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(54) **A HOUSING ARRANGEMENT**

GEHÄUSEANORDNUNG

SYSTÈME DE BOÎTIER

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EP 3 402 009 B1

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Description

[0001] The present invention relates to a housing arrangement, and more particularly relates to a housing arrangement which is configured to house an electrical device for use in a vehicle.

[0002] An electrical device will typically generate heat when operating. For instance, a radar sensor unit or an electronic control unit (ECU) for use in a vehicle comprises processors and other electrical components which generate heat during operation. The electrical components are usually housed within a housing to protect the electrical components from damage from water, dirt, dust and other elements in the surrounding environment. The housing may be sealed hermetically or sealed such that the housing is resistant to elements in the surrounding environment.

[0003] If a housing is sealed hermetically, the air pressure within the housing increases when the air within the housing is heated by heat from the electrical components. The increased air pressure within the housing can damage the housing, for instance by distorting the housing or rupturing a seal between parts of the housing. In order to minimise this risk of damage, it is known to provide the breather aperture in a housing to enable air to escape to reduce the pressure within the housing.

[0004] The problem with a conventional housing that incorporates a breather aperture is that the breather aperture can become blocked by water or dirt which prevents air from escaping from the housing. Consequently, the air pressure within the housing can increase to a level which damages the housing.

[0005] DE-A-10228948 discloses a conventional electrical device which has an encapsulated housing for accommodating electrical circuits and with at least one connector for electrically connecting the circuit accommodated in the housing to electrical means which can be connected outside the housing, the connector incorporating a channel for pressure equalization.

[0006] The present invention seeks to provide an improved housing arrangement.

[0007] According to the present invention, there is provided an arrangement as defined in claim 1 hereinafter.

[0008] So that the present invention may be more readily understood, embodiments of the present invention will now be described, by way of example, with reference to the accompanying drawings, in which:

Figure 1 is a schematic perspective view of a housing arrangement of an embodiment of the invention,

Figure 2 is a schematic cross-sectional view from above of the housing arrangement of figure 1,

Figure 3 is a schematic cross-sectional view from below of the housing arrangement of figure 1,

Figure 4 is a schematic perspective view of the front

of a first connector of an embodiment of the invention,

Figure 5 is a schematic perspective view of the rear of the connector shown in figure 4,

Figure 6 is a cross-sectional side view of a second connector of the invention,

Figure 7 is a schematic perspective view of the second connector of figure 6,

Figure 8 is a schematic view of a second connector of a further embodiment which incorporates a membrane,

Figure 9 is a schematic cross-sectional view of the invention with a first connector connected to a second connector,

Figure 10 is a schematic cross-sectional view of a further embodiment not forming part of the invention with a first connector connected to a second connector, and

Figure 11 is a schematic cross-sectional view of a housing arrangement of a yet further embodiment not forming part the invention with a first connector connected to a second connector.

[0009] Referring now to figures 1-3 of the accompanying drawings, a housing arrangement 1 of an embodiment of the invention comprises a housing 2 which is configured to house an electrical device 3. The electrical device 3 comprises electronic circuitry and components that are protected physically by the housing 2.

[0010] In embodiments of the invention, the housing 2 is configured to house an electrical device 3 for use in a vehicle, such as a radar sensor unit, an electronic control unit (ECU) or another type of vehicle sensor unit, processing unit or control unit.

[0011] The housing arrangement 1 further comprises a first connector 4 which is carried by the housing 2. In some embodiments, the first connector 4 is formed integrally with the housing 2 but in other embodiments the first connector 4 is a discrete component which is mounted to the housing 2.

[0012] In this embodiment, the first connector 4 is mounted to the housing 2 to at least partly close an aperture 5 in the housing 2. A sealing element or gasket (not visible in figure 3) is preferably provided between the first connector 4 and the housing 2. The sealing element is preferably a waterproof gasket or seal which provides a watertight or substantially watertight seal around the aperture 5 to minimise or prevent moisture, water or other liquids from entering the housing 2 through the aperture 5.

[0013] The sealing element is preferably of an elasti-

cally deformable material with an aperture having a shape that corresponds substantially to the shape of the aperture 5 in the housing 2. The sealing element is positioned so that the aperture in the sealing element is at least partly aligned with the aperture 5 in the housing 2. The first connector 4 is attached to the housing 2 so that at least part of the sealing element is trapped between the housing 2 and the first connector 4 to provide a watertight or substantially watertight seal between the first connector 4 and the housing 2.

[0014] The housing 2 comprises a base and a top cover (not shown) which provide a fluid or gas tight seal with the walls of the housing 2 to enclose the interior of the housing. In other embodiments, the housing may be of a different shape to the one shown in figures 1-3.

[0015] The housing arrangement 2 is provided with a breather aperture 6 which permits air to flow out from the interior of the housing 2 to the surrounding environment. The function of the breather aperture 6 will be described in more detail below.

[0016] Referring now to figure 4 of the accompanying drawings, the first connector 4 comprises a generally planar base 8 with mounting apertures 9, 10 to enable the first connector 4 to be mounted to the housing 2. In some embodiments of the invention, such as the embodiment shown in figure 4, the breather aperture 6 is provided in a portion of the planar base of the first connector 4.

[0017] The first connector 4 further comprises a first connector formation 11 which is coupled to the planar base 8 and extends at least partly around the breather aperture 6. In some embodiments, such as the embodiment shown in figure 4, the first connector formation 11 surrounds the breather aperture 6 in the plane of base of the first connector 4. However, in other embodiments, the first connector formation 11 extends only partly around the breather aperture 6.

[0018] In the embodiments described above, the first connector formation 11 is a generally upstanding wall that extends around the breather aperture 6. However, in further embodiments, the first connector formation is a generally downwardly extending wall that extends at least partly around the breather aperture 6. For instance, in these further embodiments, the first connector formation is a channel or side wall that extends downwardly from the base of the first connector 4, adjacent to the breather aperture 6.

[0019] In some embodiments, the first connector 4 comprises an electrical contact provided on the planar base 8 which is at least partly surrounded by the first connector formation 11.

[0020] Referring now to figure 5 of the accompanying drawings, the housing arrangement of this embodiment comprises a plurality of electrical contacts 12 which extend through the planar base 8 of the first connector 4 to electrical contacts 13 which are provided on the rear side of the first connector 4. The electrical contacts 13 are configured to connect to the electrical device 3 within the housing 2.

[0021] Referring now to figures 6 and 7 of the accompanying drawings, a second connector 14 is configured to connect to the first connector 4. The second connector 14 is, for instance, an electrical connector which is provided at the end of a cable (not shown) which is configured to be connected electrically to the electrical device 3 within the housing 2 via the connectors 4, 14.

[0022] The second connector 14 comprises a second connector formation 15 which is configured to engage with the first connector formation 11 when the first and second connectors 4, 14 are connected to one another. The first connector formation 11 engages the second connector formation 15 such that the first and second connector formations 11, 15 at least partly block fluid in the surrounding environment from entering the breather aperture 6. The engagement of the first and second connectors 4, 14 preferably provides a watertight or substantially watertight seal between the connectors 4, 14 which minimises or prevents moisture, water or other liquids in the surrounding environment from entering the breather aperture 6. In the context of embodiments of the invention, the surrounding environment is the environment in the immediate vicinity of the first connector 4.

[0023] In some embodiments, a watertight sealing element or gasket (not shown) is provided on at least one of the first and second connectors 4, 14 so that, when the connectors 4, 14 are connected to one another, the sealing element provides a watertight or substantially watertight seal between the connectors 4, 14.

[0024] In some embodiments, the second connector 14 comprises electrical contacts 16 which are configured to contact the electrical contacts 12 on the first connector 4, when the connectors 4, 14 are connected to one another.

[0025] According to the invention, the second connector 14 is provided with a further breather aperture 17. The further breather aperture 17 is positioned so that the further breather aperture 17 is at least partly aligned with the breather aperture 6 when the first and second connectors 4, 14 are connected together, as shown in figure 9.

[0026] In an embodiment, the second connector 14 comprises a breather channel 17a which extends through the body of the second connector formation 15. The further breather aperture 17 is provided at one end of the breather channel 17a and an outlet breather aperture 17b is provided at the other end of the breather channel 17a.

[0027] The further breather aperture 17 cooperates with the first breather aperture 6 and the breather channel 17a provides a continuous fluid flow path from the first breather aperture to the surrounding environment, through the outlet breather aperture 17b. The further breather aperture 17 therefore enables air flowing out from the interior of the housing 7 via the breather aperture 6 to escape to the surrounding environment.

[0028] Referring now to figure 8 of the accompanying drawings, the further breather aperture 17 on the second

connector 14 is at least partly closed by a membrane 18. The membrane 18 is preferably of a material which enables fluid, such as air, to flow through the membrane 18 in one direction but which prevents fluid or debris, such as water or dirt, flowing through the membrane 18 in another direction. In other embodiments, the membrane 18 is omitted or replaced with a different one-way valve arrangement.

[0029] Referring now to figure 10 of the accompanying drawings, a housing arrangement 19 of other embodiments not forming part of the invention comprises the same components as the housing arrangement 1 described above. However, in these embodiments, the second connector 14 does not incorporate a further breather aperture. In these embodiments, the second connector formation 15 is configured to engage with the first connector formation 11 to form a watertight or substantially watertight seal.

[0030] When the second connector 14 is connected to the first connector 4, a cavity 20 is formed between the second connector 14, the housing 2 and parts of the first connector 4. The breather aperture 6 provides a fluid flow path between the interior chamber 7 of the housing 2 and the cavity 20. In this embodiment, the cavity 20 provides a space into which air from the housing 2 can flow when the pressure of the air within the housing 2 is raised, for instance by hot electronic components within the housing 2. The configuration of the cavity 20 therefore enables the air pressure within the housing 2 to be reduced to protect the housing 2.

[0031] Referring now to figure 11 of the accompanying drawings, a housing arrangement 21 of other embodiments not forming part of the invention comprises the same components as the housing arrangement 19 of the further embodiment described above. However, in these other embodiments, there is a partial seal between the first and second connector formations 11, 15. Consequently, air flowing out from the housing 2 via the breather aperture 6 can flow into the cavity 20 and then out into the surrounding environment through the partial seal between the first and second connector formations 11, 15. This provides a further ventilating effect which reduces the air pressure within the housing 2. The breather aperture 6 of embodiments of the invention reduces the air pressure within the housing 2 to minimise damage to the housing 2. When the second connector 14 is connected to the first connector 4, the breather aperture 6 is at least partly closed or sealed which minimises the risk of fluid or dirt passing through the breather aperture 6 and into the interior chamber 7 of the housing 2.

[0032] The breather aperture 6 is at least partly surrounded or enclosed by the connector formations which minimises the risk of the breather aperture 6 becoming blocked by fluid or dirt from the surrounding environment.

[0033] In embodiments where the first connector 4 is a discrete component that is not formed integrally with the housing 2, the first and second connectors 4, 14 form a connector arrangement in other embodiments of the

invention. The connector arrangement is configured for use with a housing to provide ventilation to the housing via the breather aperture whilst minimising the risk of the breather aperture from becoming blocked by fluid or dirt from the surrounding environment.

[0034] When used in this specification and the claims, the term "comprises" and "comprising" and variations thereof mean that specified features, steps or integers and included. The terms are not to be interpreted to exclude the presence of other features, steps or compounds.

Claims

1. A housing arrangement (1) for use in a vehicle, the arrangement comprising:

a housing (2) configured to house an electrical device (3), the housing (2) incorporating a breather aperture (6) which permits air to flow out from the interior of the housing (2) through the breather aperture (6); and

a first connector (4) which is carried by the housing (2), the first connector (4) comprising a first connector formation (11) which extends at least partly around the breather aperture (6), the first connector formation (11) being configured to engage a second connector formation (15) provided on a second connector (14) such that the first and second connector formations (11, 15) at least partly block fluid in the surrounding environment from entering the breather aperture (6); and

a second connector (14) comprising a second connector formation (15), the second connector (14) being connected to the first connector (4) such that the first and second connector formations (11, 15) at least partly block fluid in the surrounding environment from entering the housing (2) through the breather aperture (6); wherein when the second connector (14) is connected to the first connector (4) a cavity (20) is formed between part of the second connector formation (15) and the housing (2), the cavity (20) being in fluid communication with the breather aperture (6) so that air can flow from the interior of the housing through the breather aperture (6) and into the cavity (20); and wherein the second connector (14) is provided with a further breather aperture (17) which cooperates with the first breather aperture (6) to provide a continuous fluid flow path from the first breather aperture (6) to the surrounding environment through the further breather aperture (17).

2. The arrangement of claim 1, wherein part of the sec-

ond connector formation (15) is configured to engage with part of the first connector formation (11) to form a substantially gas tight seal which inhibits air escaping from the cavity (20) into the surrounding environment.

3. The arrangement of claim 1, wherein part of the second connector formation (15) is configured to engage with part of the first connector formation (11) to form a partial seal to permit air to flow out from the cavity (20) into the surrounding environment between the first and second connector formations (11, 15). 5
4. The arrangement of claim 1, wherein the further breather aperture (17) is at least partly aligned with the breather aperture (6) of the housing (2) when the second connector (14) is connected to the first connector (4). 10
5. The arrangement of claim 1 or claim 4, wherein the second connector (14) comprises a breather channel (17a) which provides a fluid flow path leading from the further breather aperture (17) to the surrounding environment. 15
6. The arrangement of any one of claims 1, 4 or 5, wherein the further breather aperture (17) is at least partly closed by a one-way valve arrangement. 20
7. The arrangement of claim 6, wherein the one-way valve arrangement is a membrane (18) which permits fluid to pass through the membrane (18) in one direction but not in another direction. 25
8. The arrangement of any one of claims 1 to 7, wherein a sealing element is provided on at least one of the first and second connectors (4, 14) to provide a substantially watertight seal between the first and second connectors (4, 14) when the first and second connectors (4, 14) are connected to one another. 30
9. The arrangement of any one of the preceding claims, wherein the first connector (4) comprises an electrical contact which is configured to engage an electrical contact on the second connector (14). 35
10. An electronic control unit for use in a vehicle, the electronic control unit comprising the arrangement of any one of claims 1 to 8. 40
11. A radar sensor unit for use in a vehicle, the radar sensor unit comprising the arrangement of any one of claims 1 to 8. 45

Patentansprüche

1. Gehäuseanordnung (1) zur Verwendung in einem

Fahrzeug, wobei die Anordnung umfasst:

Ein Gehäuse (2), das ausgelegt ist, ein elektrisches Gerät (3) unterzubringen, wobei das Gehäuse (2) eine Entlüftungsöffnung (6) umfasst, die ermöglicht, dass Luft aus dem Innenraum des Gehäuses (2) durch die Entlüftungsöffnung (6) ausströmen kann; und
einen ersten Verbinder (4), der vom Gehäuse (2) getragen wird, wobei der erste Verbinder (4) eine erste Verbindungsformation (11) umfasst, die sich zumindest teilweise um die Entlüftungsöffnung (6) herum erstreckt, wobei die Verbindungsformation (11) ausgelegt ist, in eine zweite Verbindungsformation (15), die an einem zweiten Verbinder (14) vorgesehen ist, derart einzugreifen, dass die ersten und zweiten Verbindungsformationen (11, 15) das Eindringen von Flüssigkeit im Umfeld in die Entlüftungsöffnung (6) zumindest teilweise blockieren; und
ein zweiter Verbinder (14), der eine zweite Verbindungsformation (15) umfasst, wobei der zweite Verbinder (14) mit dem ersten Verbinder (4) derart verbunden ist, dass die ersten und zweiten Verbindungsformationen (11, 15) das Eindringen von Flüssigkeit im Umfeld durch die Entlüftungsöffnung (6) in das Gehäuse (2) zumindest teilweise blockieren;
wobei, wenn der zweite Verbinder (14) mit dem ersten Verbinder (4) verbunden ist, ein Hohlraum (20) zwischen einem Teil der zweiten Verbindungsformation (15) und dem Gehäuse (2) gebildet wird, wobei der Hohlraum (20) in Fluidverbindung mit der Entlüftungsöffnung (6) steht, sodass Luft aus dem Innenraum des Gehäuses durch die Entlüftungsöffnung (6) und in den Hohlraum (20) strömen kann; und
wobei der zweite Verbinder (14) mit einer weiteren Entlüftungsöffnung (17) versehen ist, die mit der ersten Entlüftungsöffnung (6) kooperiert, um einen kontinuierlichen Fluidströmungsweg aus der ersten Entlüftungsöffnung (6) durch die weitere Entlüftungsöffnung (17) zum Umfeld bereitzustellen.

2. Anordnung nach Anspruch 1, wobei ein Teil der zweiten Verbindungsformation (15) ausgelegt ist, in einen Teil der ersten Verbindungsformation (11) einzugreifen, um eine wesentlich gasdichte Dichtung zu bilden, die Luft daran hindert, aus dem Hohlraum (20) ins Umfeld zu entweichen. 50
3. Anordnung nach Anspruch 1, wobei ein Teil der zweiten Verbindungsformation (15) ausgelegt ist, in einen Teil der ersten Verbindungsformation (11) einzugreifen, um eine teilweise Dichtung zu bilden, um Luft zu ermöglichen aus dem Hohlraum (20) zwischen den ersten und zweiten Verbindungsformati- 55

onen (11, 15) ins Umfeld zu strömen.

4. Anordnung nach Anspruch 1, wobei die weitere Entlüftungsöffnung (17) zumindest teilweise mit der Entlüftungsöffnung (6) des Gehäuses (2) ausgerichtet ist, wenn der zweite Verbinder (14) mit dem ersten Verbinder (4) verbunden ist. 5
5. Anordnung nach Anspruch 1 oder Anspruch 4, wobei der zweite Verbinder (14) einen Entlüftungskanal (17a) umfasst, der einen Fluidströmungsweg bereitstellt, welcher von der weiteren Entlüftungsöffnung (17) ins Umfeld führt. 10
6. Anordnung nach irgendeinem der Ansprüche 1, 4 oder 5, wobei die weitere Entlüftungsöffnung (17) zumindest teilweise durch eine Einwegventilanordnung verschlossen ist. 15
7. Anordnung nach Anspruch 6, wobei die Einwegventilanordnung eine Membran (18) ist, welche Fluid ermöglicht, durch die Membran (18) in eine Richtung aber nicht in die andere Richtung zu passieren. 20
8. Anordnung nach irgendeinem der Ansprüche 1 bis 7, wobei das Dichtungselement zumindest an einem der ersten und zweiten Verbinder (4, 14) vorgesehen ist, um eine wesentlich wasserdichte Dichtung zwischen den ersten und zweiten Verbindern (4, 14) bereitzustellen, wenn die ersten und zweiten Verbinder (4, 14) miteinander verbunden sind. 25 30
9. Anordnung nach irgendeinem der vorhergehenden Ansprüche, wobei der erste Verbinder (4) einen elektrischen Kontakt umfasst, der ausgelegt ist, in einen elektrischen Kontakt am zweiten Verbinder (14) einzugreifen. 35
10. Elektronische Steuereinheit zur Verwendung in einem Fahrzeug, wobei die elektronische Steuereinheit die Anordnung nach irgendeinem der Ansprüche 1 bis 8 umfasst. 40
11. Radarsensoreinheit zur Verwendung in einem Fahrzeug, wobei die Radarsensoreinheit die Anordnung nach irgendeinem der Ansprüche 1 bis 8 umfasst. 45

Revendications

1. Un système de boîtier (1) à utiliser dans un véhicule, le système comprenant : 50

un boîtier (2) configuré pour loger un dispositif électrique (3), le boîtier (2) comprenant une ouverture d'évent (6) qui permet à l'air de s'écouler depuis l'intérieur du boîtier (2) à travers l'ouverture d'évent (6) ; et 55

un premier raccord (4) porté par le boîtier (2), le premier raccord (4) comprenant un premier dispositif de raccordement (11) qui s'étend au moins en partie autour de l'ouverture d'évent (6), le premier dispositif de raccordement (11) étant configuré pour mettre en prise un deuxième dispositif de raccordement (15) prévu sur un deuxième raccord (14) de manière à ce que les premier et deuxième dispositifs de raccordement (11, 15) empêchent au moins en partie le fluide du milieu environnant d'entrer dans l'ouverture d'évent (6) ; et un deuxième raccord (14) comprenant un deuxième dispositif de raccordement (15), le deuxième raccord (14) étant raccordé au premier raccord (4) de manière à ce que les premier et deuxième dispositifs de raccordement (11, 15) empêchent au moins en partie le fluide du milieu environnant d'entrer dans le boîtier (2) à travers l'ouverture d'évent (6) ; dans lequel, lorsque le deuxième raccord (14) est raccordé au premier raccord (4) une cavité (20) est formée entre une partie du deuxième dispositif de raccordement (15) et le boîtier (2), la cavité (20) étant en communication fluide avec l'ouverture d'évent (6) de manière à ce que l'air puisse s'écouler depuis l'intérieur du boîtier à travers l'ouverture d'évent (6) et entrer dans la cavité (20) ; et dans lequel le deuxième raccord (14) est prévu avec une autre ouverture d'évent (17) qui coopère avec la première ouverture d'évent (6) pour assurer un chemin d'écoulement fluide continu depuis la première ouverture d'évent (6) jusqu'au milieu environnant à travers l'autre ouverture d'évent (17).

2. Le système de la revendication 1, dans lequel une partie du deuxième dispositif de raccordement (15) est configurée pour mettre en prise une partie du premier dispositif de raccordement (11) pour former un joint sensiblement hermétique au gaz qui empêche l'air de s'échapper de la cavité (20) et d'entrer dans le milieu environnant.
3. Le système de la revendication 1, dans lequel une partie du deuxième dispositif de raccordement (15) est configurée pour mettre en prise une partie du premier dispositif de raccordement (11) pour former un joint partiel permettant à l'air de s'écouler de la cavité (20) et d'entrer dans le milieu environnant entre les premier et deuxième dispositifs de raccordement (11, 15). 50
4. Le système de la revendication 1, dans lequel l'autre ouverture d'évent (17) est alignée au moins en partie avec l'ouverture d'évent (6) du boîtier (2) quand le deuxième raccord (14) est raccordé au premier rac-

cord (4).

5. Le système de la revendication 1 ou de la revendication 4, dans lequel le deuxième raccord (14) comprend un canal d'évent (17a) qui assure un chemin d'écoulement fluide menant de l'autre ouverture d'évent (17) jusqu'au milieu environnant. 5
6. Le système d'une quelconque des revendications 1, 4 ou 5, dans lequel l'autre ouverture d'évent (17) est fermée au moins en partie par un système de soupape unidirectionnelle. 10
7. Le système de la revendication 6, dans lequel le système de soupape unidirectionnelle est une membrane (18) qui permet au fluide de traverser la membrane (18) dans une direction mais pas dans une autre direction. 15
8. Le système d'une quelconque des revendications 1 à 7, dans lequel un organe d'étanchéité est prévu sur au moins un des premier et deuxième raccords (4, 14) pour assurer un joint sensiblement étanche à l'eau entre les premier et deuxième raccords (4, 14) quand les premier et deuxième raccords (4, 14) sont raccordés l'un à l'autre. 20 25
9. Le système d'une quelconque des revendications précédentes, dans lequel le premier raccord (4) comprend un contact électrique qui est configuré pour mettre en prise un contact électrique sur le deuxième raccord (14). 30
10. Une unité de commande électronique à utiliser dans un véhicule, l'unité de commande électronique comprenant le système d'une quelconque des revendications 1 à 8. 35
11. Une unité de capteur radar à utiliser dans un véhicule, l'unité de capteur radar comprenant le système d'une quelconque des revendications 1 à 8. 40

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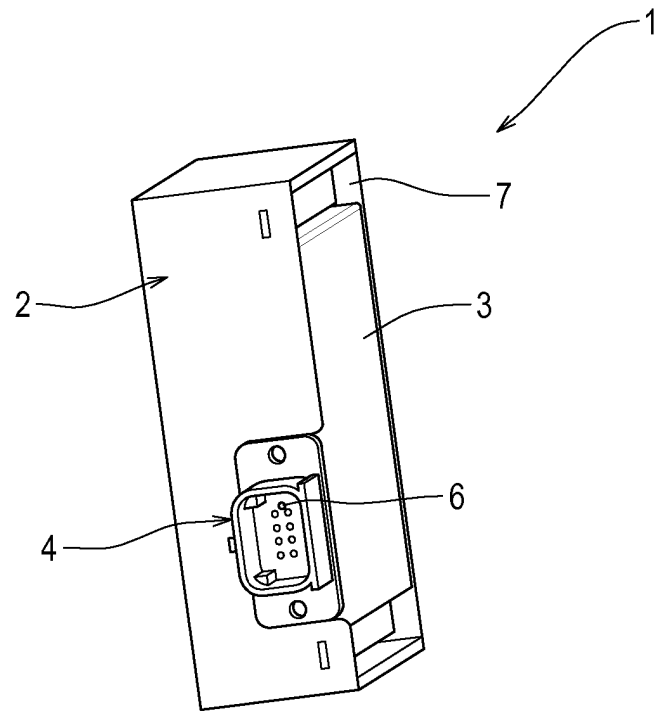


Figure 1

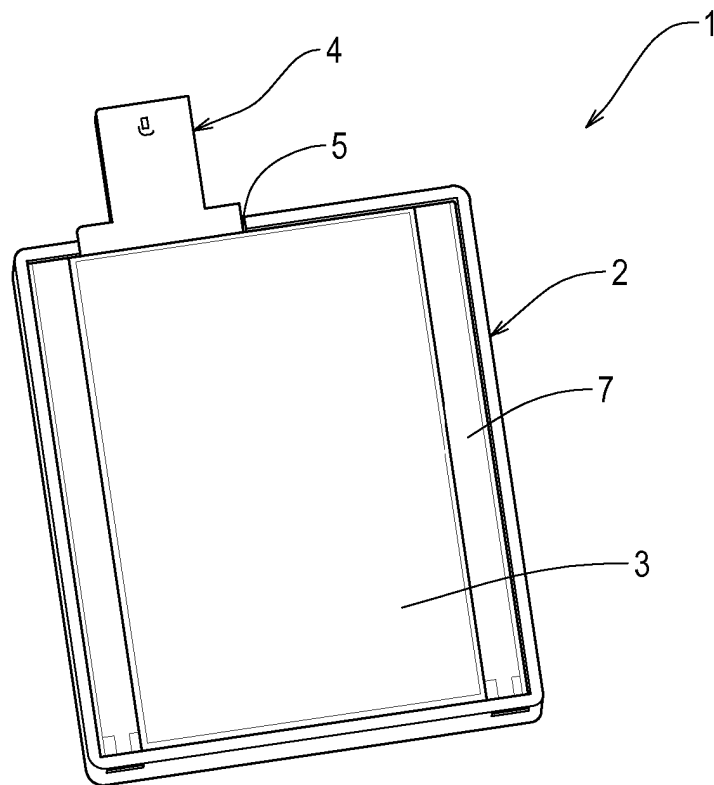


Figure 2

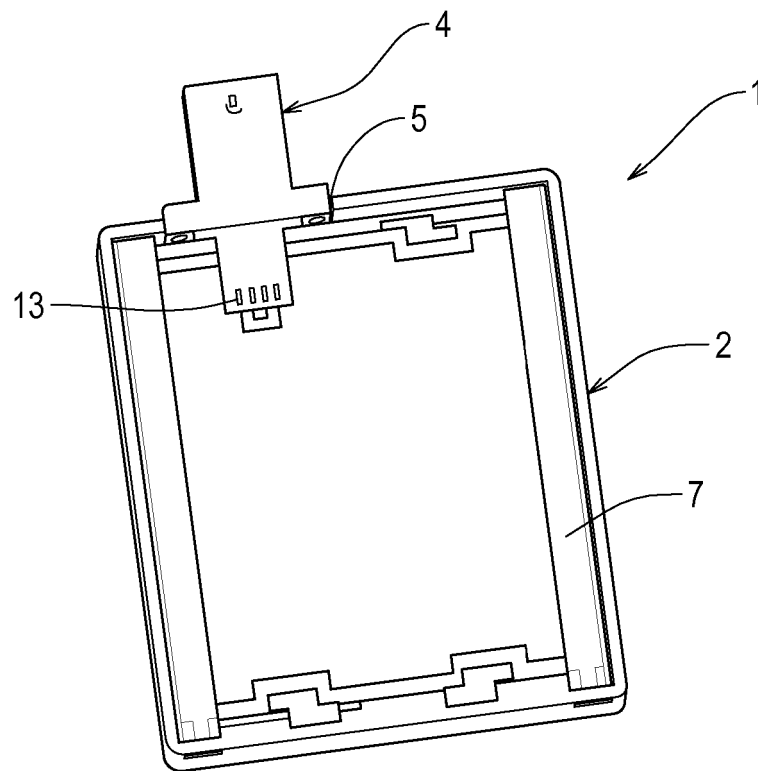


Figure 3

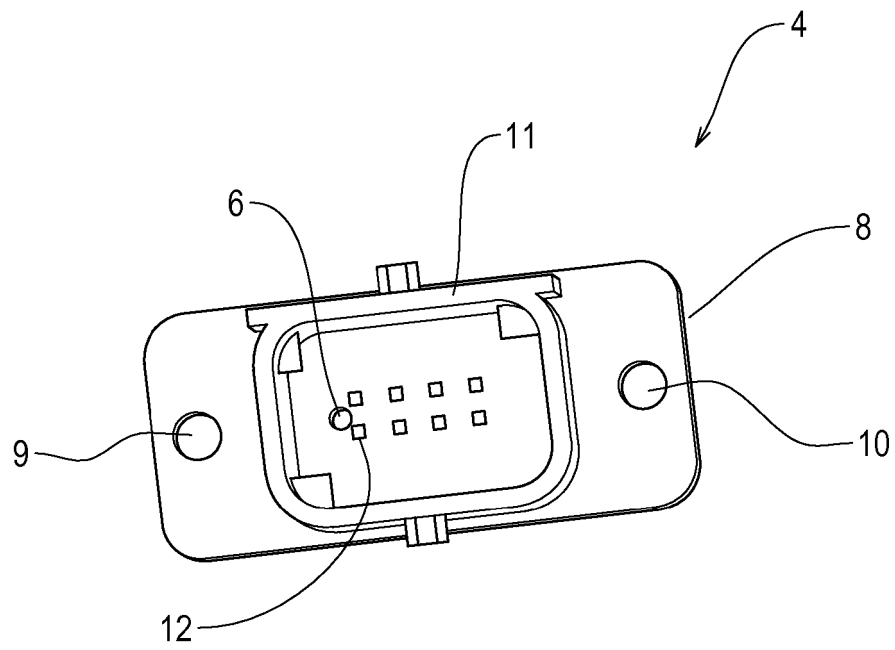


Figure 4

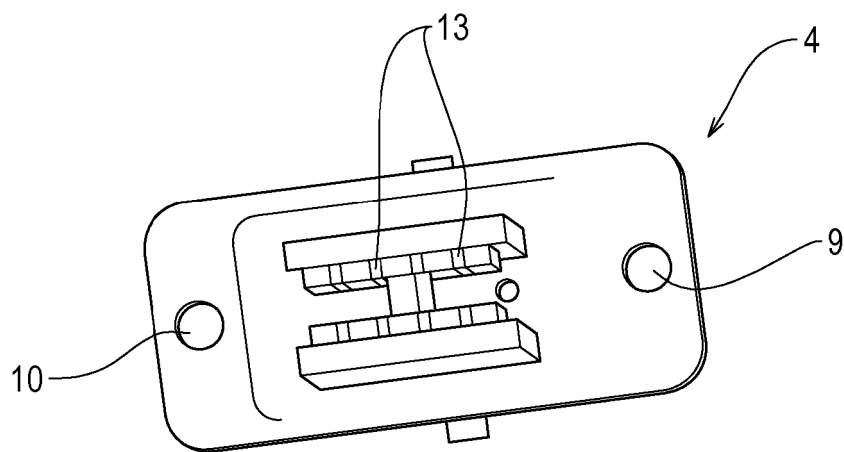


Figure 5

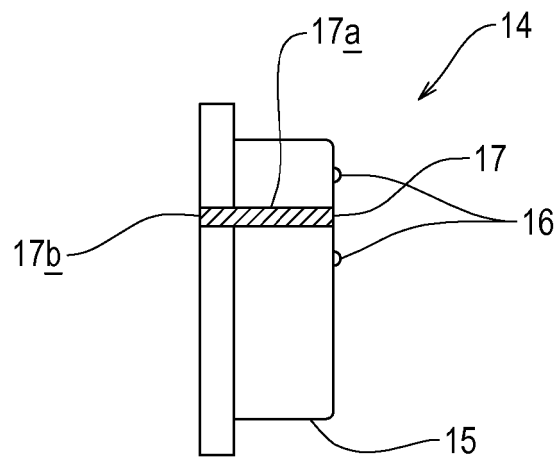


Figure 6

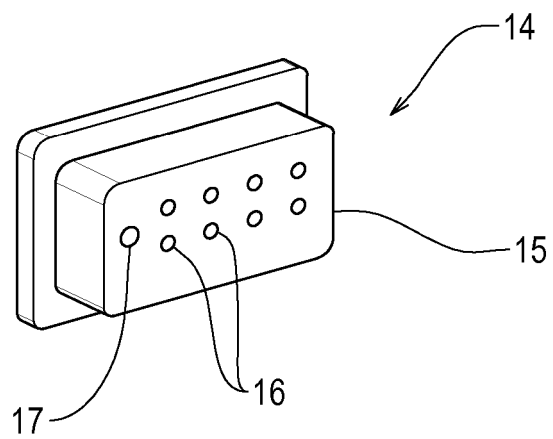


Figure 7

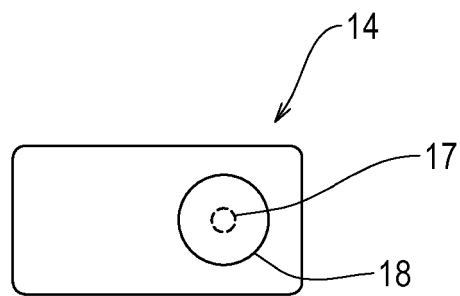


Figure 8

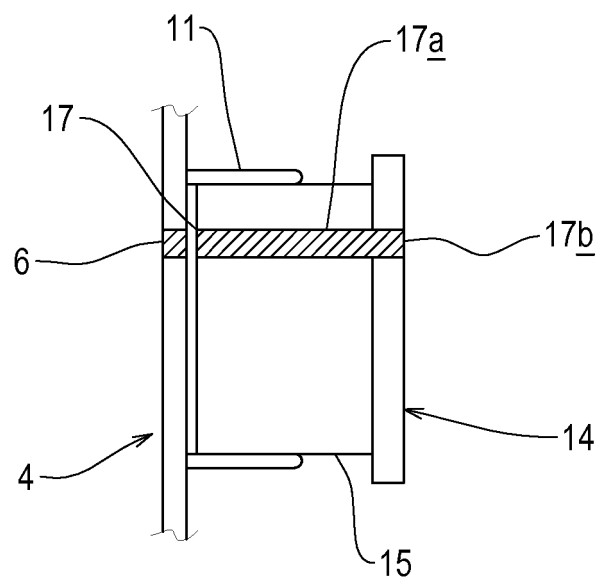


Figure 9

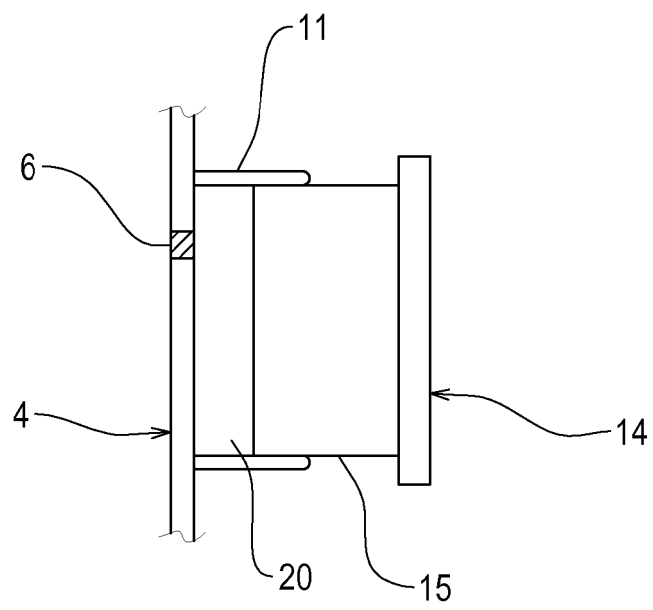


Figure 10

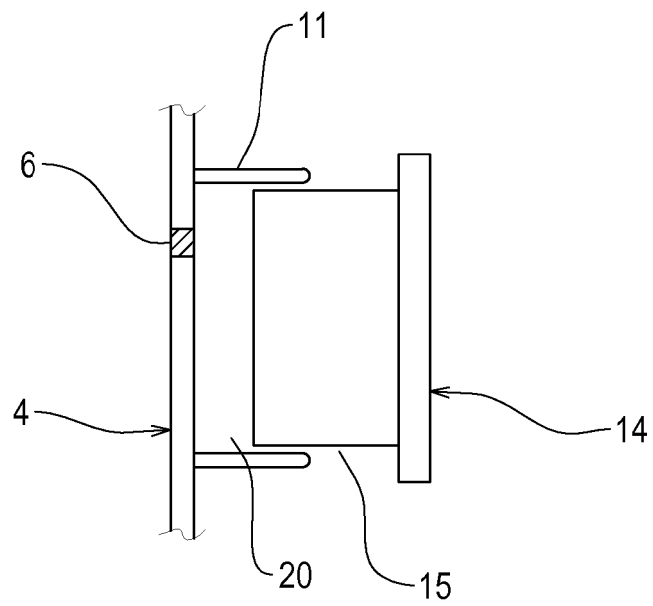


Figure 11

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

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