(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) **EP 3 396 784 A1**

(12) EUROPEAN PATENT APPLICATION

(43) Date of publication:
31.10.2018 Bulletin 2018/44

(21) Application number: **17168649.6**

(22) Date of filing: **28.04.2017**

(51) Int Cl.:
H01R 13/523 *(2006.01)* ***H01R 13/627*** *(2006.01)*
H01R 13/641 *(2006.01)* *H01R 13/533* *(2006.01)*

(84) Designated Contracting States:
AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR
Designated Extension States:
BA ME
Designated Validation States:
MA MD

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(54) HOUSING ASSEMBLY FOR A WET-MATE CONNECTOR, IN PARTICULAR FOR DEEP-SEA APPLICATIONS, HAVING A LATCH MECHANISM ON THE OUTSIDE

(57) The invention relates to a housing assembly (1) as it is used in a wet-mate connector, in particular for deep-sea applications. After being immersed in sea water or other comparably harsh conditions, there is a risk that wet-mate connectors cannot be separated from one another anymore. To avoid this, the housing assembly (1) according to the invention comprises a plug housing (2) and a latch element (12) which is mounted to an outside (14) of the plug housing (2). The latch element (12) at least partly surrounds the plug housing (2) and, at at least one location (16) along its circumference (18), partially penetrates the plug housing (2) and protrudes into a connector cavity (4), in which a mating connector (6) may be received. The latch element (12) thus may latch the mating connector (6) within the connector cavity (4). As the latch element (12) is arranged on the outside of the housing assembly (1), it can be cleaned if it is clogged or jammed after a long usage interval. Further, arranging the latch element (12) on the outside of the housing assembly (1) allows to replace the latch element (12) without disconnecting the wet-mate connector or replacing the whole housing assembly (1).

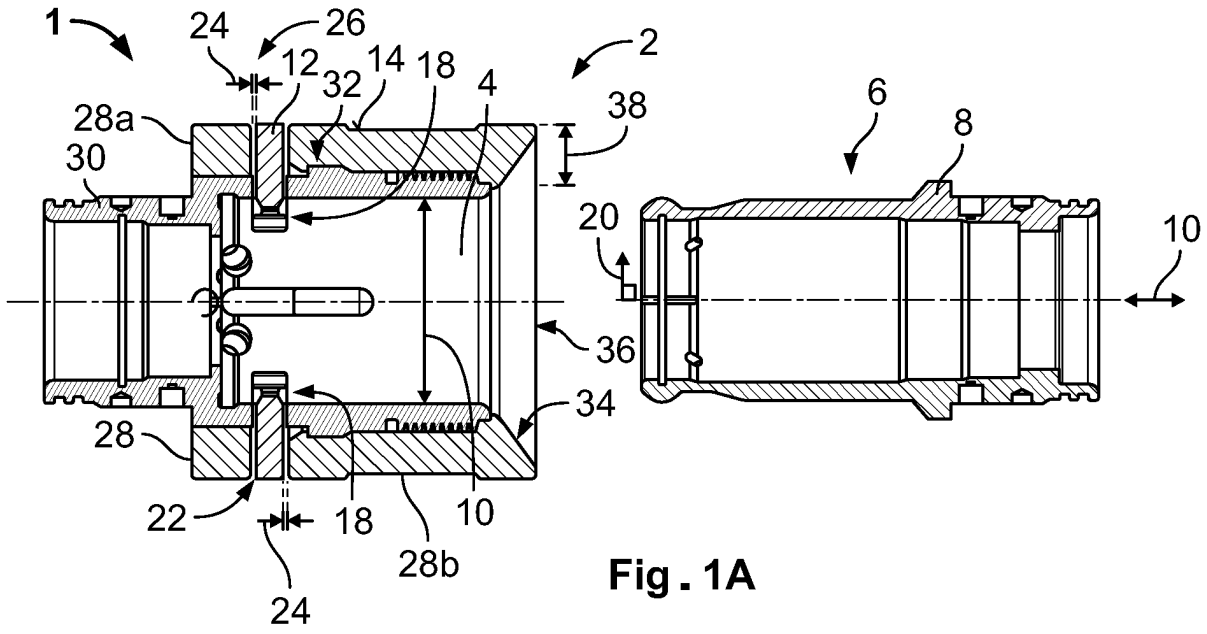

Fig. 1A

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Description

[0001] The invention relates to a housing assembly for a wet-mate connector, in particular for deep-sea applications.

[0002] Wet-mate connectors are known in the art. They are configured to be plugged together even underwater in other harsh environments, such as mud. Wet-mate connectors can be used to connect electric or optical terminals to each other. Examples of wet-mate connectors are shown e.g. in US 9,270,051, GB 201419752, CN 104505653, CN 104538789, WO 2011/11361, US 2009/0080836, US 8,388,235 and WO 2015/68050.

[0003] Although the wet-mate technology is now well established to ensure electric and/or optical connection through mated connectors even when the connectors are plugged together in a deep sea or similar environment, there still remain problems. The lifetime of a deep sea wet-mate connector is quite long, typically around 25 years. It is therefore highly likely that the connection, which is established by the wet-mate connector, must be released and newly established at least once for maintenance and/or repair work during the lifetime.

[0004] Many of the above-mentioned wet-mate connectors, however, cannot be separated from one another anymore without damage after they have been lying underwater for some time. When damaged, the connectors need to be replaced as a whole.

[0005] The present invention tries to address these problems and strives to provide a housing assembly for wet-mate connectors that can be separated even after a long usage in harsh conditions.

[0006] According to the invention, this problem is solved by a housing assembly for a wet-mate connector, in particular for deep-sea applications, the housing assembly comprising a plug housing and a latching element, the plug housing comprising a connector cavity for receiving a mating connector, the latch element being mounted to an outside of the plug housing, the latch element further at least partly surrounding the plug housing and, at at least one location along its circumference, partly penetrating the plug housing and protruding into the connector cavity for latching the mating connector.

[0007] In contrast to the known wet-mate connectors, the latch element according to the invention is not located in an internal part of the plug housing but arranged on the outside of the plug housing. Thus, it is accessible even when the mating connector is received in the connector cavity, and it can be cleaned if it is clogged. The known latch mechanism in the interior cannot be accessed and therefore the connection cannot be released underwater without destroying the connector once the latch is clogged. As the latch element is mounted on the outside of the plug housing as a separate element, it can be removed or replaced when the latch gets damaged or must be broken.

[0008] The inventive solution can be further improved by the following features, which can be combined independently of one another and of which each is advantageous on its own.

[0009] For example, the latch element may be mounted onto the plug housing in an axially floating manner. The axial direction is the direction along which the mating connector is inserted into the connector cavity. The axial direction defines the radial direction, which is perpendicular to the axial direction, and the circumferential direction, which extends around the axial direction. By having the latch element float with respect to the plug housing, it is easier to remove material which may otherwise clog the latch element and provide release of the latch between the mating connector and the plug housing. Instead of or in addition to allowing some axial travel, there may be at least one axial gap, which preferably is continuous in the circumferential direction, between the latch element and the plug housing. Preferably, two axial gaps are provided adjacent the two axially facing sides of the latch element. In particular, the plug housing may provide an axial gap and/or travel between 0.5 mm and 5 mm, preferably around 0.5 to 2 mm. This gap and/or travel is sufficient to effectively clean up the housing assembly and to restore releasability of the latch element.

[0010] The latch element is preferably made from seawater-resistant resin material to ensure longevity.

[0011] It is further preferred that the body of the latch element does not have any internal cavities. Such cavities may e.g. result from an improperly conducted molding process. In deep-sea applications, there is the risk that such a cavity collapses under high pressure. Such a collapse may deform the latch element such that a required, predefined retaining force which is generated by the latch element and has to be overcome for release of the mating connector, cannot be maintained anymore.

[0012] According to another advantageous embodiment, the latch element is mounted onto the outside of the plug housing in a repeatedly removable manner. This means that the latch element can be removed without any damage to the plug housing. This allows repair and maintenance work underwater if e.g. the latch element is broken without the need to replace the entire plug housing or housing assembly. In one variant, the latch element may be slid upon the plug housing in the radial direction. The latch element may itself be engaged with the plug housing in a form-fit lock so that the latch element is secured on the plug housing.

[0013] To facilitate identification of the latch element underwater, the latch element may have at least one surface region which has a maximum of light reflection in wavelengths between about 565 and about 575 nm, i.e. is yellow. Preferably, the at least one surface with a reflection maximum in the 565 to 575 nm range of light wavelengths is located on a surface which faces in the axial and/or radial direction. This allows quick identification of the latch element in deep sea conditions.

[0014] To exert symmetric forces when the mating connector is latched with the plug housing, it may be preferred that the latch element protrudes into the connector

cavity at at least two diametrically opposed locations. This avoids tilting and jamming of the mating connector in the connector cavity.

[0015] To provide a predefined plugging force, the latch element may be provided, at least in a section which protrudes into the connector cavity, with at least one bevel which is inclined with respect to both the axial and the radial direction. The bevel facilitates the sliding of the mating connector over the part of the latch element which protrudes into the connector cavity.

[0016] In an undeflected, i.e. force-free state of the latch element, the bevel may follow the internal circumference of the connector cavity, i.e. may have a circular outer contour.

[0017] In order to facilitate mounting of the latch element onto the plug housing irrespectively of the orientation of the latch element, it is of advantage if the latch element is symmetric with respect to a radial plane, i.e. a plane perpendicular to the axial direction.

[0018] The latch element may be shaped as a bracelet and/or a spring clip which embraces circumferentially the plug housing. The latch element may extend in an arc between 215° and 330°, preferably between 260° and 320° as measured around the axis of the connector cavity. The latch element may have a U-shape inside, in particular with two opposed straight sections. The straight sections may include the bevel and extend into the connector cavity by extending through slots in the wall of the connector cavity in a radius parallel direction.

[0019] According to another embodiment, the latch element may have a C-shaped outer contour, e.g. be rounded or circular on its outside. The outside diameter of the latch element may correspond to or be smaller than the outside diameter of the plug housing. An inner width of the latch element may be smaller than the diameter of the connector cavity.

[0020] In an especially advantageous embodiment, the latch element may be radially deflected in an elastic manner. To remove such a spring clip from the plug housing, two circumferential ends are pried apart from each other.

[0021] According to another embodiment, the latch element may have at least one section along its perimeter, which section has an increased radial thickness. Such a section stiffens the latch element. In particular, the at least one section with increased radial thickness may protrude into the connector cavity. The increased radial thickness provides sufficient stiffness so that the latch element is not deformed torsionally by the passing of the mating connector.

[0022] According to another embodiment, the latch element may comprise two legs that are joined by a section of reduced radial thickness. In such a configuration, the deformation upon deflection of the latch element is concentrated in the section of reduced radial thickness. This allows an improved control over the latching forces in the design process. The two legs may terminate in two circumferentially spaced ends.

[0023] The plug housing may have a circumferential groove in which the latch element is located. Such a circumferential groove serves as a protection and/or as a support of the latch element. In some applications, it may however be preferred that the circumferential groove is interrupted in one or more locations in the circumferential direction, i.e. is made up of an aligned series of circumferential grooves. The latter design may facilitate removal of the latch mechanism. In order to avoid loss of the latch element, it may be latched or locked in the groove e.g. by a form-fit. In another embodiment, the latch element may be inserted radially into the groove.

[0024] If it is more important to protect the latch mechanism, it is preferred that the latch element is covered by the circumferential groove, i.e. does not protrude radially from the groove, at least if the latch element is not deflected by a mating connector.

[0025] Independent of whether the latch element is arranged in a circumferential groove or not, it is preferred according to another embodiment, that the latch element does not protrude radially from the plug housing, in particular the axial shadow of the plug housing, if the latch element is not deflected radially. The axial shadow of the plug housing is the shadow which the plug housing would generate if illuminated by light beams which are parallel to the axial direction. The latch element may, if not deflected radially, be completely received in the groove without sliding out of any position.

[0026] In another embodiment, the latch element may protrude radially from the plug housing or, preferably, from the axial shadow of the plug housing, if the latch element is deflected and/or widened radially. Thus, it can immediately be seen from the outside, when the latch element is deflected. This serves as a safety guard for checking any connection between the plug housing and the mating connector.

[0027] The plug housing may have an outer shell and an inner shell. The outer shell may be softer than the inner shell, the inner shell lining the connector cavity. The outer shell may form a circumferential bevel widening radially towards the outside at a mouth of the connector opening. The circumferential bevel acts as a funnel which guides the mating connector into the connector cavity. It is made of softer material to prevent damage of the mating connector. The outer shell may further enclose the inner shell outside the connector cavity, i.e. the part of the plug housing in which the mating connector is received. The soft or outer shell is thus able to protect the region of the housing assembly in which the electric and/or optical contact through the mated connectors is established.

[0028] The inner shell may be made of, in particular, sea-water resistant and/or non-corrosive metal material. The outer shell may be a resin. The outer shell may also be softer than the latch assembly which needs to be rigid in order to ensure high, strictly defined latching forces.

[0029] The outer shell may be a separate part which is mounted onto the inner shell, e.g. by form-fit connec-

tions such as latches or locks. Alternatively, the outer shell may be monolithically joined to the inner shell, e.g. by molding the outer shell around the inner shell or by co-injection molding.

[0030] The latch element may be at least partly received in the outer shell. In particular, the recess for receiving the latch element may be located preferably solely in the outer shell. In order to ensure integrity of the outer shell across the latch element, the outer shell may be arranged between the latch element and the inner shell in an area which is of limited extent in the circumferential direction and/or it may extend between two circumferentially opposed cuts of the latch element.

[0031] A housing of the mating connector may be part of the housing assembly. The housing of the mating connector may have a circumferential protrusion, such as an e.g. annular bulge, which is adapted to engage the latch element, and together with the latch element, form a latch mechanism for retaining the housing of the mating connector in the connector cavity of the plug housing. In one embodiment, the latch element may comprise an indicator signaling a transfer of the mating connector in a fully mated state. The indicator may output a visual, tactile and/or oral signal informing on the mating sequence, i.e. the transfer of the mating connector in the fully mated state. Visual indicators are easy to detect. In one preferred embodiment, the latch element does not protrude from the plug housing or, preferably, from the axial shadow of the plug housing if the mating connector is in the fully mated state. According to another embodiment, the latch element may protrude from the plug housing or, preferably from the axial shadow of the plug housing if the latch element is deflected by the mating connector, in particular its housing. Thus, protrusion of the latch element signals to a user that the latching connection is not yet fully established.

[0032] In the following, the invention and its further improvements are, at least partly and exemplarily, described with reference to the accompanying drawings. In the drawings, the same reference numerals are used for elements that correspond to each other in design and/or function.

[0033] As is clear from the above description, the combination of elements that is shown in the drawings can be readily altered. For example, an above feature which further improves the invention and is shown in the drawings can be omitted if the technical effect of this particular feature is not needed for a specific application. Conversely, a feature which is not shown in the drawings and which improves the invention may be added if the technical effect of this feature is needed for a specific application.

[0034] In the drawings:

Fig. 1A shows a schematic view of a housing assembly according to the invention cut along the axial direction in a first operational state;

Fig. 1B shows a schematic side view of the housing assembly of Fig. 1A;

Fig. 2 shows a schematic axial view of the housing assembly of Fig. 1A;

Fig. 3 shows a schematic view of the housing assembly of Fig. 1A in a cut along the axial direction in a second operational state;

Fig. 4 shows a schematic axial view of the housing assembly of Fig. 3;

Fig. 5 shows a schematic view of the housing assembly of Fig. 1A in an axial cut in a third operational state;

Fig. 6 shows a schematic axial view of the housing assembly of Fig. 5;

Fig. 7 shows a schematic view of the housing assembly of Fig. 1A in an axial cut in a fourth operational state;

Fig. 8 shows a schematic axial view of the housing assembly of Fig. 7;

Fig. 9 shows a schematic perspective view of a latch element according to the invention;

Fig. 10 shows a schematic view of the housing assembly of Fig. 3 in an axial cut along a plane rotated by 90° with respect to Fig. 3; and

Fig. 11 shows a schematic view of the housing assembly of Fig. 5 in an axial cut along a plane rotated by 90° with respect to Fig. 5.

[0035] First, the general layout of the housing assembly 1 is explained with reference to Figs. 1A and 1B. The housing assembly 1 comprises a plug housing 2 which comprises a connector cavity 4. The connector cavity 4 provides a receptacle for a mating connector 6 or a housing 8 of the mating connector 6, respectively. The mating connector 6, or only its housing 8, may also be considered as part of the housing assembly 1.

[0036] In Fig. 1A and the remaining figures, the housing assembly 1 is shown without interior elements for simplicity. The housing assembly 1 is part of a wet-mate connector which can be plugged together underwater and is configured to be used in deep sea or other harsh, corrosive and dirty conditions.

[0037] To establish a wet-mate connection which may be at least one of an electric and optic connection, the housing 8 is inserted into the connector cavity 4 along an axial direction 10. The housing assembly 1 further comprises a latch element 12 on the outside of the plug housing 2. In particular, the latch element 12 may be mounted onto the plug housing on an outside 14 of the

housing assembly 1, e.g. by being slid onto the plug housing 2 in a direction perpendicular to the axial direction 10.

[0038] The latch element 12 at least partly surrounds the plug housing 2 and the connector cavity 4. At at least one location 16 along its circumference 18, the latch element 12 penetrates the plug housing 2 and protrudes into the cavity 4. In the embodiment of Figs. 1A and 1B, there are two such locations 18, which are symmetrically arranged opposite each other in a radial direction 20.

[0039] The latch element 12 is mounted in a recess such as a circumferential groove 22 which may extend continuously or in a disrupted manner around the plug housing 2. In the force-free state as shown in Figs. 1A and 1B, the latch element 12 is covered completely by the plug housing 2 in the axial direction 10. That is, the latch element 12 does not protrude in the radial direction 20 from the plug housing 2. In particular, it does not protrude from the axial shadow of the plug housing 2 as it is shown in Fig. 2.

[0040] The latch element 12 may be mounted onto the plug housing 2 in an axially floating manner which means that it is not held rigidly in the axial direction 10 on the plug housing 2, but is allowed a small amount of axial travel 24. The amount of travel may be between 0.5 mm and 5 mm.

[0041] As an alternative to or instead of having a floating latch element, it may be preferred that there is at least an axial gap 26 between the latch element 12 and at least part of the plug housing 2. Preferably, the axial gap 26 is continuous in the circumferential direction. The travel 24 and/or the gap 26 prevent clogging of the latch element 12 and allow for cleaning after the housing assembly 1 has been used and lying around underwater for an extended period of time, for example, several years.

[0042] The plug housing 2 may comprise an outer shell 28 and an inner shell 30. The outer shell 28 is preferably made from softer material than the inner shell 30. For example, the outer shell 28 may be a sea-water resistant and/or non-corrosive resin and/or the inner shell 30 may be made of a metal. As shown, the outer shell 28 may be a separate element which is preferably latched rigidly onto the inner shell 30 by a form-fit connection 32, preferably in a rigid manner offering no travel in the axial direction 10.

[0043] The outer shell 28 may in one variant comprise two parts 28a, 28b which delimit the circumferential groove 22 in both axial directions 10. The latch element 12 is located between the two parts 28a, 28b. Alternatively, the outer shell 28 may be a single part which may extend through a circumferential gap of the latch element 12 or, at at least one location in the circumferential direction, between the latch element 12 and the inner shell 30.

[0044] Alternatively, the plug housing 2 may be a monolithical part integrating both the outer shell 28 and the inner shell 30. Such a monolithical part can be obtained e.g. by molding a resin over the metal inner shell 30. If the inner shell 30 is made from resin as well, the plug housing 2 may be manufactured using multi-component molding.

[0045] The circumferential groove 22 may be present only in the outer shell 28. The groove 22 serves as a protection of the latch element 12.

[0046] The outer shell 28 may provide a bevel 34 at a mouth 36 of the connector cavity 4. The bevel 34 serves as a guide to facilitate insertion of the housing 8 of the mating connector 6 into the connector cavity 4. Due to its softness, there will be no damage to the mating connector 6, even if it collides under force with the bevel 34. In the radial direction 20, a thickness 38 of the bevel 34 may be between an eighth and a third of the internal diameter 40 of the connector cavity 4.

[0047] In order to facilitate manipulation of the housing assembly 1, the latch element 12 is at least partly provided with a surface which has maximum reflectance for incident light in the wavelengths between 565 nm and 575 nm. These wavelengths are best discerned by cameras as they are used by robot manipulators in deep-sea applications.

[0048] The latch element 12 is a separate part as shown in Fig. 9.

[0049] As can be seen, the latch element 12 may have the shape of a bracelet. It may be overall C- or U-shaped. In particular, it may have a central opening which is U-shaped and has two preferably straight inner sides 41 opposite each other. The outer contour 42 of the latch element 12 may be round, in particular, circular. When mounted, the latch element 12 is arranged coaxial to the plug housing 2.

[0050] A material thickness 43 of the latch element 12 may vary along its perimeter, i.e. along the circumferential direction 44 around the axial direction 10 (Fig. 1A). The distance between the inner sides 41 is smaller than the inner diameter 40 of the connector cavity 4. The outer diameter of the latch element 12 may correspond to or be smaller than a center diameter 46 (Fig. 2) of the plug housing 2.

[0051] In particular, two or more regions 47 having increased material thickness 43 may be joined by a region 48 having less material thickness in the radial direction. Thus, the latch element 12 forms a clip which can be widened elastically in the radial direction due to the flexibility in the region 48.

[0052] The at least one region 47 having increased material thickness 43 in the radial direction may be the part latch element 12 which penetrates through the plug housing 2 into the connector cavity 4 as shown in Fig. 1A.

[0053] To facilitate the passing of the mating connector 6 by the latch element 12 and in order to provide a predetermined latching force, the latch element 12 may be provided with at least one bevel 50. The bevel 50 is preferably restricted to the part of the latch element 12, which is located within the connector cavity 4. In the radial outward direction, the bevel 50 may follow a circle and/or the inner contour of the connector cavity 4.

[0054] In order to be inserted into the plug housing 2 in any orientation, the latch element 12 is symmetric

about a plane which is perpendicular to the axial direction 10.

[0055] The latch element 12 extends between 215° and 330°, preferably between 260° and 320° around the axial direction 10.

[0056] In Fig. 10, the bevel 50, which is inclined with respect to both the radial and axial directions, is seen extending through the slot-like openings 51 in the plug housing 2 into the connector cavity 4. The opening 51 is elongated in the circumferential direction. Fig. 10 shows a cut view in the radial direction 20 through the middle of a gap 52 which separates the two circumferential ends 54 (Fig. 9) of the latch element 12. The gap 52 is located diametrically opposite the section 48.

[0057] At the ends 54, the latch element 12 may engage the plug housing 2 e.g. by a form-fit. For this, the ends 54 may be provided with at least one of a recess and protrusion which engages a mating protrusion or recess on the plug housing 2. This engagement secures the latch element 12 on the plug housing 2 in the radial direction 20. The latch element 12 may be removed from the plug housing 2 by prying the two ends 54 apart from each other and pulling it from the plug housing in the radial direction. To mount the latch element 12 on the plug housing 2, the latch element 12 is slid radially onto the plug housing 2 until latched.

[0058] Next, the function of the latch element 12 is explained with references to Figs. 3 to 8 and 11.

[0059] The mating connector 6 may be inserted into the connector cavity 4 without major mechanical resistance until it hits the latch element 12 protruding into the connector cavity 4. For wet-mating capabilities, the connector cavity 4 is provided at an end thereof facing away from the mouth 36 with at least one vent hole 56 which is connected to the environment 57. This allows water which is trapped in the connector cavity 4 to be vented when the mating connector 6 is inserted into the connector cavity 4.

[0060] The mating connector 6 or in particular its housing 8 may be provided with a radially protruding annular bulge 58 which is preferably followed in the axial direction 10 by a radial recess 60. The bulge 58 forms a bevel at the axial front 62 of the housing 8 which facilitates centering of the mating connector 6 within the connector cavity 4 and, in connection with the bevel 50 of the latch element 12, provides a predefined force for deflecting the latch element 12.

[0061] In Fig. 3, the latch element 12 is not yet radially deflected. The latch element 12 does not protrude radially from the axial shadow of the plug housing 2. This is shown in Fig. 4.

[0062] In Fig. 5, the latch element 12 is deflected i.e. elastically widened by the mating connector 6, in particular its bulge 58. The deformation has reached its maximum. Due to the deformation, the ends 54 (Fig. 9) of the latch element 12 are pried apart circumferentially. A protruding section 64 at at least one of the ends 54 forms a shoulder 65 protruding in the circumferential direction 44 from the section 64 with increased material thickness into the gap 52 (Fig. 9). The shoulder 65 prevents the latch element 12 from falling off the plug housing 2 when pried apart by the mating connector 6. The protruding section 64 still stays engaged with the plug housing 2 and thus secures the latch element 12 on the plug housing 2 in the radial direction 20.

[0063] As the ends 54 are pushed apart from each other by the mating connector 6, the latch element 12 protrudes from the plug housing 2 in the radial direction 20 in at least a section of its perimeter. This is shown in Fig. 6. In particular, only the at least one region 47 having increased thickness may protrude radially from the plug housing 2 or its axial shadow respectively. To alert a user, at least one axial face 66 may be provided with a surface having increased reflectance in the visible light range between 565 nm and 575 nm wavelength. This is an alert that the latch element 12 is triggered but not engaged.

[0064] As can be seen from Fig. 11, the section 48 with reduced material thickness of the latch element 12 does not necessarily protrude radially from the plug housing 2, as it is not pushed out by the mating connector 6.

[0065] Fig. 7 shows the housing assembly 1 comprising the housing 8 of the mating connector 6 in the fully mated state forming a wet-mate connection 67. The bulge 58 or any functionally equivalent locking protrusion has slipped past the latch element 12 which, compared with the fully deflected state as shown in Fig. 5, has relaxed. In the fully engaged state, the latch element 12 may still be elastically deformed to exert a constant force on the mating connector 6. Due to the bevel 50 of the latch element 12 which, in the fully engaged state, may be pressed against a complementary bevel 68 of the housing 8 facing axially away from the front 62, the radial inward pressure exerted by the latch element 12 is translated into a constant axial force. The constant force takes out any axial travel 24 of the latch element 12 and helps to ensure sealing between the connector cavity 4 and the mating connector 6.

[0066] In the fully engaged state, contrary to the non-fully mated state shown, e.g. in Fig. 6, the latch element 12 does not protrude from the plug housing 2 or its axial shadow respectively, as is seen in Fig. 8. This signals to a user that the connection is safely established. The latch element 12 thus comprises an indicator 69 signaling the transfer of the mating connector 6 in the fully mated state. In the shown, exemplary embodiment, a visual indicator 69 is used, namely the part of the latch element 12 protruding from the plug housing and thus being visible when a part of the latch element protrudes radially from the plug housing 12 (see Fig. 6).

REFERENCE NUMERALS

[0067]

1	housing assembly
2	plug housing

4	connector cavity
6	mating connector
8	housing of mating connector
10	axial direction
12	latch element
14	outside of housing assembly
16	location where latch element penetrates into connector cavity
18	circumference or perimeter of latch element
20	radial direction
22	circumferential groove
24	axial travel of latch element
26	axial gap between latch element and plug housing
28	outer shell of plug housing
28a	part of outer shell
28b	part of outer shell
30	inner shell of plug housing
32	form-fit connection between outer shell and inner shell
34	bevel at mouth of plug housing
36	mouth of plug housing
38	radial thickness of bevel at mouth
40	inner diameter of connector cavity
41	inner side of latch element
42	outer contour
43	material thickness of latch element in radial direction
44	circumferential direction
45	center diameter of latch element
47	center diameter of plug housing
47	region of latch element having increased material thickness
48	region of latch element having decreased material thickness
50	bevel of latch element
51	opening in plug housing
52	radial gap of latch element
54	ends of latch element facing gap
56	vent hole of connector cavity
57	environment
58	bulge of mating connector
60	radial recess behind bulge
62	front of housing of mating connector
64	protruding section at end of latch element
65	shoulder
66	axial face of latch element
67	wet-mate connection
68	complementary bevel
69	indicator

Claims

1. Housing assembly (1) for a wet-mate connector, in particular for deep-sea applications, the housing assembly (1) comprising a plug housing (2) and a latching element (12), the plug housing (2) comprising a connector cavity (4) for receiving a mating connector (6), the latch element (12) being mounted to an outside (14) of the plug housing (2), at least partly surrounding the plug housing (2) and, at at least one location (16) along its circumference (18), penetrating the plug housing (2) and protruding into the connector cavity (4) for latching the mating connector (6).

2. Housing assembly (1) according to claim 1, wherein the latch element (12) is mounted on the plug housing (2) providing an axial gap (26) between the plug housing (2) and the latch element (12).

3. Housing assembly (1) according to claim 1 or 2, wherein the latch element (12) is shaped as a spring clip embracing the plug housing (2) outside the connector cavity (4).

4. Housing assembly (1) according to any one of claims 1 to 3, wherein the latch element (12) protrudes into the connector cavity (4) at at least two diametrically opposed locations (16).

5. Housing assembly (1) according to any one of claims 1 to 4, wherein the latch element (12) is provided, at least in a region (47) which protrudes into the connector cavity (4), with at least one bevel (50) which is inclined with respected to both the axial direction (10) and the radial direction (20).

6. Housing assembly (1) according to any one of claims 1 to 5, wherein the latch element (12) is symmetric with respect to a plane perpendicular to the axial direction (10).

7. Housing assembly (1) according to any one of claims 1 to 6, wherein the latch element (12) has at least one region (47) along its circumference (18) with increased material thickness (43) in the radial direction (20), wherein the least at one region (47) preferably protrudes into the connector cavity (4).

8. Housing assembly (1) according to any one of claims 1 to 7, wherein the plug housing (2) has a circumferential groove (22), in which the latch element (12) is located.

9. Housing assembly (1) according to any one of claims 1 to 8, wherein the latch element (12) does not protrude radially from the plug housing (2) if the latch element (12) is not deflected radially.

10. Housing assembly (1) according to any one of claims 1 to 9, wherein the latch element (12) protrudes radially from the plug housing (2) if the latch element (12) is deflected radially out of the connector cavity (4).

11. Housing assembly (1) according to any one of claims 1 to 10, wherein the plug housing (2) has an outer shell (28) and an inner shell (30), the outer shell (28) being softer than the an inner shell (30), the inner shell (30) lining the connector cavity (4) and the outer shell (28) forming a circumferential bevel (34) widening towards the outside (14) at mouth (36) of the connector cavity (4).

12. Housing assembly (1) according to claim 11, wherein the latch element (12) is at least partly received in the outer shell (30).

13. Housing assembly (1) according to any one of claims 1 to 12, wherein the housing assembly (1) further comprises a housing (8) of the mating connector (6), the housing (8) of the mating connector (6) being locked in the connector cavity (4) by the latch element (12) in a fully mated state, wherein the latch element (12) does not protrude from the plug housing (2) in the fully mated state, and wherein the latch element (12) protrudes from the plug housing (2) if the latch element (12) is deflected at least partly out of the connector cavity (4) by the housing (8).

14. Housing assembly (1) according to any one of claims 1 to 13, wherein the latch element (12) comprises an indicator (69) signaling a transfer of the mating connector (6) in the fully mated state.

15. Wet-mate connector for deep-sea applications having a housing assembly (1) according to any one of claims 1 to 14.

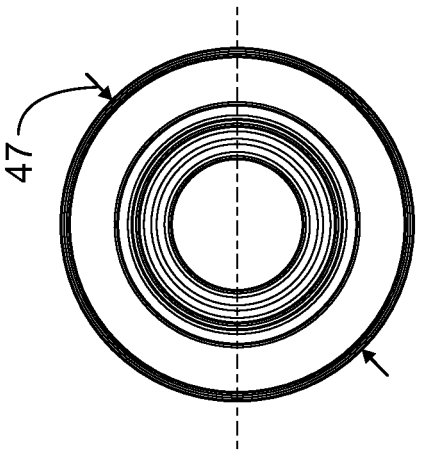

Fig. 2

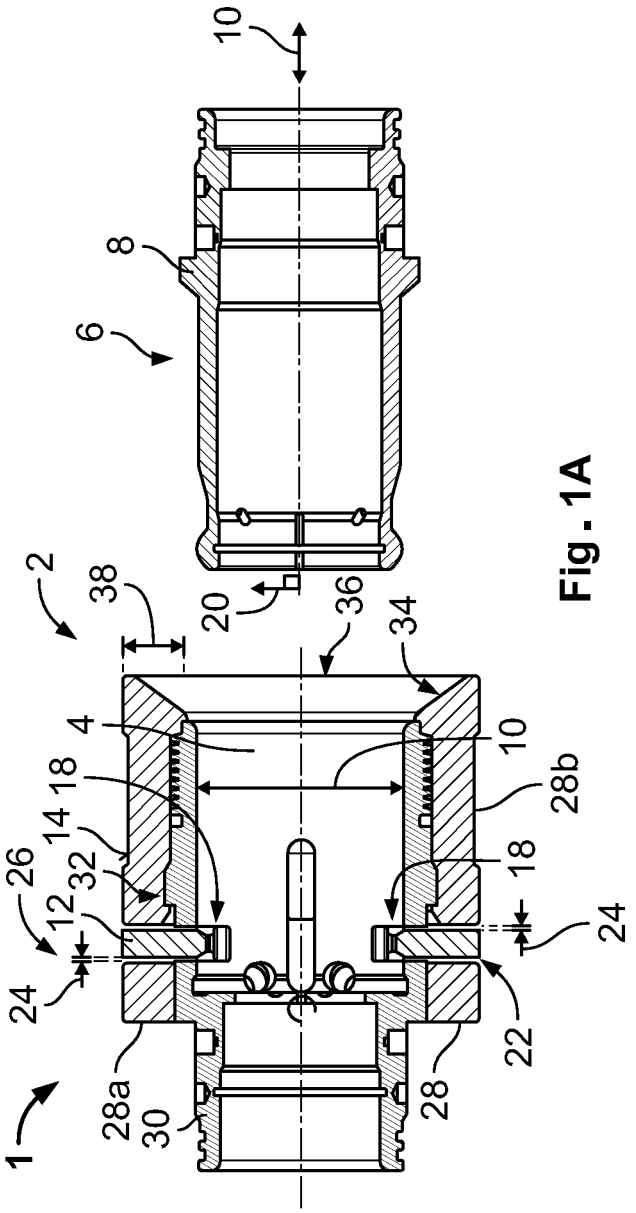

Fig. 1A

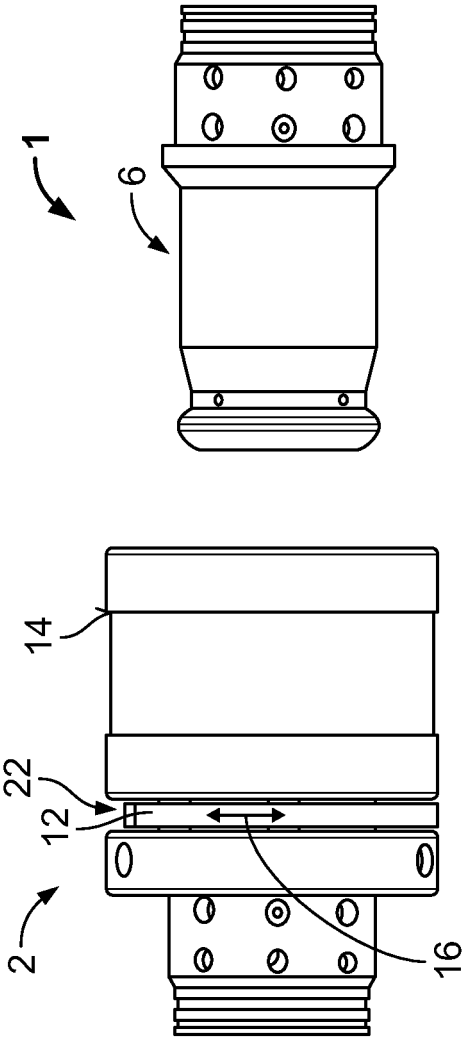

Fig. 1B

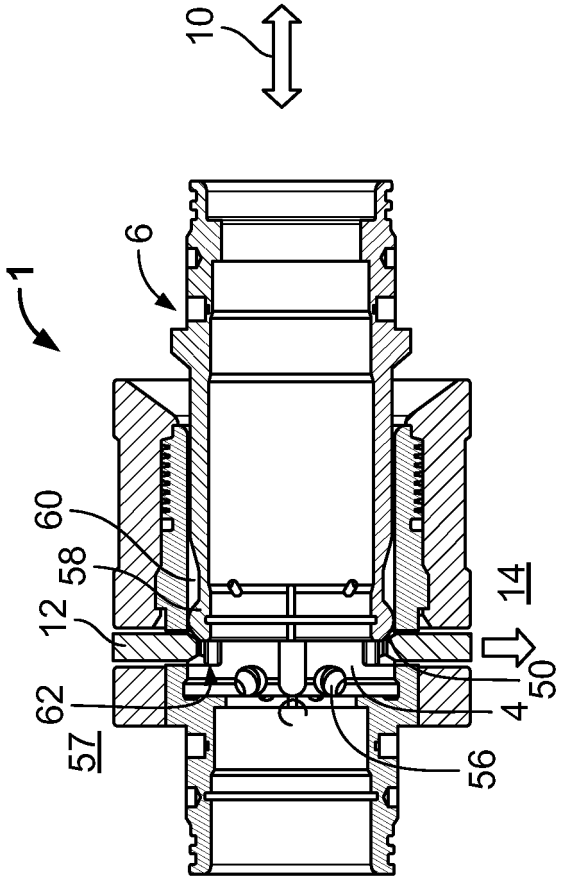

Fig. 3

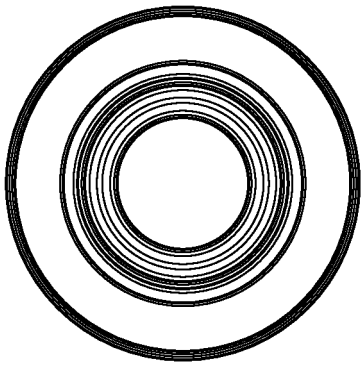

Fig. 4

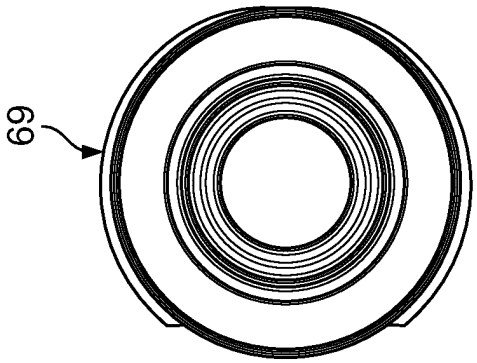

Fig. 6

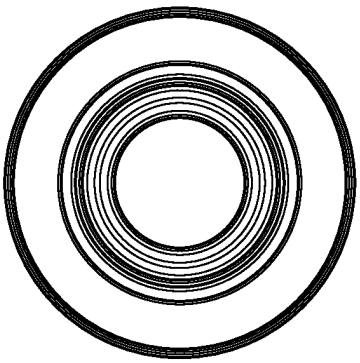

Fig. 8

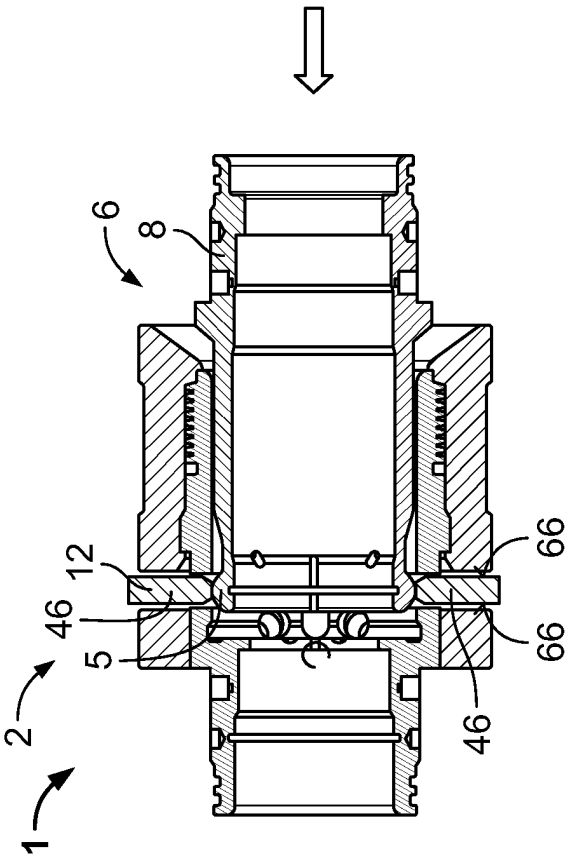

Fig. 5

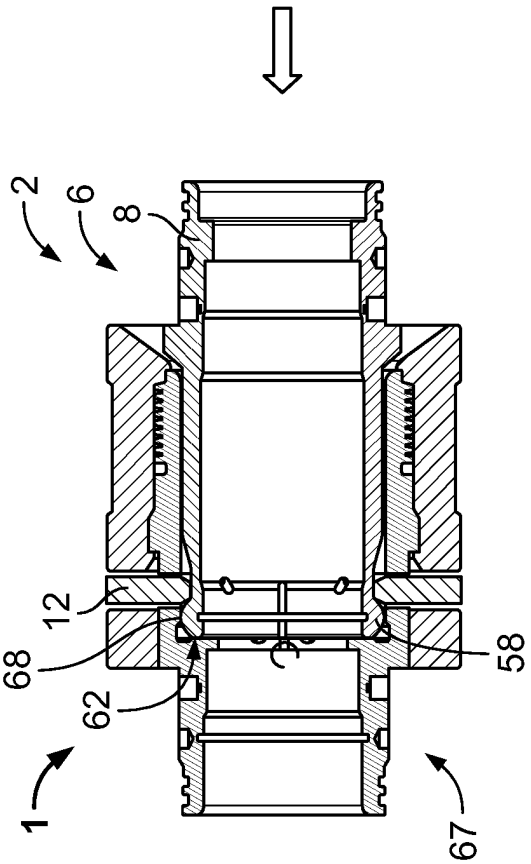

Fig. 7

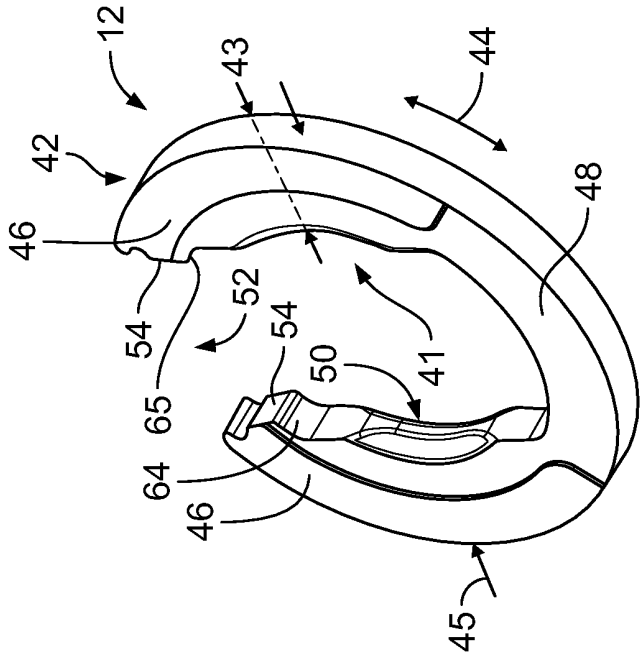

Fig. 9

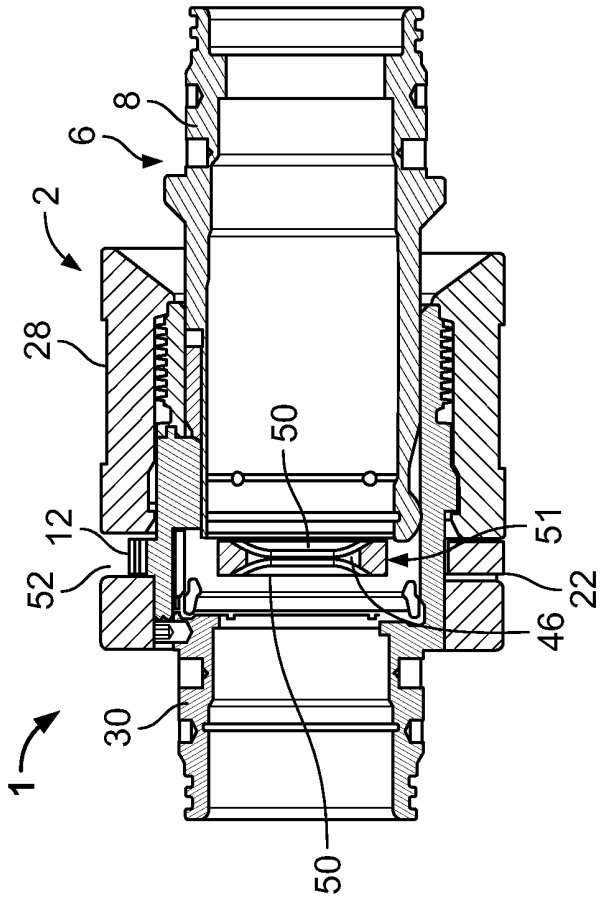

Fig. 10

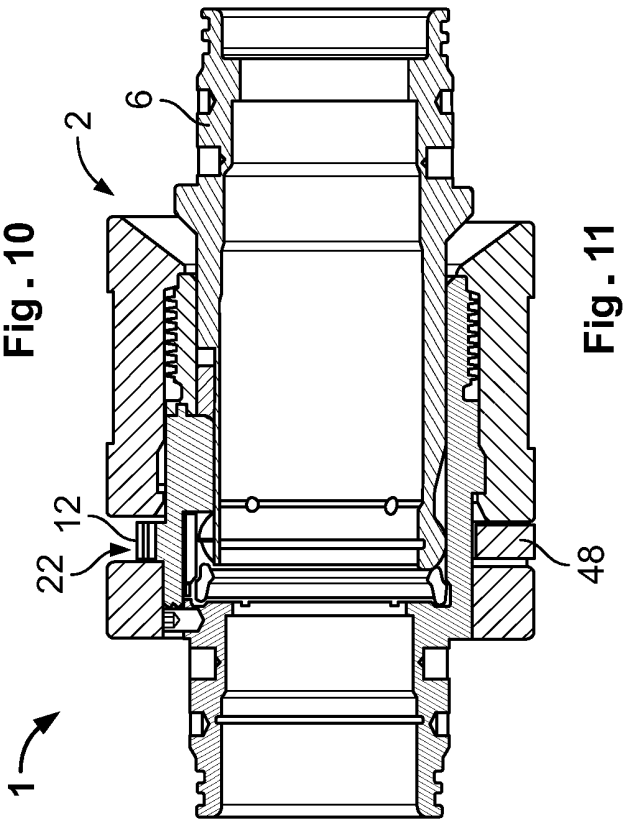

Fig. 11

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EUROPEAN SEARCH REPORT

Application Number
EP 17 16 8649

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
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TECHNICAL FIELDS SEARCHED (IPC)

H01R

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	27 June 2017	Alberti, Michele

CATEGORY OF CITED DOCUMENTS

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27-06-2017

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REFERENCES CITED IN THE DESCRIPTION

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