobei der Dichtungsring (30) einen im wesentlichen zylindrischen Bereich (31) mit ringförmigen Ausstülpungen (35A, 35B; 36A, 35B) an seiner Innen- und Außenseite und einen Einrastbereich (32) einschließlich einer Einrastaustülpung (37A, 37B; 37A', 37B') umfaßt, wobei eine entsprechende Dichtungsringaufnahmevertiefung (26A, 26B; 50A, 50B; 60A, 60B) in einer peripheren Wand (25) des männlichen Verbindungsstückgehäuses (20, 20a, 20b) gebildet ist, um die Einrastausstülpung des Dichtungsringes (30) aufzunehmen, dadurch gekennzeichnet, daß die Vertiefung (26A, 26B; 50A, 50B; 60A, 60B) sich durch die Wand (25) erstreckt, um eine Sichtinspektion der Einrastausstülpungen (37A, 37B; 37A', 37B') zu ermöglichen, die so angeordnet sind, daß sie über dem Umfang den Schlitzen (26A, 26B; 50A, 50B; 60A, 60B) entsprechen.

2. Wasserdichtes Verbindungsstück nach Anspruch 1, bei dem die Einrastausstülpungen (37A, 37B; 37A', 37B') nach außen hin in axialer Dicke zunehmen.

3. Wasserdichtes Verbindungsstück nach Anspruch 1 oder Anspruch 2, wobei die axial innere Wand jedes Schlitzes (26A, 26B; 50A, 50B; 60A, 60B) so geformt ist, daS sie eine scharfe Kante mit der Innenseite der peripheren Wand (25) bildet.

4. Wasserdichtes Verbindungsstück nach einem der vorhergehenden Ansprüche, bei dem der Dichtungsring (30) aus einem Material geformt ist, das unter Druck verformt wird.

5. Wasserdichtes Verbindungsstück nach Anspruch 4, bei dem der Dichtungsring (30) aus Gummi besteht.

6. Wasserdichtes Verbindungsstück nach einem der vorhergehenden Ansprüche, bei dem das männliche Verbindungsstück mit einer Lampenfassung (40) verbunden ist.

7. Wasserdichtes Verbindungsstück nach einem der vorhergehenden Ansprüche, bei dem das männliche Verbindungsstückgehäuse Abdekkungserweiterungen (51A, 51B) umfaßt, um teilweise die Ränder der Einrastausstülpungen (37A, 37B) des Dichtungsrings (30) an der Außenseite der Dichtungsringaufnahmeschlitze (50A, 50B) des männlichen Verbindungsstückgehäuses (20a) abzudecken.

8. Wasserdichtes Verbindungsstück nach Anspruch 7, bei dem die Breite B_2 jedes Dichtungsringaufnahmeschlitzes (50A, 50B) kleiner ist als die maximale Breite B_1 der Einrastausstülpungen (37A', 37B') des Dichtungsringes (30) entlang der Verbindungsstückeinsetzrichtung.

9. Wasserdichtes Verbindungsstück nach Anspruch 7, das außerdem Schutzrippen (52) an den longitudinalen Enden der Dichtungsringaufnahmeschlitze (60A, 60B) des männlichen Verbindungsstückgehäuses (20b) aufweist.

10. Wasserdichtes Verbindungsstück nach einem der vorhergehenden Ansprüche, das außerdem dünne Zungen (61A, 61B) aufweist, die sich von der Basis des männlichen Verbindungsstückgehäuses (20b) zur Innenseite des Dichtungsrings (30) erstrecken.

FIG. 1A

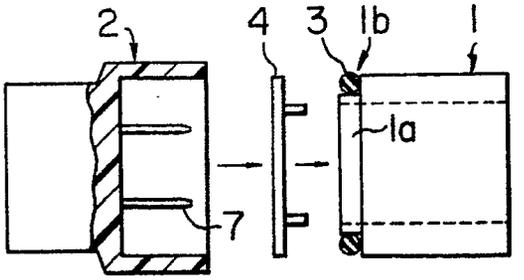


FIG. 1B

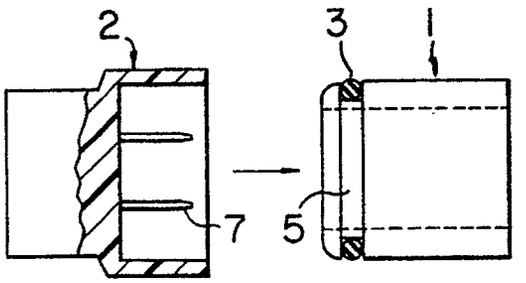


FIG. 1C

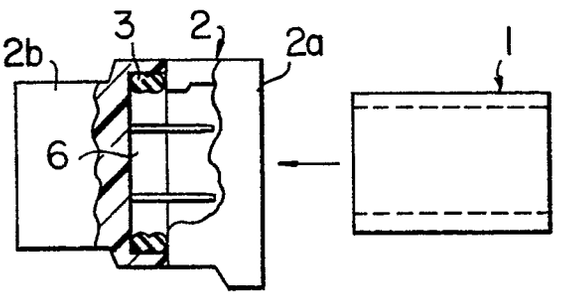


FIG. 1D

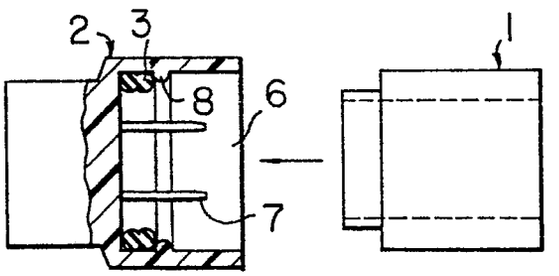


FIG. 2

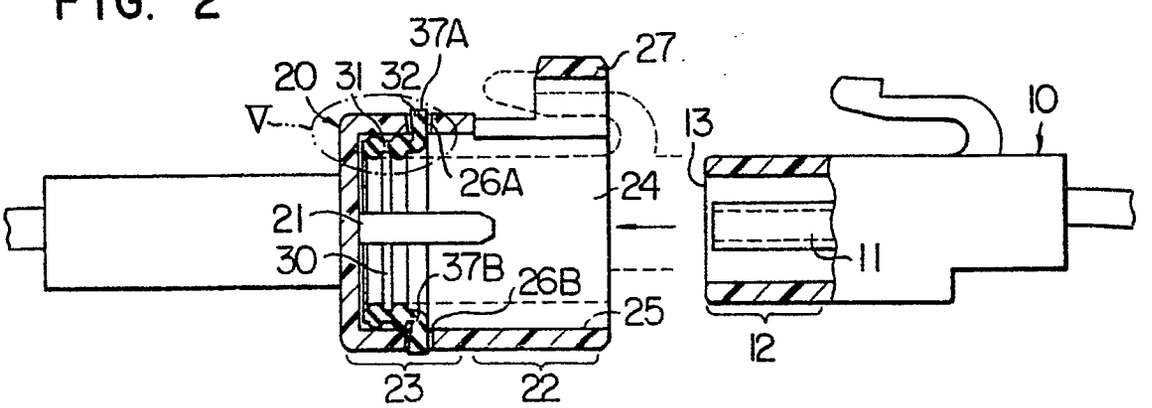


FIG. 3A

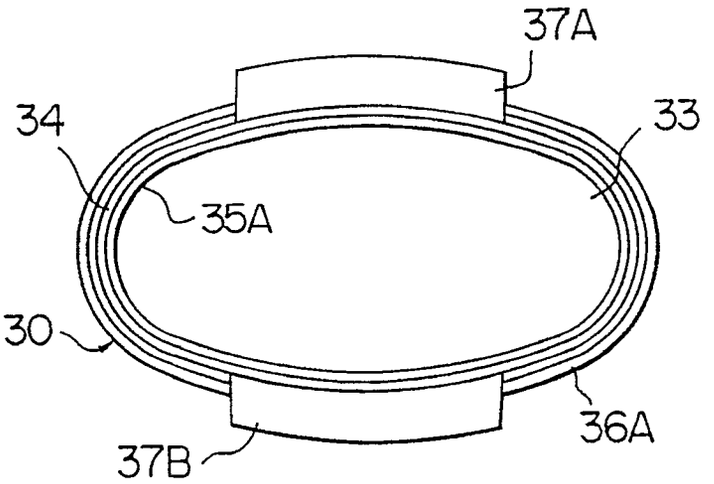


FIG. 3B

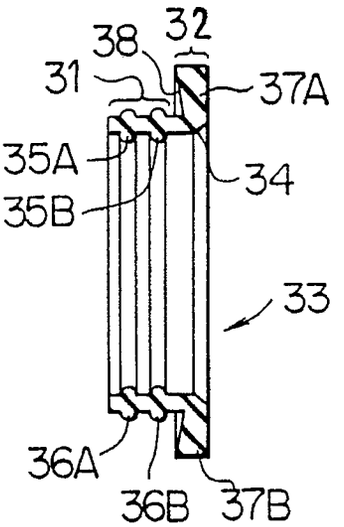


FIG. 3C

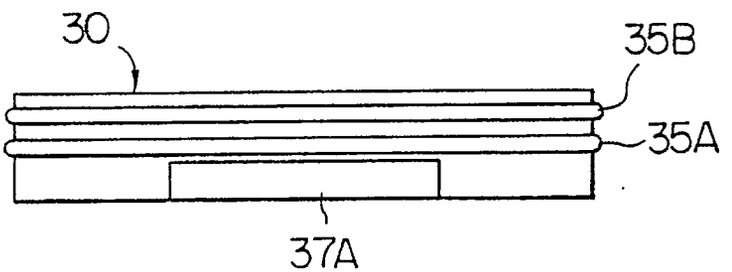


FIG. 4A

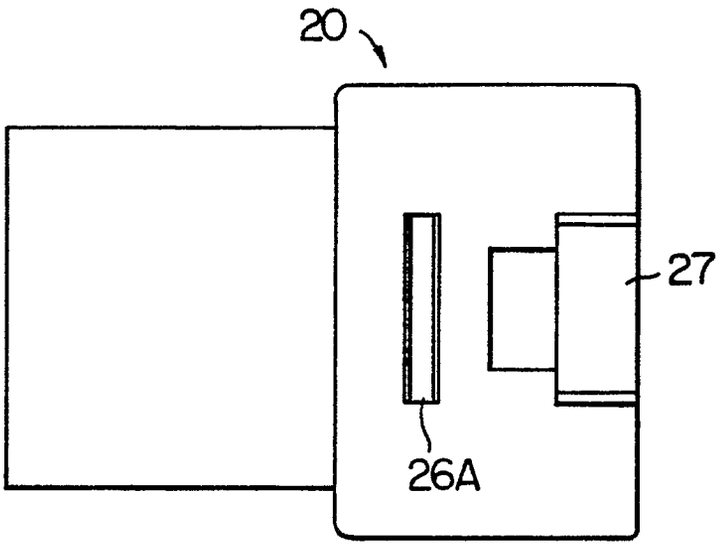


FIG. 4B

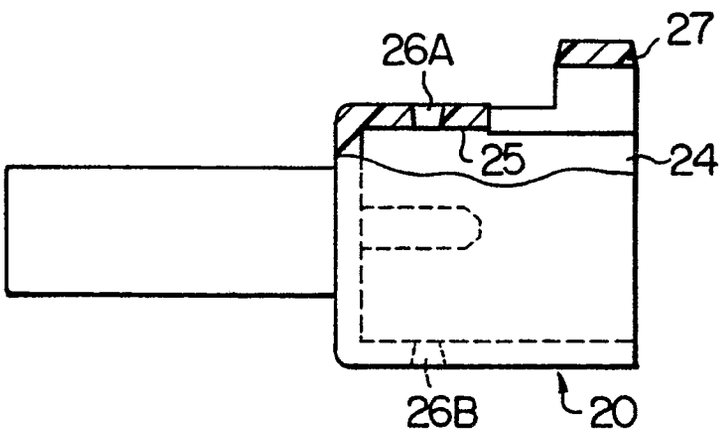


FIG. 4C

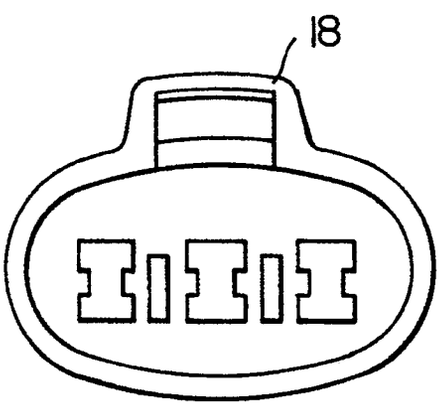


FIG. 5

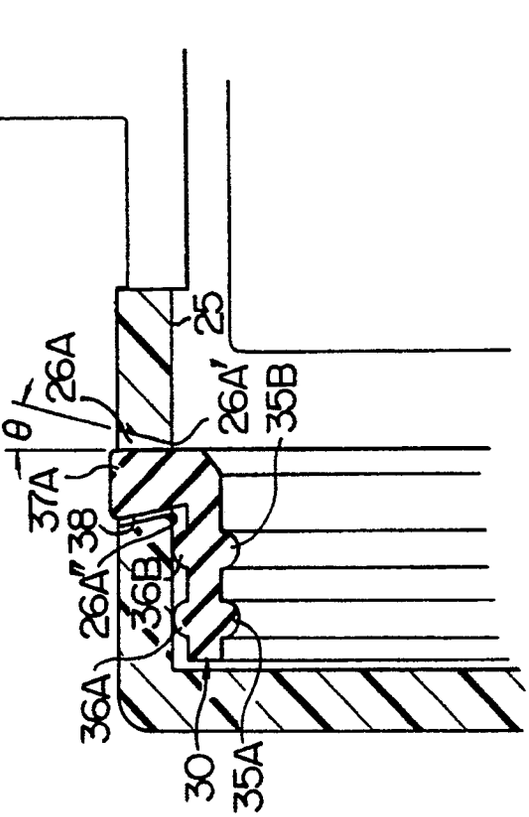

25
26A
θ
26A'
35B
37A
38
26A"
36B
36A
30
35A

FIG. 6

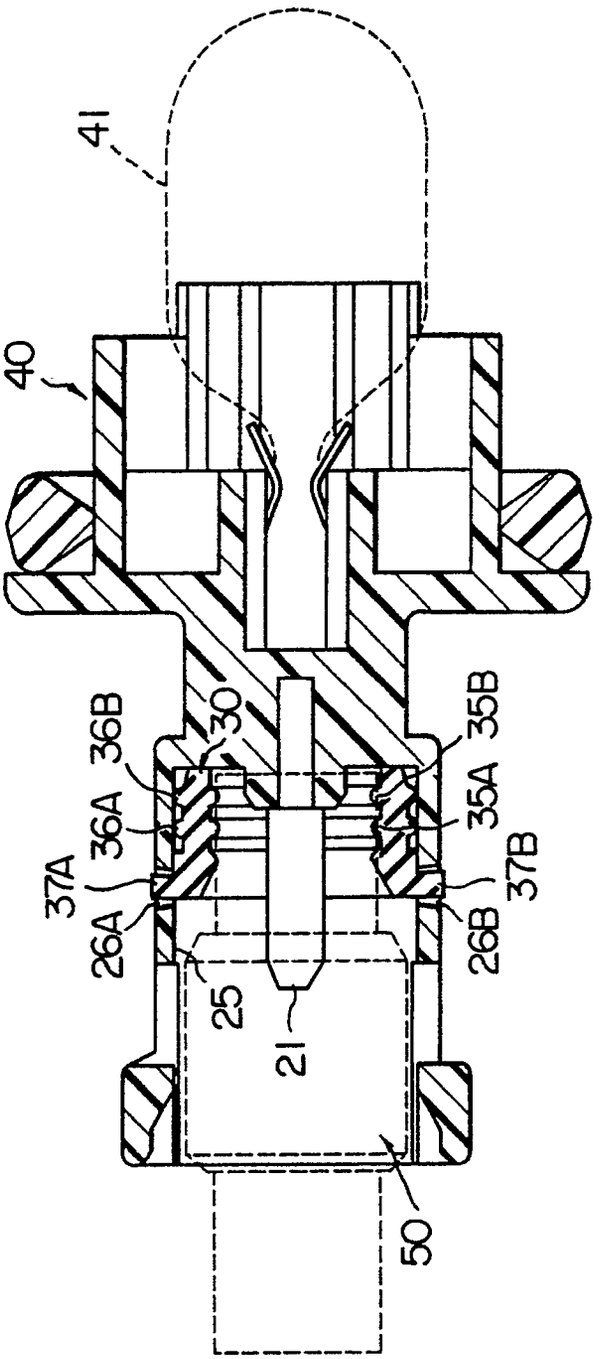

41
40
36B
30
35B
36A
35A
37A
37B
26A
26B
25
21
50

FIG. 7A

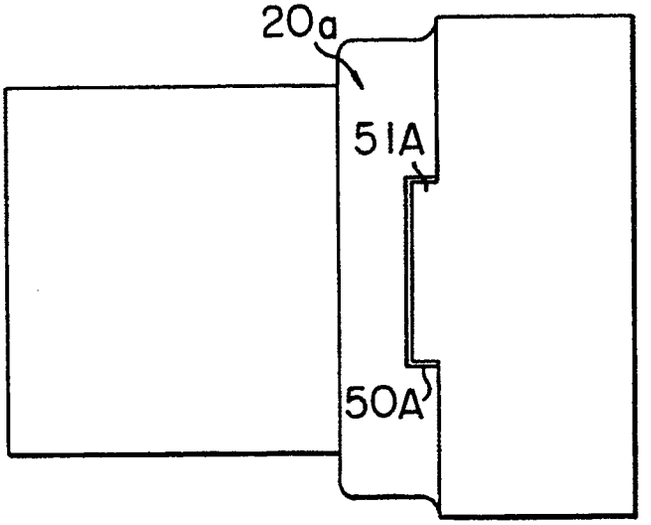


FIG. 7B

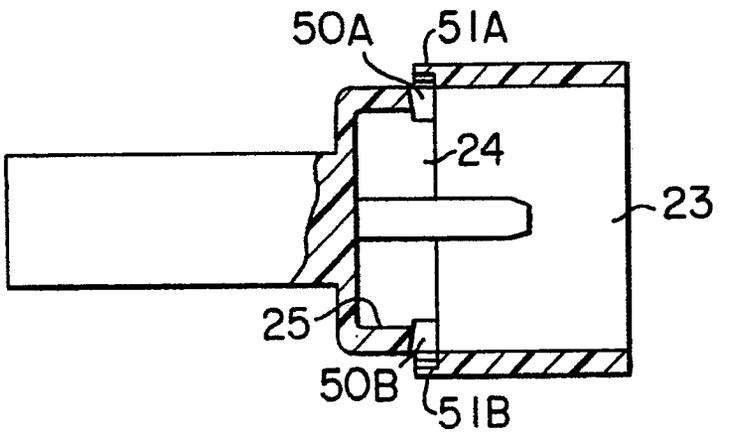


FIG. 7C

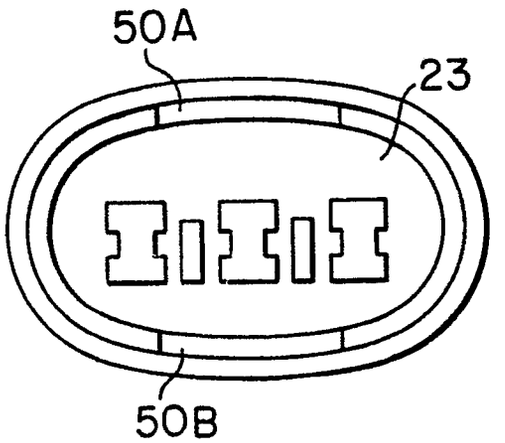


FIG. 8

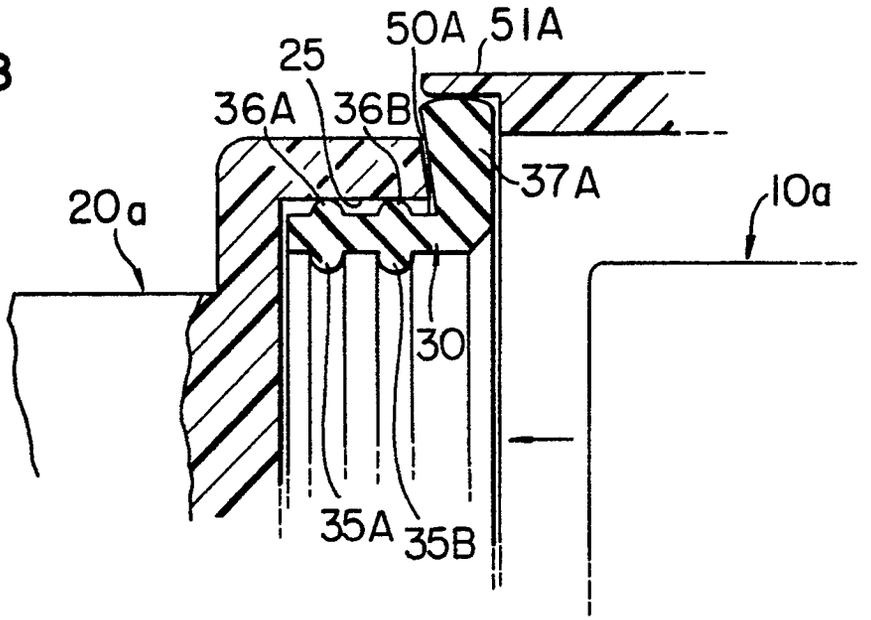

50A
51A
25
36A
36B
37A
10a
20a
30
35A
35B

FIG. 9

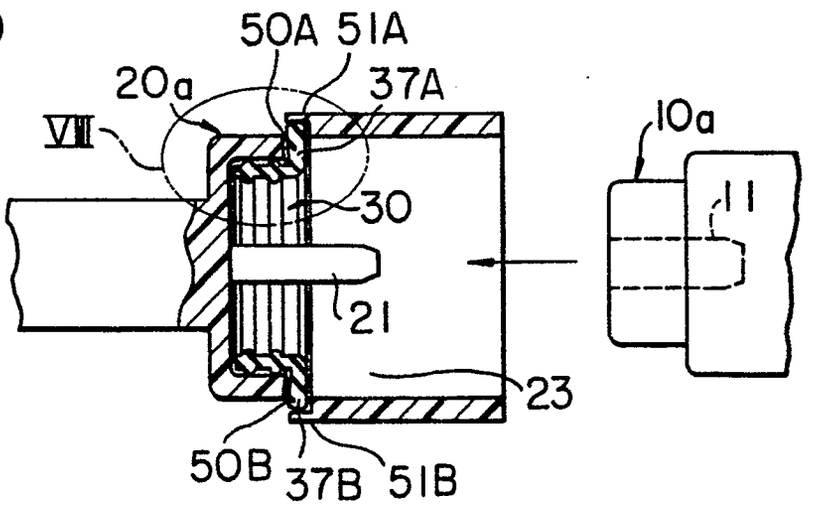

50A
51A
20a
37A
VII
10a
11
30
21
23
50B
37B
51B

FIG. 10

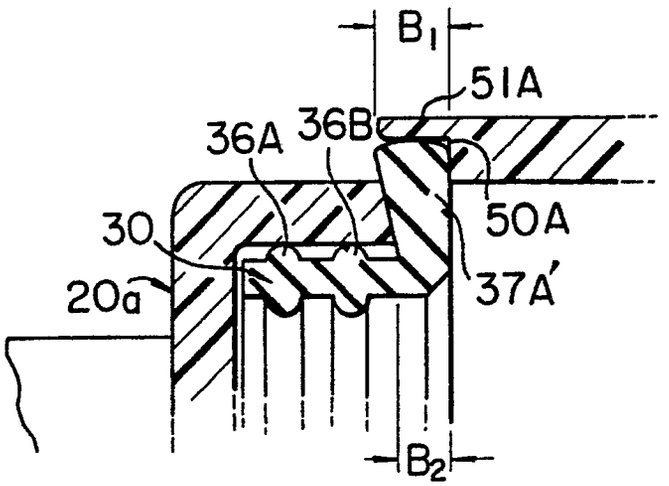


FIG. 11

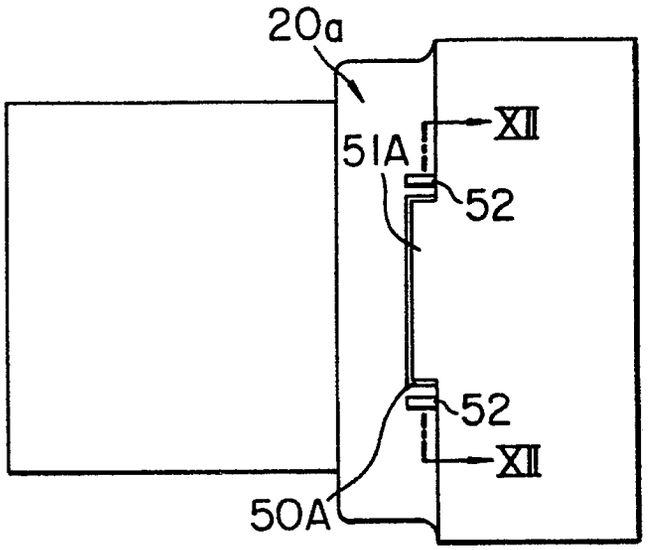


FIG. 12

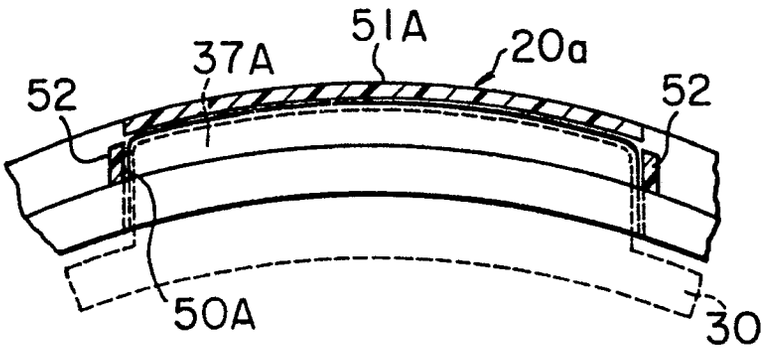


FIG. 13A

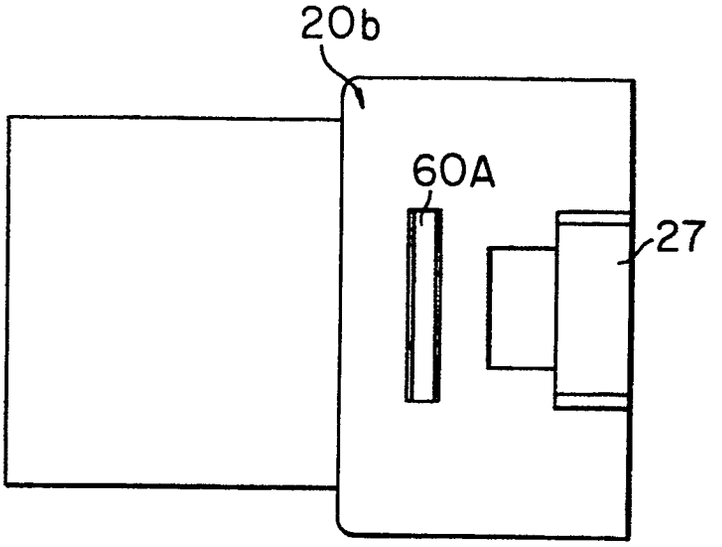


FIG. 13B

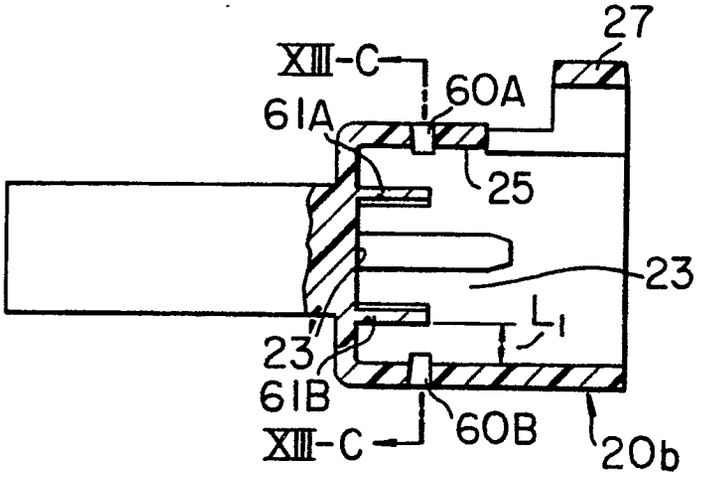


FIG. 13C

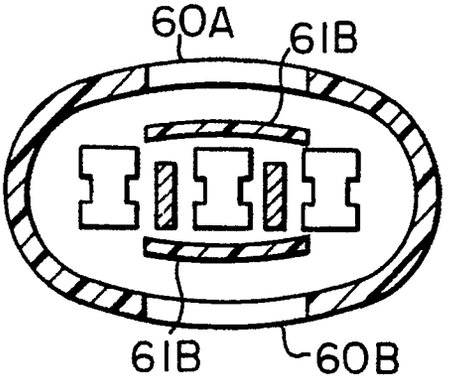


FIG. 14

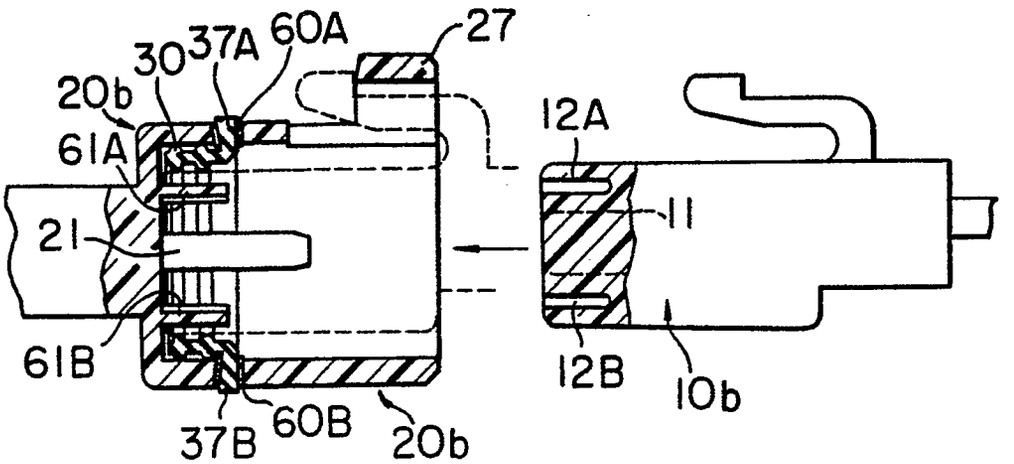
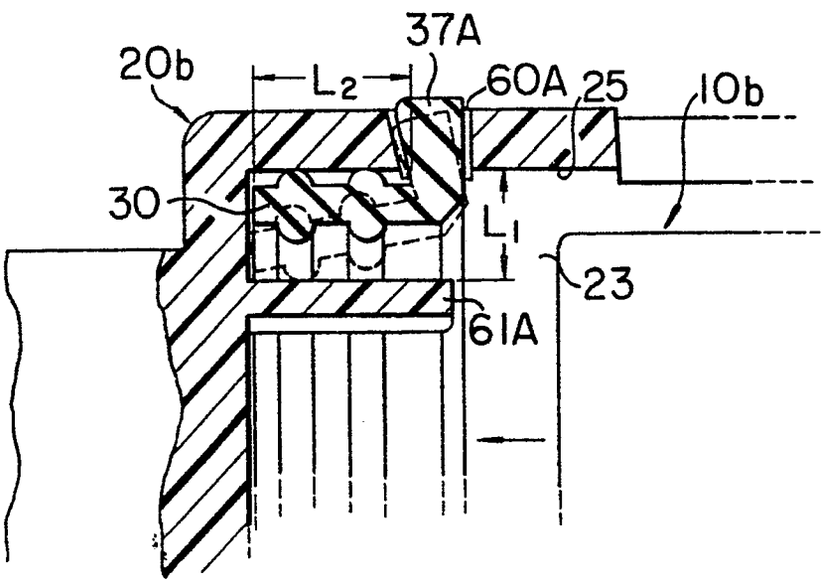

30
37A
60A
27
20b
61A
21
61B
37B
60B
20b
12A
11
12B
10b

FIG. 15


37A
20b
L2
60A
25
10b
30
L1
23
61A