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(54) **SECURING ELEMENT WITH SEALING FUNCTION FOR AN ELECTRICAL CONNECTOR SYSTEM**

(57) The present disclosure relates to a securing element, such as e.g. a primary lock reinforcement, PLR, element or terminal position assurance, TPA, element, for an electrical connector system. The securing element comprises a main portion that is dimensioned to receive a terminal housing that is adapted to accommodate an electrical terminal. The securing element further comprises a seal portion.

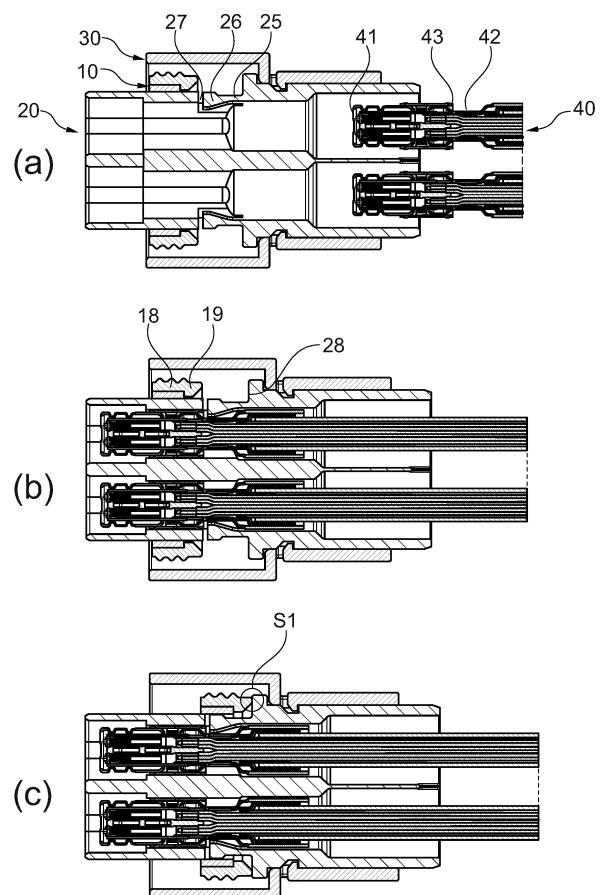


Fig. 10

Description

1. Field of the invention

[0001] The present disclosure relates to a securing element, such as e.g. a PLR (primary lock reinforcement) or TPA (terminal position assurance) element, for securing an electrical terminal within a terminal housing of an electrical connector system, to a connector system, and to a method of assembly of a connector system.

2. Technical background

[0002] Electrical connector systems are well known in the art. A connector is typically connected with a corresponding counter connector in order to establish an electrical connection between both components.

[0003] Fig. 1 exemplarily illustrates components of a connector of the prior art. The connector comprises a connector housing 1, a terminal housing 2, a seal element 3, and a TPA (terminal position assurance) element 4. For assembly of the prior art connector, the seal element 3 is placed on the terminal housing 2 such that it engages a flange protruding outwardly from the terminal housing 2. The terminal housing 2 with the seal element 3 is then arranged in the connector housing 1 such that the seal element 3 engages a sealing surface of the connector housing 1. Next step, an electrical terminal (not shown) may be inserted into the terminal housing 2. Subsequently, the TPA element 4 is inserted laterally through an opening 5 of the connector housing and through an opening 6 of the terminal housing 2. The inserted TPA element 4 is configured to prevent removal of the electrical terminal from the terminal housing 2.

[0004] Fig. 2 illustrates a cross section through the assembled connector of Fig. 1. The seal element 3 provides sealing interfaces with an outer surface of the terminal housing 2, and with the flange protruding outwardly from the terminal housing 2. Upon inserting the counter connector housing and tightening the counter connector housing to the connector housing 1, the sealing functionality is provided for. In this manner, the inner area of the connector is secured against moisture or other contaminants. In particular, the arrangement of the seal element 3 prevents moisture from reaching the electrical terminal via the interface between the terminal housing 2 and the connector housing 1.

[0005] The electrical terminal (not shown) may feature a groove (or pocket/neck/cut-out) which is engaged by the TPA element 4 reaching laterally through the terminal housing 2. This engagement prevents a removal of the electrical terminal from the terminal housing 2. Only when the TPA element 4 is removed first, thereby vacating the groove of the electrical terminal, the electrical terminal can be removed from the terminal housing 2. In this manner, the TPA element 4 provides for an additional lock, separate to the primary lock securing the electrical terminal in the terminal housing 2.

[0006] As known to the skilled person, a PLR (primary lock reinforcement) element may be provided, which is adapted to prevent unlocking of the primary lock securing the electrical terminal in the terminal housing 2. For example, a PLR element may block a deflection of the primary lock, such that the electrical terminal cannot be released while the PLR element is in position.

[0007] The provision of a PLR/TPA element is particularly important in applications where safety is critical, such as in aerospace, automotive, or medical devices, where a loose or disconnected connection could have serious consequences. By providing a more secure and reliable connection, a PLR/TPA element helps ensure the integrity and safety of the overall electrical connector system. In particular, the PLR/TPA element may prevent accidental disconnection or loosening a connection due to vibration, shock, or other environmental factors. This is particularly important in applications where the connectors are exposed to harsh or extreme conditions, such as high temperatures, pressure, vibrations or moisture.

[0008] However, the assembly of this prior art connector requires the provision of a large number of single components. Further, the overall size of the connector is relatively large.

[0009] There is thus a need for an improved connector design which preferably has reduced size and can be easily assembled.

[0010] This and other problems, which may become apparent to the skilled person in view of the present disclosure, are solved by a securing element of claim 1, an electrical connector system of claim 8, and a method of assembly of a connector system of claim 15.

3. Summary of the invention

[0011] One aspect of the disclosure relates to a securing element for securing an electrical terminal within a terminal housing of an electrical connector system. The electrical connector system may comprise a connector and a corresponding counter connector for establishing an electrical connection. The securing element may be adapted to provide additional locking and retention strength to a connector, to hold the electrical terminal in place within the terminal housing. The securing element may be adapted to secure the electrical terminal within the terminal housing once the electrical terminal has been fully inserted into the terminal housing upon assembly thereof. The securing element may, for example, be provided as a PLR (primary lock reinforcement) element or as a TPA (terminal position assurance) element.

[0012] The securing element comprises a main portion having the shape of a sleeve and being dimensioned to receive a terminal housing. The securing element may have a passage opening allowing for insertion of the terminal housing. Preferably, the passage opening of the securing element matches the sectional profile of the terminal housing. The securing element is preferably dimensioned such that the terminal housing can be inserted

into and partially passed through the securing element. The securing element is preferably dimensioned such that, when provided on the terminal housing, a longitudinal section of the terminal housing is fully enclosed by the securing element.

[0013] The securing element further comprises a seal portion provided at least partially on an outer surface of the main portion. The securing element may have an inner surface which may face the terminal housing when the terminal housing is inserted into the securing element (or when the securing element is arranged on the terminal housing). The outer surface of the securing element is opposite to the inner surface. Said outer surface may at least partially be covered by the seal portion. The seal element encompasses the circumference of the main portion, but not necessarily along the entire longitudinal length of the main portion. Accordingly, also the seal element may have the shape of a sleeve. The seal portion is preferably in fluid-tight contact with the outer surface of the main portion. Preferably, the seal portion is rigidly attached to the main portion. The outer surface of the seal portion may provide for a sealing interface with a connector housing, such as with the connector housing of a counter connector. Preferably, the securing element is adapted to come into fluid-tight contact with a perpendicular face of the terminal housing.

[0014] By providing a securing element with a seal portion, the size of the connector system can be reduced. It is no longer necessary to provide a sealing interface on the terminal housing as was required for the prior art system described above. Further, assembly of the connector system is simplified, since the number of separate elements is reduced.

[0015] The main portion and the seal portion are preferably not integrally formed. The main portion and the seal portion may be formed of different materials, that are preferably characterized by different hardness characteristics. The main portion itself may be integrally formed, preferably of a plastic material. The seal portion itself may be integrally formed, preferably of a suitable sealing material. For example, the seal portion may be of a material such as rubber or plastic (e.g. silicone) that is more compressible than the material of the main portion.

[0016] Preferably, the seal portion covers the entire outer surface of the main portion of the securing element. Thus, the seal element encompasses the circumference of the main portion along the entire longitudinal length of the main portion. In this manner, the strength and sealing function of the securing element is enhanced.

[0017] Preferably, the seal element has a L-shaped cross section and covers at least partially an edge of the main portion of the securing element. The edge of the main portion may also be understood as the face of the main portion. A first leg of the L-shaped seal element may cover the outer surface of the main portion. A second leg of the L-shaped seal element may extend from the first leg, preferably rectangular, towards the center of the

sleeve-shaped securing element, thereby covering at least partially the edge of the main portion of the securing element. In this manner, the sealing interface between the main portion and the sealing portion of the securing element is enhanced. Further, the securing element can provide for a sealing interface at its edge/face.

[0018] Preferably, the main portion comprises a protrusion on its inner surface and a cavity beneath the protrusion allowing a deflection of the protrusion. The protrusion may face towards the center of the sleeve-shaped securing element, and may reach into the passage opening into which the terminal housing may be inserted. The provision of the cavity allows for deflecting the protrusion away from the center of the sleeve-shaped securing element, such that the passage opening of the securing element is cleared from the protrusion. This allows for moving the securing element to defined positions on the terminal housing, and holding the securing element at these positions, as will be detailed further below. Preferably, the protrusion has a height of 0.2 to 0.6 mm, further preferred of 0.3 to 0.5 mm, most preferred of about 0.4 mm. Preferably, the cavity has a height of 0.2 to 0.6 mm, further preferred of 0.3 to 0.5 mm, and most preferred of about 0.4 mm. Preferably, the height of the protrusion corresponds to the height of the cavity. The height of the protrusion and of the cavity may be measured in a direction perpendicular to the inner surface of the main portion of the securing element.

[0019] Preferably, the main portion comprises a locking latch on its inner surface which is adapted to engage a notch of the terminal housing. The locking latch may reach into the passage opening into which the terminal housing may be inserted. The locking latch may have a wedged face allowing a deflection of the locking latch away from the center of the securing element when the terminal housing is inserted into the securing element and engages the wedged face of the locking latch. Opposite of the wedged face, the locking latch may have a stop face. When the locking latch engages the notch of the terminal housing, the stop face may come into blocking contact with the notch preventing removal of the securing element from the terminal housing. Thus, by means of the locking latch, the securing element can be easily and securely attached to the terminal housing.

[0020] Preferably, the main portion comprises a rail portion on its inner surface adapted to engage a guide portion of the terminal housing. The rail portion may reach into the passage opening into which the terminal housing may be inserted, and may have an elongated structure aligned with the insertion direction of the terminal housing. The provision of such a rail portion may facilitate attachment of the securing element to the terminal housing.

[0021] Preferably, the seal portion is in form-fit connection with the main portion. The seal portion may fit tightly against the main portion. In this manner, an improved securing element with durable sealing function is provided for. The seal portion may be pulled over the main

portion to provide the form-fit connection. Further preferred, the seal portion is molded onto the main portion to form the form-fit connection. In this manner, the securing element can be provided as a durable component to be used for the assembly of an electrical connector system.

[0022] A further aspect of the present disclosure relates to an electrical connector system. The electrical connector system may comprise a connector and a corresponding counter connector for establishing an electrical connection. The electrical connector system comprises a terminal housing adapted to accommodate an electrical terminal. The terminal housing may have one or more longitudinal terminal receiving portions each dimensioned to accommodate an electrical terminal. Preferably, there are provided two terminal receiving portions to receive two separate electrical terminals. The skilled person understands that other embodiments may feature multi-port terminal housings. Preferably, the system further comprises the respective electrical terminal(s). The electrical connector system further comprises a securing element as described above. The skilled person understands that the above specifications of the securing element similarly apply with regard for the electrical connector system comprising such a securing element.

[0023] The terminal housing is received in the main portion of the securing element along a mating direction. The main direction may correspond to the main orientation of the one or more longitudinal terminal receiving portions of the terminal housing. When provided on the terminal housing, the securing element may cover the terminal housing along its circumference, while at least part of the inner surface of the main portion of the securing element may contact the terminal housing. The terminal housing and securing element may be part of a connector, and the outer surface of the sealing portion of the securing element may provide for a sealing interface with the housing of a corresponding counter connector.

[0024] Further, the securing element is configured to be movable relative to the terminal housing along the mating direction between a locked position preventing removal of the electrical terminal from the terminal housing and an unlocked position enabling removal of the electrical terminal from the terminal housing. Insertion or removal of the electrical terminal into or from the terminal housing may require a deflection of part of the terminal housing which may only be enabled when the securing element is in the unlocked position. When in the locked position, the securing element may block such a deflection.

[0025] Preferably, when the securing element is in the locked position, the seal portion covering at least partially the edge of the securing element is sealingly engaging the terminal housing. The terminal housing may comprise a flange protruding outwardly, against which the seal portion covering at least partially the edge of the securing element may abut to form a sealing interface. The sealing interface is preferably gapless along the edge of the se-

curing element. In this manner, the inside of the terminal housing and electrical terminals provided therein are secured against moisture or other contaminants.

[0026] Preferably, the terminal housing comprises a first recess and a second recess arranged along the mating direction and engageable by the protrusion of the securing element, wherein the securing element is in the unlocked position when the protrusion engages the first recess, wherein the securing element is in the locked position when the protrusion engages the second recess. When moving the securing element between the unlocked and locked positions, the protrusion on the inner surface of the main portion of the securing element may be deflected, and when the securing element reaches one of the unlocked and locked positions, the protrusion may snap into the corresponding recess of the terminal housing. In this manner, the securing element may be located in defined positions.

[0027] Preferably, the terminal housing comprises a first notch and a second notch arranged along the mating direction and engageable by the locking latch of the securing element, wherein the securing element is in the unlocked position when the locking latch engages the first notch, wherein the securing element is in the locked position when the locking latch engages the second notch. First notch may have a wedged face engaging and deflecting the locking latch of the securing element when the securing element is moved from the unlocked position to the locked position. The first notch may further have a stop face opposite of the wedged face which may come into blocking contact with the locking latch of the securing element preventing removal of the securing element from the terminal housing. The configuration of the second notch may correspond to that of the first notch. In this manner, the position of the securing element can be fixed to the locked position, which improves the overall securing functionality of the securing element.

[0028] Preferably, the terminal housing comprises a longitudinal guide portion extending along the mating direction, wherein the rail portion of the securing element is received in the guide portion of the terminal housing. The longitudinal guide portion may be dimensioned to receive the guide portion of the terminal housing, and may be provided in the form of a longitudinal recess. The interplay of the guide portion of the terminal housing with the rail portion of the securing element may facilitate attachment of the securing element to the terminal housing, and may further facilitate moving the securing element along the terminal housing.

[0029] In a preferred embodiment, the electrical connector system further comprises a counter connector adapted to be mated with the terminal housing, wherein, in the mated configuration, the seal portion of the securing element is sealingly engaging a housing of the counter connector. In the mated configuration, a sealing interface may be provided between an inner surface of the housing of the counter connector and the outer surface of the seal portion of the securing element. The sealing

interface is preferably gapless around the perimeter of the securing element. In this manner, a secure seal is provided for.

[0030] In a further preferred embodiment, the terminal housing comprises a flexible blocking lance extending essentially along the mating direction. When not deflected, the flexible blocking lance may be in a rest position. When the flexible blocking lance is in the rest position, a wedge of the flexible blocking lance reaches into a terminal receiving portion of the terminal housing. The wedge may have any suitable shape preventing removal of the electrical terminal from the terminal housing when the blocking lance is in the rest position. When the securing element is in the unlocked position and the flexible blocking lance is in the rest position, the flexible blocking lance may be deflected outwardly to reach a deflected position in which the wedge is at least partially retracted from the terminal receiving portion of the terminal housing. When inserting the electrical terminal into the terminal housing, the electrical terminal may engage the wedge of the blocking lance and urge the blocking lance to the deflected position to clear the passageway for the insertion of the electrical terminal. When the securing element is in the locked position, the securing element covers the flexible blocking lance at least partially thereby blocking deflection of the flexible blocking lance from the rest position to the deflected position. In this manner, a possible deflection of the blocking lance induced by the electrical terminal is blocked. In order to remove the electrical terminal from the terminal housing, the securing element has to be moved into the unlocked position. Afterwards, the flexible blocking lance can be forced to deflect, for example, by means of a respective tool, such that the wedge is at least partially retracted from the terminal receiving portion of the terminal housing.

[0031] A further aspect of the present disclosure relates to a method of assembly of a connector system. The connector system may be configured as described above. The method comprises providing a terminal housing received in a securing element as described above, wherein the securing element is in an unlocked position enabling insertion of an electrical terminal into the terminal housing. Further, the method comprises inserting the electrical terminal into the terminal housing, and moving the securing element relative to the terminal housing along the mating direction from the unlocked position to a locked position preventing removal of the electrical terminal from the terminal housing. For disassembly of the connector system, the securing element may be moved relative to the terminal housing along the mating direction from the locked position to the unlocked position enabling removal of the electrical terminal from the terminal housing. Afterwards, the electrical terminal may be removed from the terminal housing.

4. Description of preferred embodiments

[0032] In the following the present invention is described with reference to the accompanying figures. In the figures, similar elements are provided with the same reference signs.

Fig. 1 illustrates individual components of a connector of the prior art;

Fig. 2 illustrates a cross-section of the assembled connector of Fig. 1;

Fig. 3 illustrates three different views of a PLR element according to an embodiment of the invention;

Fig. 4 illustrates a PLR element in a pre-assembled configuration according to an embodiment of the invention;

Fig. 5 illustrates the PLR element of Fig. 5 in an assembled configuration;

Fig. 6 illustrates a terminal housing according to an embodiment of the invention;

Fig. 7 illustrates the terminal housing of Fig. 6 in a different view;

Fig. 8 illustrates an electrical connector in a pre-assembled configuration according to an embodiment of the invention;

Fig. 9 illustrates the electrical connector of Fig. 8 in an assembled configuration;

Fig. 10 illustrates three different configurations of the electrical connector of Fig. 9;

Fig. 11 illustrates the electrical connector of Fig. 9 in a mated configuration.

[0033] Fig. 3 illustrates three different views of a PLR element 10 according to an embodiment of the invention. The PLR element 10 has the shape of a sleeve, defining a longitudinal passage opening allowing for longitudinal insertion of the terminal housing. The shape of the PLR element 10 is a closed loop defined by two parallel sections and two semicircular sections.

[0034] The PLR element 10 comprises a main portion 11 of a hard plastic material. The inner surface of the main portion 11 defines the passage opening that can receive the terminal housing. The PLR element 10 further comprises a seal portion 12 of silicone, i.e. a material that is more compressible than the material of the main portion 11. The seal portion 12 is provided on the outer surface of the main portion 11 covering the entire outer surface of the main portion 11. The seal portion 12 is in a form-fit connection with the main portion 11. The outer surface of the seal portion 12 features grooves extending around the PLR element providing improved sealing functionality as known in the art.

[0035] On the inner surface of the main portion 11, there are provided two protrusions 13 having a height of 0.4 mm. Beneath each protrusion, in the body of the main portion 11, there is provided a cavity 14 having a height of 0.4 mm. The protrusions 13 can be deflected away from the center of the PLR element 10, thereby squeezing

the cavities 14.

[0036] On the inner surface of the main portion 11, there is further provided a locking latch 15 that extends along the longitudinal direction of the passage opening of the PLR element 10. The locking latch 15 comprises a projection extending from a main arm of the locking latch 15 towards the center of the PLR element 10.

[0037] On the inner surface of the main portion 11, there is further provided a rail portion 16. The rail portion 16 has an elongated structure aligned along the longitudinal direction of the passage opening of the PLR element. The rail portion 16 reaches into the passage opening.

[0038] Fig. 4 illustrates the PLR element 10 of Fig. 3 in a pre-assembled configuration, while Fig. 5 illustrates the respective assembled configuration. As can be depicted from Fig. 4, for assembly of the PLR element 10, the seal portion 12 is expanded radially outwards, for example manually, such that the seal portion 12 can be provided over the main portion 11, as also illustrated in Fig. 4. The seal portion 12 comprises a mating projection 17 on its inner surface which is brought into alignment with a corresponding mating groove (not shown) on the outer surface of the main portion 11. Afterwards, the expansion of the seal portion 12 is released such that it snaps onto the main portion 11, as seen in Fig. 5, to form the form-fit connection.

[0039] Fig. 6 illustrates a terminal housing 20 which may be inserted into the PLR element 10 of Fig. 3. The terminal housing has in this example two longitudinally extending terminal receiving portions 21 which are hollow openings into which electrical terminals may be inserted. On a longitudinal rim extending between the two terminal receiving portions 21, there are provided two notches 22A, 22B at different longitudinal positions. The first notch 22A is provided on a longitudinal position closer to the mating end of the terminal housing 20 than the second notch 22B. Each notch has a stop face facing the rear end of the terminal housing 20, and a wedged face opposite of the stop face. Opposite of the longitudinal rim with the two notches 22A, 22B, there is provided a guide portion 23 in the form of a longitudinal groove.

[0040] Fig. 7 illustrates the terminal housing 20 of Fig. 6 in a different orientation. As can be seen, the guide portion 23 is provided between the two terminal receiving portions 21. Further, there are provided two recesses 24A, 24B at different longitudinal positions on the outer surface of each terminal receiving portion 21. The recesses have a dimension corresponding to that of the protrusions 13 of the PLR element 10. On each terminal receiving portion 21, a first recess 24A is provided on a longitudinal position closer to the mating end of the terminal housing 20 than the second recess 24B.

[0041] Fig. 8 illustrates an electrical connector in a pre-assembled configuration. The connector is formed of the PLR element according to Fig. 3, the terminal housing according to Fig. 6, an outer housing 30, electrical terminals 40 (e.g. H-MTD terminals), and an end cap 50. The

skilled person recognizes that further components may be provided, such as e.g. a CPA (connector position assurance) element. To assemble the connector, the terminal housing 20 is moved into the PLR element 10 along a mating direction. The outer housing 30 is moved onto the terminal housing 20 along the mating direction. The electrical terminals 40 are moved into the terminal housing along the mating direction. Then, the rear part is closed by means of the end cap 50.

[0042] Fig. 9 illustrates the electrical connector of Fig. 8 in an assembled configuration. The PLR element 10 is provided on the terminal housing 20 such that the locking latch 15 engages the first notch 22A, defining the unlocked position of the PLR element 10. In this unlocked position, the first protrusions 13 of the PLR element 10 engage the first recesses 24A of the terminal housing 20, preferably only once during assembly. In this configuration of Fig. 9, the electrical terminals 40 can be inserted into the terminal housing 20, or removed therefrom, as will be detailed below. The skilled person recognizes that the locking latch 15 can principally be released from the first notch 22A for removing the PLR element 10, by deflecting the locking latch 15 by means of a tool.

[0043] Fig. 10 illustrates three different configurations of the electrical connector of Fig. 9. In the first configuration (a), the PLR element 10 is in the unlocked position. As described above, the locking latch 15 of the PLR element 10 engages the first notch 22A of the terminal housing 20, and the first protrusions 13 of the PLR element 10 engage the first recesses 24A of the terminal housing 20. An unwanted movement of the PLR element is prevented in this manner.

[0044] Each terminal receiving portion 21 of the terminal housing is provided with one flexible blocking lance 25. The flexible blocking lances 25 extend essentially along the mating direction, with its free ends pointing towards the mating end of the terminal housing 20. In the configuration (a) of Fig. 10, the flexible blocking lances 25 are in a rest position. At the free end of each flexible blocking lance 25, there is provided a wedge 26 that reaches into the inside of the respective terminal receiving portion 21. The wedges are dimensioned to prevent removal of the electrical terminals 40 when the blocking lances 25 are in the rest position.

[0045] In the unlocked position, the PLR element 10 is not covering the flexible blocking lances 25. When inserting the electrical terminals 40 into the terminal housing 20, leading edges 41 of the electrical terminals 40 engage the wedges 26 of the flexible blocking lances 25 thereby urging the flexible blocking lances 25 to deflect radially outwards to finally reach a deflection position in which the electrical terminals 40 can pass by the wedges 26. This deflection of the flexible blocking lances 25 is not blocked by the PLR element 10 being in the unlocked position.

[0046] In the second configuration (b) of Fig. 10, the electrical terminals 40 have been fully inserted into the terminal housing 20 and the flexible blocking lances 25

have returned to the rest position in which the wedges 26 enter grooves 42 of the electrical terminals 40. In this configuration (b), stop edges 43 of the electrical terminals 40 face corresponding stop edges 27 of the flexible blocking lance 25, providing a primary lock retaining the electrical terminals 40 within the terminal housing 20. This primary lock can be released by means of an unlocking tool.

[0047] To secure the electrical terminals 40 in the terminal housing 20, the PLR element 10 is moved from the unlocked position to the locked position. In this context, the protrusions 13 of the PLR element 10 are urged to deflect radially outward to vacate the first recesses 24A of the terminal housing 20. Further, the wedged face of the first notch 22A of the terminal housing 20 urges the locking latch 15 of the PLR element 10 to deflect radially outward. When the PLR element 10 has been moved sufficiently far for the locking latch 15 to reach the second notch 22B and for the protrusions 13 to reach the second recesses 24B, the locking latch 15 snaps into the second notch 22B and the protrusions snap into the second recesses 24B, defining the locked position of the PLR element 10.

[0048] In the third configuration (c) of Fig. 10, the PLR element 10 is in the locked position. The PLR element 10 covers the flexible blocking lance 25 thereby blocking a deflection of the flexible blocking lance 25 from the rest position to the deflected position. In this manner, the PLR element 10 further secures the electrical terminals 40 within the terminal housing 20.

[0049] As can generally be seen in Fig. 10, the sealing portion 12 of the PLR element 10 has a L-shaped cross section. A first leg 18 of the L-shaped seal element 12 covers the entire outer surface of the main portion 11. A second leg 19 of the L-shaped seal element 12 extend from the first leg 18 towards the center of PLR element 10, thereby partially covering the edge of the main portion 11 of the PLR element 10. One edge/face of the PLR element 10 is defined by the second leg 19 of the sealing portion 12.

[0050] In the locked position, the PLR element 10 provides for a sealing interface with the terminal housing 20. The second leg 19 of the PLR element sealingly engages a flange 28 of the terminal housing protruding outwardly to form a first sealing interface S1. This first sealing interface S1 is gapless along the edge of the PLR element 10. In this manner, the inside of the terminal housing and electrical terminals provided therein are secured against moisture or other contaminants.

[0051] Fig. 11 illustrates the electrical connector of Fig. 9 in a mated configuration, i.e. the connector is mated with a corresponding counter connector. As can be seen in Fig. 11, a housing (60) of the counter connector is partially received by the outer housing 30. A second sealing interface S2 is formed between an inner surface of the housing 60 of the counter connector and the outer surface of the first leg 18 of the seal portion 12 of the PLR element 10. In this manner, a reliable sealing func-

tion is provided for. Further, in the mated configuration, a stop face 61 provided on the housing 60 of the counter connector faces an edge of the PLR element 10, thereby securing the PLR element 10 in the locked position.

Claims

1. A securing element (10) for securing an electrical terminal within a terminal housing of an electrical connector system, the securing element (10) comprising:
 - a main portion (11) having the shape of a sleeve and being dimensioned to receive a terminal housing (20); and
 - a seal portion (12) provided at least partially on an outer surface of the main portion (11).
2. The securing element (10) of claim 1, wherein the seal portion (12) covers the entire outer surface of the main portion (11).
3. The securing element (10) of claim 1 or 2, wherein the seal portion (12) has a L-shaped cross-section and covers at least partially an edge of the main portion (11) of the securing element (10).
4. The securing element (10) of any one of claims 1-3, wherein the main portion (11) comprises a protrusion (13) on its inner surface and a cavity (14) beneath the protrusion (13) allowing a deflection of the protrusion (13),
 - in particular wherein the protrusion (13) and/or the cavity (14) has a height of 0.2 to 0.6 mm, preferably of 0.3 to 0.5 mm, and most preferred of about 0.4 mm.
5. The securing element (10) of any one of claims 1-4, wherein the main portion (11) comprises a locking latch (15) on its inner surface which is adapted to engage a notch (22A, 22B) of the terminal housing (20).
6. The securing element (10) of any one of claims 1-5, wherein the main portion (11) comprises a rail portion (16) on its inner surface adapted to engage a guide portion (23) of the terminal housing (20).
7. The securing element (10) of any one of claims 1-6, wherein the seal portion (12) is in form-fit connection with the main portion (11), preferably wherein the seal portion (12) is molded onto the main portion (11).
8. An electrical connector system, comprising:
 - a terminal housing (20) adapted to accommodate an electrical terminal (40);
 - the securing element (10) according to any one

- of claims 1-7;
 wherein the terminal housing (20) is received in the main portion (11) of the securing element (10) along a mating direction;
 wherein the securing element (10) is configured to be movable relative to the terminal housing (20) along the mating direction between a locked position preventing removal of the electrical terminal (40) from the terminal housing (20) and an unlocked position enabling removal of the electrical terminal (40) from the terminal housing (20).
9. The connector system of claim 8 in combination with claim 3, wherein, when the securing element (10) is in the locked position, the seal portion covering at least partially the edge of the securing element (10) is sealingly engaging the terminal housing (20).
10. The connector system of claim 8 or 9 in combination with claim 4, wherein the terminal housing (20) comprises a first recess (24A) and a second recess (24B) arranged along the mating direction and engageable by the protrusion (13) of the securing element (10), wherein the securing element (10) is in the unlocked position when the protrusion (13) engages the first recess (24A), wherein the securing element (10) is in the locked position when the protrusion (13) engages the second recess (24B).
11. The connector of any one of claims 8-10 in combination with claim 5, wherein the terminal housing (20) comprises a first notch (22A) and a second notch (22B) arranged along the mating direction and engageable by the locking latch (15) of the securing element (10), wherein the securing element (10) is in the unlocked position when the locking latch (15) engages the first notch (22A), wherein the securing element (10) is in the locked position when the locking latch (15) engages the second notch (22B).
12. The connector of any one of claims 8-11 in combination with claim 6, wherein the terminal housing (20) comprises a longitudinal guide portion (23) extending along the mating direction, wherein the rail portion (16) of the securing element (10) is received in the guide portion (23) of the terminal housing (20).
13. The connector system of any one of claims 8-12, further comprising a counter connector adapted to be mated with the terminal housing (20), wherein, in the mated configuration, the seal portion (12) of the securing element (10) is sealingly engaging a housing (60) of the counter connector.
14. The connector system of any one of claims 8-13, wherein the terminal housing (20) comprises a flexible blocking lance (25) extending essentially along

the mating direction,

- wherein, when the flexible blocking lance (25) is in a rest position, a wedge (26) of the flexible blocking lance (25) reaches into a terminal receiving portion (21) of the terminal housing (20); wherein, when the securing element (10) is in the unlocked position and the flexible blocking lance (25) is in a deflected position, the flexible blocking lance (25) is deflected outwardly such that the wedge (26) is at least partially retracted from the terminal receiving portion (21) of the terminal housing (20); wherein, when the securing element (10) is in the locked position, the securing element (10) covers the flexible blocking lance (25) at least partially thereby blocking deflection of the flexible blocking lance (25) from the rest position to the deflected position.
15. Method of assembly of a connector system, the method comprising:
- providing a terminal housing (20) received in the securing element (10) according to any one of claims 1-7, wherein the securing element (10) is in an unlocked position enabling insertion of an electrical terminal (40) into the terminal housing (20);
 inserting the electrical terminal (40) into the terminal housing (20);
 moving the securing element (10) relative to the terminal housing (20) along the mating direction from the unlocked position to a locked position preventing removal of the electrical terminal (40) from the terminal housing (20).

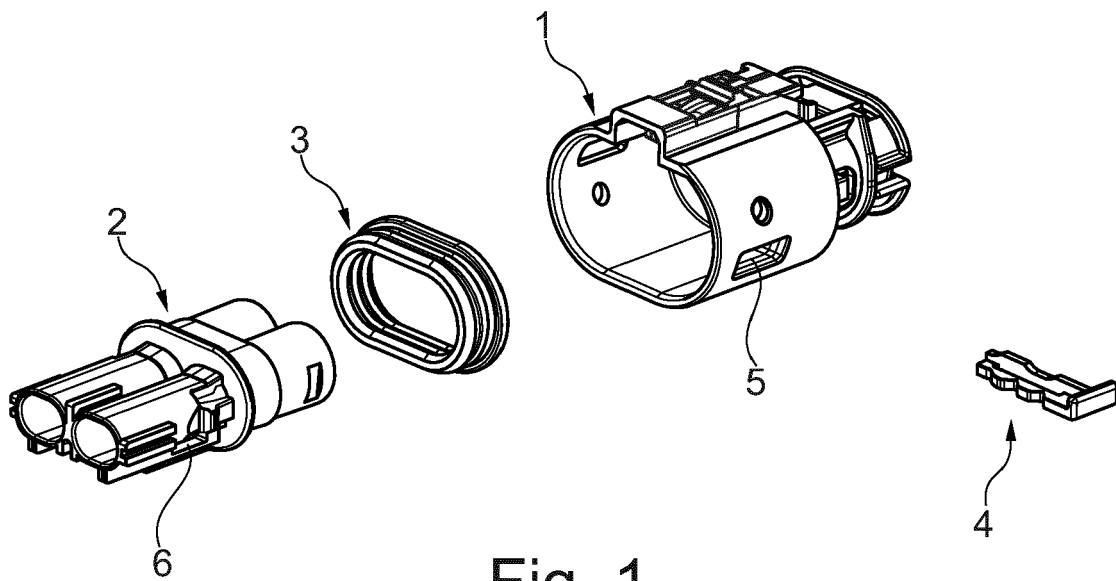


Fig. 1
(prior art)

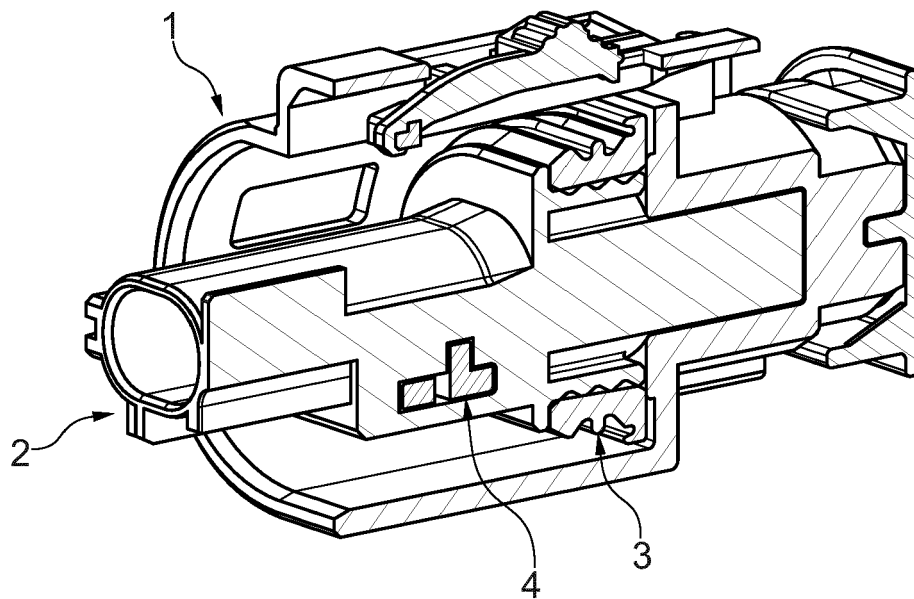


Fig. 2
(prior art)

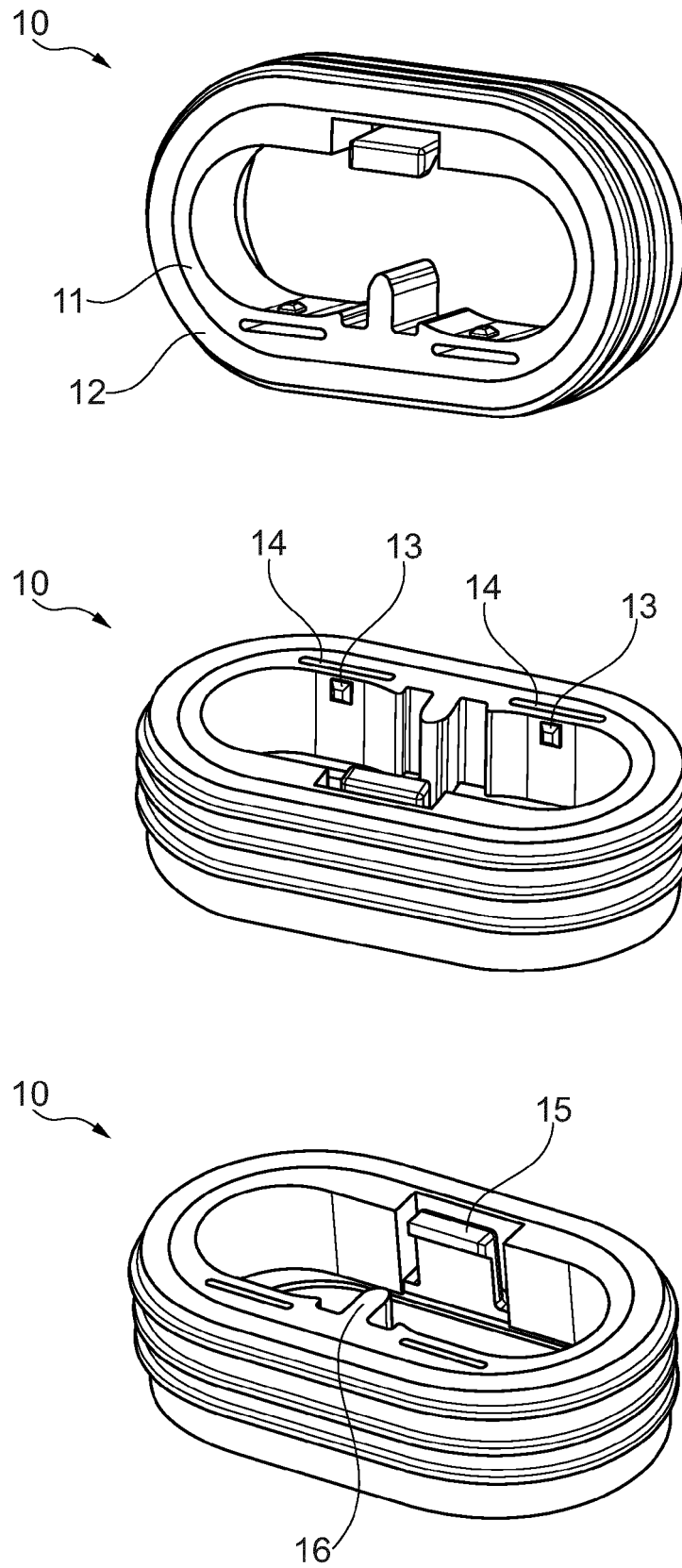


Fig. 3

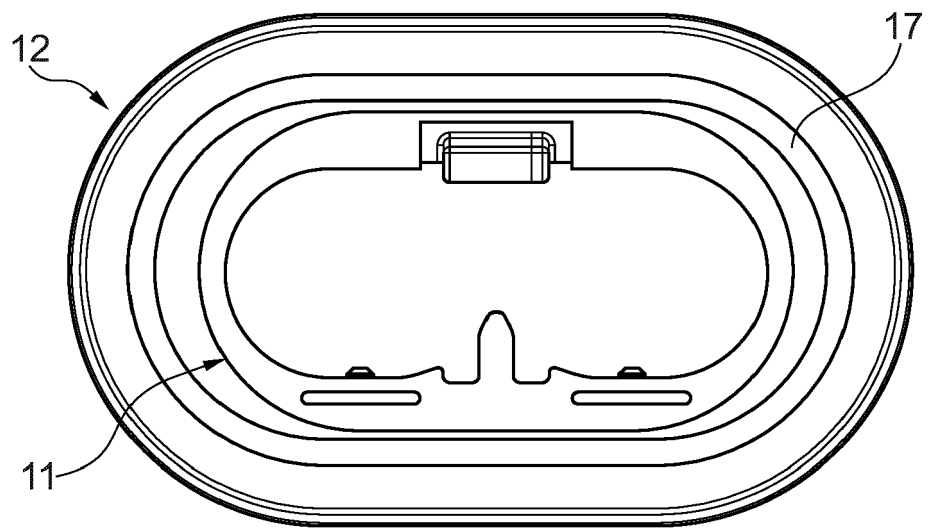


Fig. 4

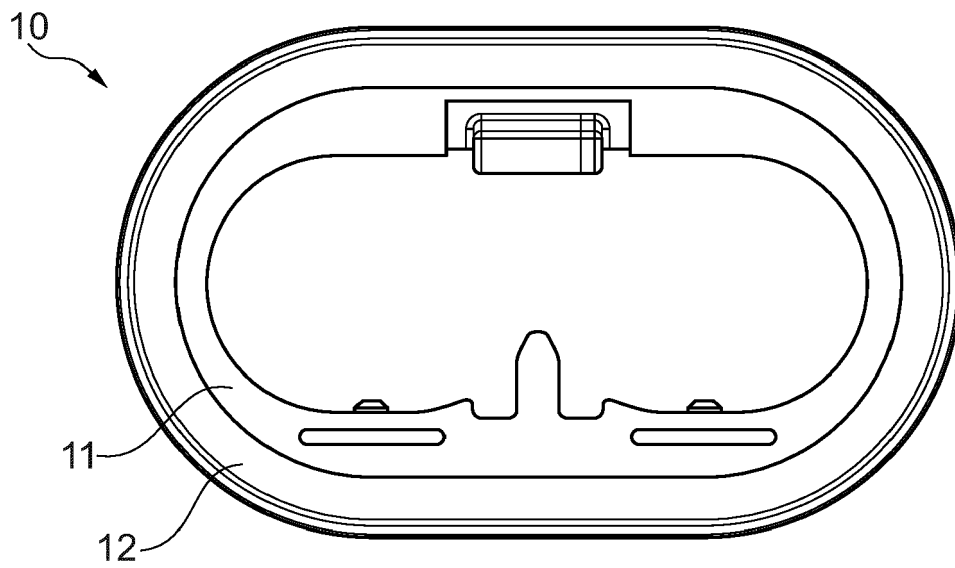


Fig. 5

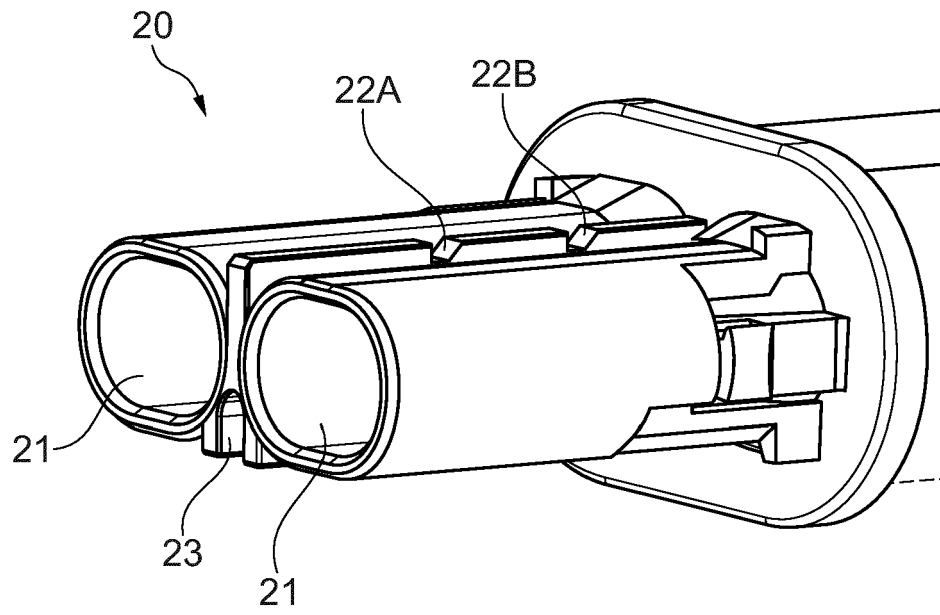


Fig. 6

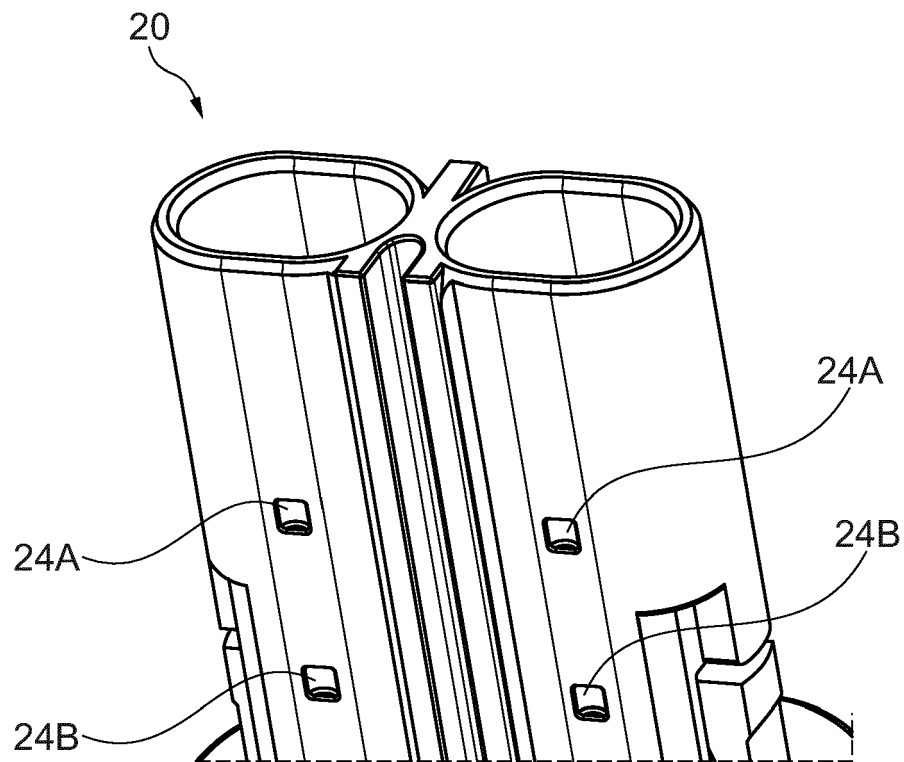


Fig. 7

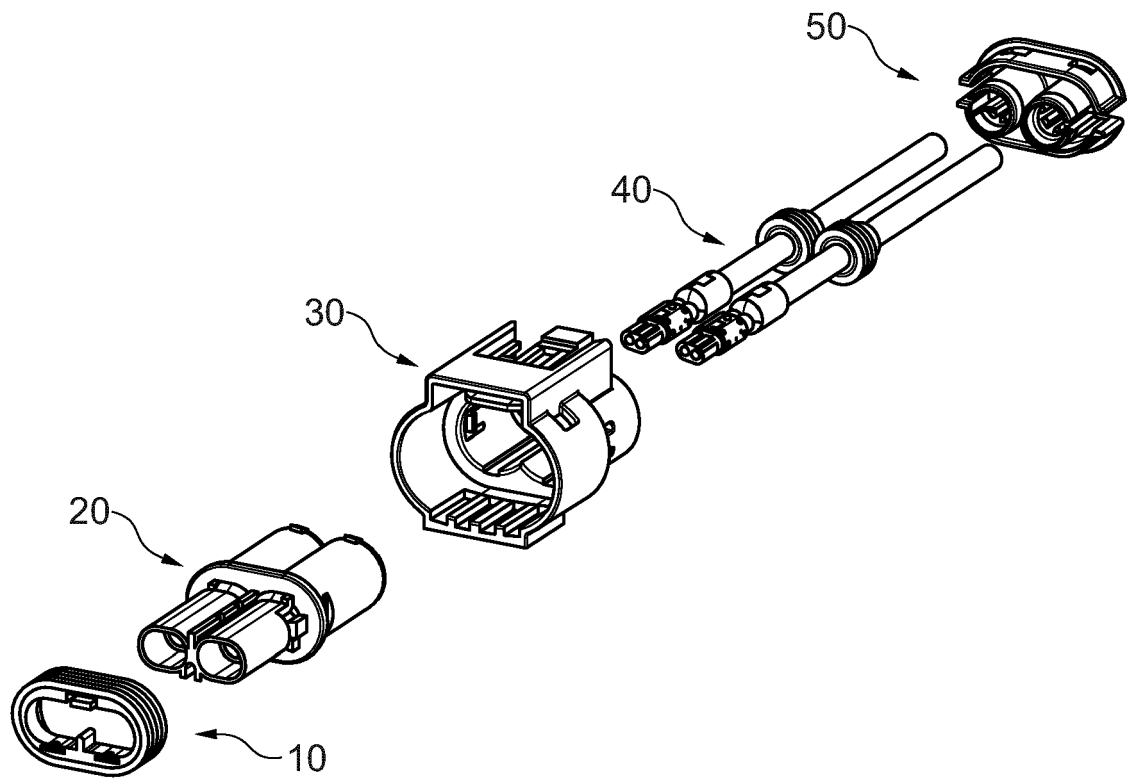


Fig. 8

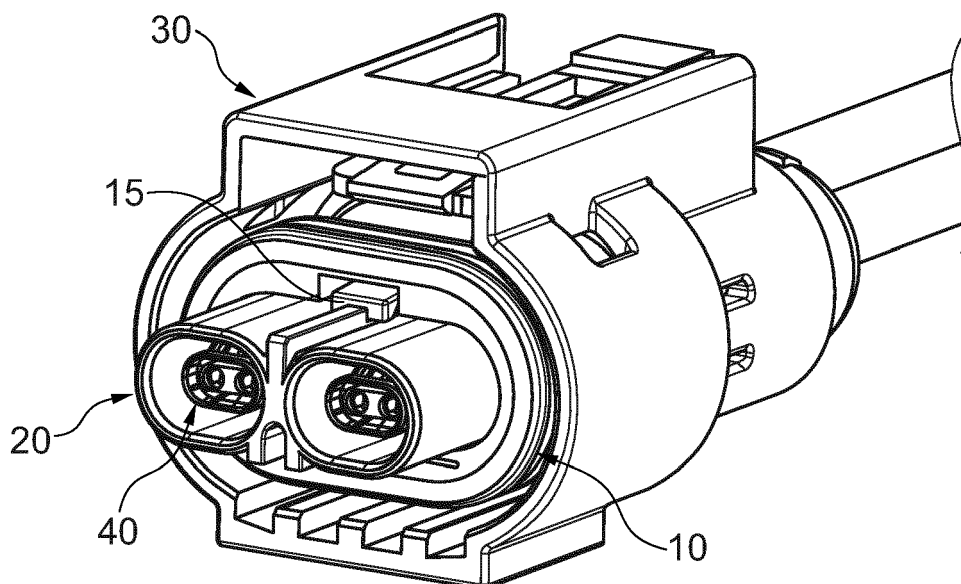
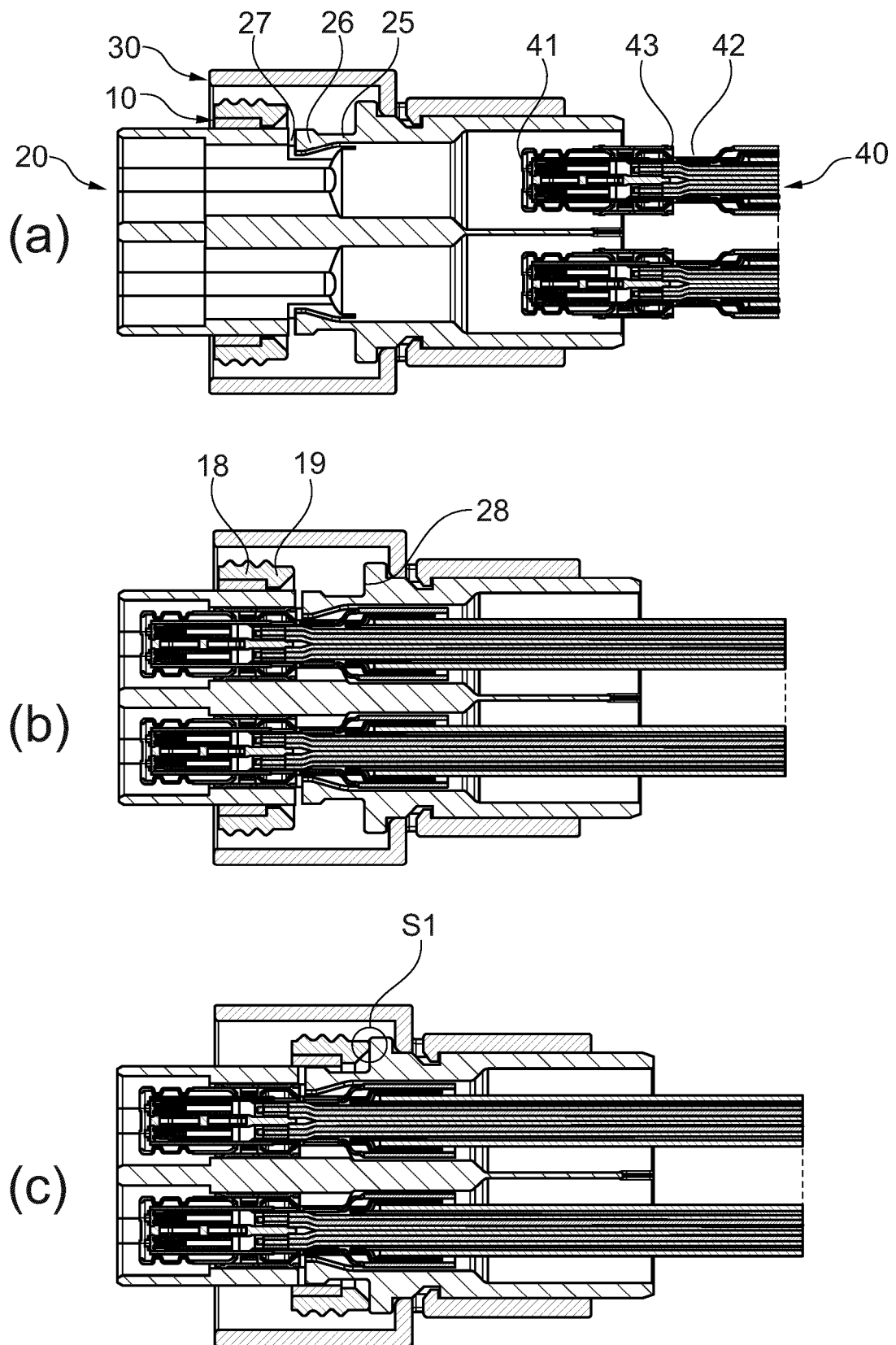


Fig. 9



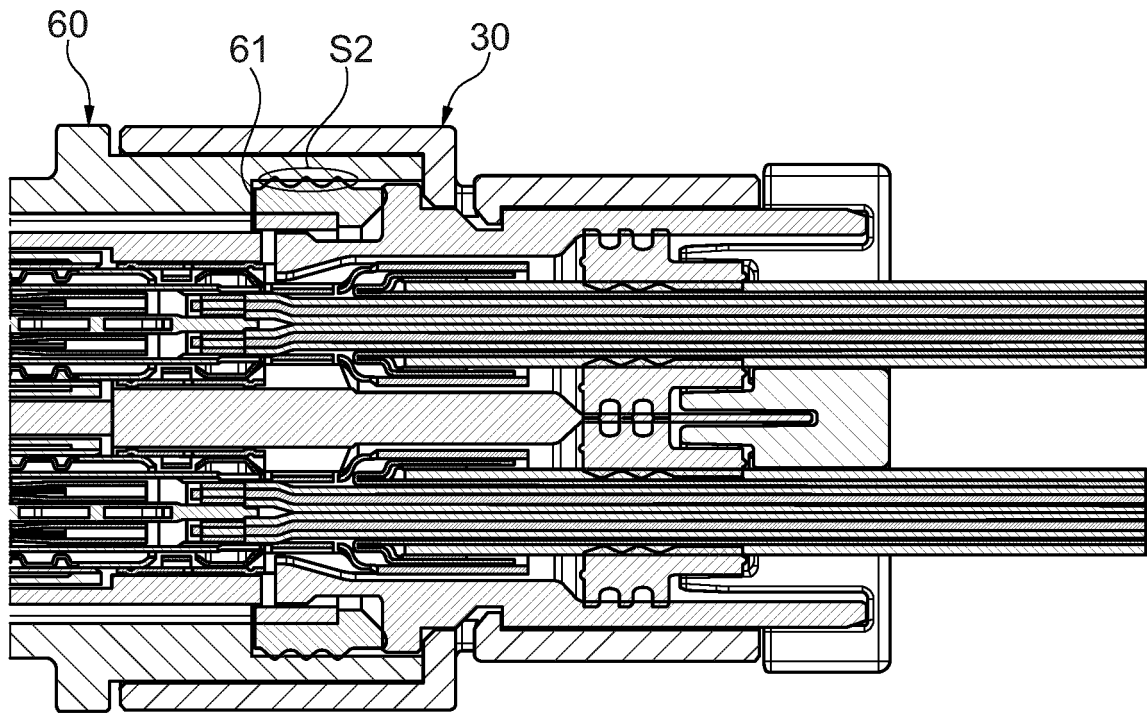


Fig. 11



EUROPEAN SEARCH REPORT

Application Number

EP 23 16 9800

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	US 2010/055961 A1 (MARTIN GALEN M [US] ET AL) 4 March 2010 (2010-03-04) * paragraph [0002] - paragraph [0026]; figures 1,2,4,5,6,7,8 * -----	1-15	INV. H01R13/436 H01R13/52 ADD. H01R13/422
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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		3 October 2023	Mateo Segura, C
CATEGORY OF CITED DOCUMENTS		T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document	
X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document			

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EPO FORM 1503 03.82 (P04C01)

ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.

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5 This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
The members are as contained in the European Patent Office EDP file on
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03-10-2023

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