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

(11) **EP 3 979 433 A1**

(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
06.04.2022 Bulletin 2022/14

(21) Application number: **20199648.5**

(22) Date of filing: **01.10.2020**

(51) International Patent Classification (IPC):
H01R 13/627 *(2006.01)* ***H01R 13/629*** *(2006.01)*
H01R 13/639 *(2006.01)* *H01R 13/703* *(2006.01)*

(52) Cooperative Patent Classification (CPC):
H01R 13/6273; H01R 13/62955; H01R 13/639; H01R 13/703

(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:
KH MA MD TN

(71) Applicant: **TE Connectivity Germany GmbH**
64625 Bensheim (DE)

(72) Inventors:
- **BISCHOFF, Daniel**
  64572 Büttelborn (DE)
- **SCHIEMER, Bjoern**
  64295 Darmstadt (DE)
- **DOMKE, Daniel**
  67227 Frankenthal (DE)

(74) Representative: **Grünecker Patent- und Rechtsanwälte**
PartG mbB
Leopoldstraße 4
80802 München (DE)

(54) HOUSING ASSEMBLY WITH A SPRING BIASED CPA

(57) In order to provide a housing assembly with increased safety for a connection of the housing assembly (1) with a mating connector (7) and in order to facilitate the removal of the mating connector (7) from the housing assembly (1), the invention provides a housing assembly (1) for an electrical connector (2), the housing assembly (1) comprising a housing (3) having a receptacle (5) for receiving at least parts of a mating connector (7), at least one connector position assurance element (CPA) (17) for securing the position of the mating connector (7) in the receptacle (5), and at least one CPA-actuator (23) that is operationally coupled to the CPA (17) for driving the CPA (17) from a locking position 19 to a release position (21), wherein in the release position (21), the CPA (17) is moved away from the receptacle (5) in relation to the locking position (19), and wherein the at least one CPA (17) is spring biased into the locking position (19).

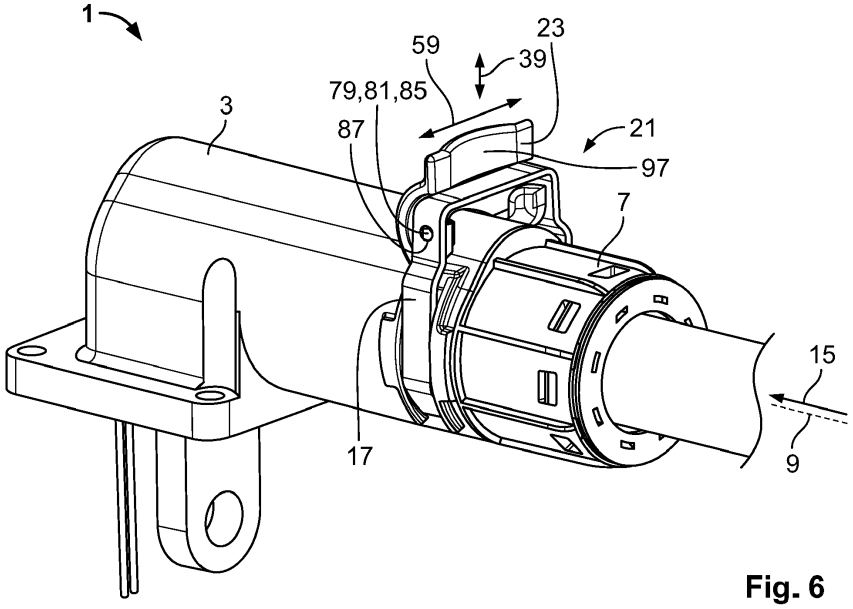


Fig. 6

EP 3 979 433 A1

Description

[0001] The invention relates to a housing assembly for an electrical connector and to a connector assembly. The invention further relates to a connector assembly that comprises a housing assembly according to the invention and a mating connector.

[0002] In order to provide a safe and reliable electrical connection between a housing assembly of an electrical connector and a mating connector, a connector position assurance element, also known as CPA, can be used. However, using a CPA may be cumbersome and sometimes require special technical skills.

[0003] It is thus the object of the invention to overcome at least one of these problems and provide a housing assembly with which a connection between the housing assembly and a mating connector can easily and reliably be secured and released.

[0004] This objective is solved according to the invention by a housing assembly for an electrical connector, the housing assembly comprising a housing having a receptacle for receiving at least parts of a mating connector, at least one connector positon assurance element (CPA) for securing the position of the mating connector in the receptacle, and at least one CPA-actuator that is operationally coupled to the CPA for driving the CPA from a locking position to a release position, wherein in the release position, the CPA is moved away from the receptacle in relation to the locking position, and wherein the at least one CPA is spring-biased into the locking position.

[0005] With the CPA-actuator, the CPA can easily be transferred from the locking position to the release position. Hence, removal of the mating connector from the receptacle is facilitated. Due to the CPA being spring-biased into the locking position, the safety of the connection between the housing assembly and the mating connector is increased. Due to the spring bias, the CPA may be moved automatically into the locking position when no external force is applied on the CPA-actuator.

[0006] In the locking position, an inserted mating connector is blocked from being removed from the receptacle. In the release position, the receptacle is unblocked for releasing the mating connector.

[0007] In the following, further improvements of the invention are described. The additional improvements may be combined independently of each other, depending on whether a particular advantage of a particular improvement is needed in a specific application.

[0008] According to a first advantageous improvement, at least one elastically deflectable spring member may be integrated in the CPA for generating the spring bias. Preferably, the CPA itself is configured as a spring member. In order to act as a spring member and to provide safe locking of the mating connector, the CPA is preferably made from steel, in particular spring steel.

[0009] Preferably, the CPA at least partially clasps the housing. The CPA thereby preferably encompasses more than 180° of a cross-section of the housing, wherein said cross-section is viewed perpendicular to an axis of the receptacle.

[0010] By clasping the housing, the CPA may be captively connected to same. Furthermore, when the CPA encompasses or clasps the housing about more than 180°, it may interact with the mating connector at at least two positions, which may be arranged diametrically to each other across the receptacle.

[0011] Preferably, the CPA and the CPA-actuator are combined unitarily with each other. In other words, the CPA and the CPA-actuator preferably form a unit. The unit comprising the CPA and the CPA-actuator is preferably captively connected to the housing. Due to this arrangement, the handling of the housing assembly may be facilitated since the loss of the CPA may be prevented. This is beneficial compared to housing assemblies where the CPA is a separate part.

[0012] The CPA is preferably configured as a clip, the clip having at least one leg with a locking section that at least partially extends into the receptacle in the locking position. Preferably, the clip is a U-clip with two legs which extend from a common ground or base. The two legs are preferably spaced apart from each other, particularly diametrically, across the receptacle. Thereby, each of the legs may interact with a mating connector at its locking section in order to block the movement of the mating connector in the locking position. The clip may also have the shape of a C-clip, an E-clip, a circclip or another shape that serves the same purpose.

[0013] In order to securely fixate a mating connector in the receptacle, the at least one locking section is preferably basically straight. At least the locking section of a leg may be slidably seated in a groove on the housing, at least in the locking position.

[0014] The locking section preferably extends perpendicular to an axis of the receptacle. The axis of the receptacle is preferably a longitudinal axis of a basically longitudinally shaped receptacle. The axis may also define a receiving direction of the receptacle along which a mating connector may be received. Hence, said receiving direction is identical to an insertion direction of the mating connector.

[0015] The CPA is preferably movable along a CPA moving direction on the housing. Said CPA moving direction is preferably perpendicular to the axis of the receptacle. At least the locking sections of the legs are preferably parallel with the CPA moving direction.

[0016] The at least one leg has preferably at least one sliding section that is configured to slide along an outer surface of the housing at least during a transition between the release position and the locking position. Said sliding section is preferably arranged at an end facing away from the ground of the CPA. In other words, the locking section is preferably arranged between the sliding section and the ground. In the preferred embodiment with a CPA having two legs, the two sliding sections of both legs may be inclined towards each other.

[0017] Preferably, at least a section of the outer surface of the housing is inclined with respect to the CPA moving direction, wherein the inclined section and the CPA are configured for converting a sliding movement of the sliding section along the inclined section during a transition from the locking position to the release position into a movement of the locking section further away from the receptacle. Thereby, a mating connector can easily be released by simply moving the CPA along the moving direction.

[0018] According to another advantageous improvement, the housing preferably has a basically round cross-section that is to say, an essentially circular or elliptic cross-section. This round shape may provide the inclined sections. Moving the CPA along the CPA moving direction during the transition from the locking position to the release position may lead to sliding of the sliding section along the round surface, wherein a distance from a contact point of the sliding section with the housing to a diameter of the cross-section that runs parallel with the CPA moving direction increases. Said distance is measured perpendicular to said diameter.

[0019] In a preferred embodiment, where the CPA has two legs, the CPA widens when the sliding sections slide along the housing and the distance between the two sliding sections increases. IN the locking position, the sliding sections are closer together than in the release position. The housing is preferably provided with at least one groove for each leg for guiding at least a part of the CPA. Said groove preferably extends perpendicular to the axis of the receptacle and basically parallel with the CPA moving direction.

[0020] The direction in which the locking sections move away from each other during transition from the locking position to the release position, namely the locking direction, is preferably perpendicular to the axis of the receptacle and to the CPA moving direction.

[0021] In order to easily move the CPA from the locking position to the release position, preferably at least one joint portion is provided on the CPA-actuator, the joint portion connecting the CPA and the CPA-actuator with each other, wherein the CPA-actuator further comprises at least one lever member of which at least an output portion is arranged between the joint portion and at least an abutment section, preferably a shoulder, of the housing for abutting the CPA-actuator on the housing. The abutment section may support the lever member such that the lever member may pull the CPA from the locking position to the release position.

[0022] Preferably, the CPA-actuator is biased against the abutment section by the spring bias. Hence, the output portion may always be in contact with the abutment section.

[0023] The joint portion preferably forms a hinge for the at least one lever member. The lever member may thereby rotate around a rotational axis.

[0024] In order to transform a rotational movement of the at least one lever member into a sliding movement of the CPA, the output portion of the at least one lever member preferably have a lever surface extending around the at least one joint portion with a gradually changing distance from the joint portion. Thereby, the distance between the joint portion and the abutment section increases when the CPA actuator is transferred from the locking position to the release position. This increasing distance from the locking position to the release position allows for pulling the CPA during a rotation of the lever member. The distance is thereby measured from the joint portion to the lever surface.

[0025] Preferably, the CPA actuator comprises two lever members which are spaced apart from each other, in particular spaced apart from each other perpendicular to the axis of the receptacle, and which are interconnected by at least one lever handle for operating the CPA-actuator.

[0026] The at least one lever handle may be configured for covering the CPA at least in parts in the locking position. For example, the lever handle may be configured for covering a ground of the CPA.

[0027] According to another advantageous improvement, the at least one lever handle may be configured for being fixated to the housing in the locking position. Therefore, the lever handle may be provided with at least one latching element.

[0028] The housing may be provided with at least one CPA opening through which the CPA at least partially extends in the locking position for blocking the movement of the mating connector and from which it is retracted in the release position. By extending into the receptacle, a cross section of the receptacle may be narrowed. Preferably, the housing is provided with two openings on two opposing sides of the receptacle for engaging the mating connector on two sides.

[0029] A mating connector, which may be part of a connector assembly according to the invention may be provided with at least one complementary locking means that is configured for abutting the CPA in the locking position, thereby preventing the removal from the receptacle.

[0030] The at least one complementary locking means of the mating connector is preferably provided with an inclined surface configured for deflecting or widening the CPA during insertion of the mating connector into the receptacle when the CPA is in the locking position.

[0031] In the following, the invention and its improvements are described in greater detail using exemplary embodiments and with reference to the drawings. As described above, the various features shown in the embodiments may be used independently of each other in specific applications.

[0032] In the following figures, elements having the same function and/or the same structure will be referenced by the same reference signs.

[0033] In the drawings:

Fig. 1 shows a first embodiment of a housing as-

sembly according to the invention in the locking position in a perspective view;

Fig. 2 shows the housing assembly from Fig. 1 and a mating connector;

Figs. 3-5 show the housing assembly and the mating connector from Fig. 2 during insertion in a cut-view;

Fig. 6 shows the housing assembly and the mating connector from Fig. 2 in the release position in a perspective view;

Fig. 7 shows the housing assembly and the mating connector from Fig. 6 in the release position in a cut-view;

Fig. 8 shows the housing assembly and the mating connector from Fig. 6 in the release position in a cross-sectional-view;

Fig. 9 shows the housing assembly and the mating connector from Fig. 6 in the release position in a different cross-sectional-view;

Fig. 10 shows a second embodiment of a housing assembly according to the invention in the locking position in a cut-view; and

Fig. 11 shows the housing assembly of Fig. 10 in a perspective view.

[0034] In the following, the overall structure of the housing assembly and a connector assembly according to the invention will be described with respect to Figures 1 and 2.

[0035] A preferred embodiment of a housing assembly 1 according to the invention is shown in Fig. 1. The housing assembly 1 comprises a housing 3 having a receptacle 5 for receiving a mating connector 7 at least in parts.

[0036] The receptacle 5 extends along an axis 9 and has an opening 11 through which it is accessible for the mating connector 7 along a receiving direction 13. The receiving direction 13 extends parallel with the axis 9 and defines an insertion direction 15 for the mating connector 7.

[0037] In the receptacle 5, one or more electrical contacts may be arranged for being electrically connected to mating contacts of the mating connector 7. Such contacts are not shown in the figures. The housing assembly 1 and said electric contacts may form at least parts of an electrical connector 2.

[0038] The housing 3 may be made of any suitable material. However, the housing 3 is preferably made from aluminum or a thermoplastic material.

[0039] The housing assembly 1 comprises a connector position assurance element 17, or CPA 17, for securing the position of the mating connector 7 in the receptacle 5. The CPA 17 can be moved from a locking position 19, which is shown in Figures 1 to 5, to a release position 21, which is shown in Figures 6 to 9.

[0040] In the locking position 19, an inserted mating connector 7 is blocked from unintentional removal from the receptacle 5. In the release position 21, the mating connector 7 can be removed from the receptacle 5.

[0041] In order to move the CPA 17, at least from the locking position 19 to the release position 21, the housing assembly 1 further comprises preferably one CPA-actuator 23 that is operationally coupled to the CPA 17 and adapted for driving the CPA 17 from the locking position 19 to the release position 21.

[0042] In the release position 21, the CPA 17 is moved away from the receptacle 5 in relation to the locking position 19. This will be described later on with respect to Figures 6 to 9.

[0043] In order to increase the safety of the housing assembly 1, in particular in order to increase the safety of a connection between the housing assembly 1 and the mating connector 7, the CPA 17 is spring-biased into the locking position 19.

[0044] In other words, the spring-bias exerts a reset force for pulling the CPA 17 back into the locking position 19. Hence, the spring bias moves the CPA 17 from the release position 21 into the locking position 19 when no external force acts on the CPA actuator 23.

[0045] In a preferred embodiment, as also shown in the figures, the CPA-actuator 23 is only used for moving the CPA 17 from the locking position 19 to the release position 21. Movement from the release position 21 into the locking position 19 is preferably performed only by the spring bias.

[0046] The CPA 17 and the CPA-actuator 23 are combined unitarily with each other. In other words, the CPA 17 and the CPA-actuator 23 together form a unit 25. The unit 25 is preferably captively connected to the housing 3. The unit 25 is thereby preferably held by the CPA 17 on the housing 3.

[0047] The housing 3 is provided with two CPA openings 27, through which the CPA 17 extends in parts in the locking position for a blocking a movement of the mating connector 7. In the release position 21, the CPA is at least partially retracted from the CPA openings 27, at least to such an extent that the mating connector 7 may be released from the receptacle 5. The two openings 27 are arranged on two opposing sides of the housing diametrically across the receptacle 5.

[0048] The CPA openings 27 may be arranged in offset regions 29 of the housing, in which a wall 31 that forms the housing 3 is offset towards an outside of the housing 3. This can be seen in Figures 3 to 5, which show cross sections of the housing 3. In the locking position 19 and when the CPA 17 is not deformed by the mating connector 7, inner sides 33 of the CPA 17 may be flush with inner sides 35 of the housing wall 31 in sections adjacent to the offset sections 29.

[0049] The CPA openings 27 may be arranged in grooves 37 of the housing 3, which allow a sliding movement of the CPA 17 in a CPA moving direction 39, which is perpendicular to the axis 9 of the receptacle 5. The grooves 37 may be formed by the offset sections 29 of the wall 31. The grooves 37 prevent a movement of the CPA 17 along the direction of the axis 9 of the receptacle 5. Hence, the grooves 37 extend basically parallel with the CPA moving direction 39.

[0050] Before going into detail about the coupled movement of the CPA 17 and CPA-actuator 23, an insertion process of the mating connector 7 into the receptacle 5 is briefly described with respect to Figures 3 to 5.

[0051] Figures 3 to 5 all show the CPA 17 in the locking position 19. The CPA 17 is arranged in the grooves 37 on both sides of the housing 3 and reaches into the receptacle 5 through the CPA openings 27.

[0052] The mating connector 7 is provided with complementary locking means 41 that are configured to abut the CPA 17 in the locking position 19. The complementary locking means 41 are configured as latching hooks 42, of which each is provided with an inclined or sloped surface 43 for deflecting the CPA 17 during insertion of the mating connector 7 into the receptacle 5.

[0053] The insertion process of the mating connector 7 into the receptacle 5 is shown starting from Figure 3. Here, the complementary locking means 41 arrive at the CPA 17. In Figure 4, the mating connector 7 is shown further introduced into the receptacle 5 along the insertion direction 15. Here, the CPA 17 is widened because the sloped surfaces 43 have abutted the inner sides 33 of the CPA and thereby spread the CPA 17 through the CPA openings 27 such that at least parts of the CPA 17 have moved away from the receptacle 5.

[0054] As soon as the latching hooks 42 of the complementary locking means 41 have passed the CPA 17 along the insertion direction 15, the CPA 17 snaps back against the mating connector 7 and abutment walls 45 of the complementary locking means 41 abut sides 47 of the CPA 17 against the insertion direction 15. The mating connector 7 is then securely fixated in the receptacle 5. The abutment walls 45 preferably at least partially extend perpendicular to the insertion direction 15.

[0055] The housing assembly 1 and the mating connector 7 together form a connector assembly 49.

[0056] In the following, the structure of the CPA 17, the CPA-actuator 23 and the process of transferring the CPA 17 from the locking position 19 into the release position 21 is described with respect to Figures 6 to 9. Each of Figures 6 to 9 shows the CPA 17 in the release position 21.

[0057] First, the structure of the CPA 17 is described with respect to Figure 8.

[0058] The CPA 17 at least partially clasps the housing 3, whereby the CPA 17 preferably encompasses more than 180° of a cross-section of the receptacle 5, wherein the angle 51, at which the CPA 17 encompasses the cross-section is measured around the axis 9 of the receptacle 5.

[0059] The CPA 17 preferably has the overall shape of a clip 53, i.e. basically the overall shape of a U-clip. The clip 53 has two legs 55, which are connected via a ground 57.

[0060] The legs 55 basically extend parallel with the CPA moving direction 39. The ground 57 basically extends perpendicular to the legs 55 and perpendicular to the axis 9. The ground 57 basically extends parallel with a CPA locking direction 59, which as mentioned above, is perpendicular to the axis 9 and perpendicular to the CPA moving direction 39. The locking direction 59 is also the direction along which the CPA 17 is widened during insertion of the mating connector 7 as discussed with respect to Figures 3 to 5.

[0061] Each of the legs 55 has a locking section 61, which basically extends straight and which is basically parallel with the CPA moving direction 39, at least in the locking position 19. In the release position 21, the locking sections 61 may deviate from the parallel alignment with the CPA moving direction 39.

[0062] At the ends of the legs 55, which are opposite the ground 57, each leg 55 is provided with a sliding section 63 which abuts the outer surface 65 of the housing 3. The outer surface 65 may be the outer surface of the wall 31. At the sliding sections 63, the distance 67 between the two legs 55 is basically smaller than the distance between the legs 55 at their locking sections 61.

[0063] The CPA 17 is preferably configured for being elastically deformable. In particular, the legs 55 are preferably elastically deflectable from each other. In other words, the CPA 17 is configured as an elastically deflectable spring member 69. Said spring member 69 is configured for generating the spring bias towards the locking position 19.

[0064] As mentioned above, the sliding section 63 of each leg 55 is configured to slide along the outer surface 65 of the housing 3. The housing 3 has a basically round cross section.

[0065] In the locking position 19, the sliding sections 63 encompass the housing 3 such that the housing 3 is at least partially arranged inside the clip-shaped CPA 17. Moving the CPA 17 along the CPA moving direction 39 in the direction of the ground 57 will lead to a widening of the CPA 17 since the sliding sections 63 each follow the outer surface 65. It becomes obvious that a chord 71 which is perpendicular to the CPA moving direction 39 and measured from the contact points 73, where the sliding sections 63 abut the outer surface 65 becomes larger during a movement of the CPA 17 along the CPA moving direction 39 in the direction of the ground 57.

[0066] In other words, the outer surface 65 of the housing 3 is inclined with respect to the CPA moving direction 39. These inclined sections 72 and the CPA 17 are together configured for converting a sliding movement of the sliding sections 63 along the inclined sections 72 during a transition from the locking position 19 to the release position 21 into a movement of the locking sections 61

further away from the receptacle 5.

[0067] A movement of the CPA 17 along the CPA moving direction 39 towards the ground 57 will lead to a spreading of the locking sections 61. The locking sections 61 may thereby by moved far enough from the complementary locking means 41 of the mating connector 7 that the mating connector 7 may be released from the receptacle 5 without the CPA 17 blocking its movements against the insertion direction 15.

[0068] The CPA 17 is preferably made from a strip that is formed into the shape of the CPA. The CPA therefore has an overall rectangular cross-section, which can be seen in the cross-sectional views of Figures 3 to 5 and 9. Preferably, the CPA 17 is made from steel, in particular spring steel 75.

[0069] In the following, the transition from the locking position 19 to the release position 21 is described.

[0070] As already mentioned above, in the locking position 19, the locking sections 61 are arranged inside the grooves 37 such that the complementary locking means 41 from the mating connector 7 engage the locking sections 61 such that the mating connector 7 is blocked from being removed from the receptacle 5.

[0071] In the locking position, the CPA-actuator 23 is arranged in a down position 77, which is shown in Figures 1 and 2. In said down position 77, the CPA actuator 23 may cover at least the ground 57 of the CPA 17.

[0072] In order to move the CPA 17 from the locking position 19 to the release position 21, the CPA-actuator 23 is used. The CPA-actuator 23 is coupled to the CPA 17 at two joint portions 79. At the joint portions 79, the CPA-actuator 23 is joined with the CPA 17 via two hinges 81, which allow the CPA-actuator 23 to rotate around a rotational axis 83.

[0073] By way of example, the CPA-actuator 23 may be provided with pins 85, which extend into corresponding holes 87 in the CPA 17. Alternatively, the pins 85 may also be arranged on the CPA 17 and corresponding holes 87 can be arranged in the CPA-actuator 23.

[0074] The CPA-actuator 23 further comprises two lever members 89, of which output portions 91 are arranged between the joint portions 79 and an abutment section 93, which is preferably formed as a shoulder 95 on the housing 3.

[0075] The CPA-actuator 23 further comprises a lever handle 97, which can be used for operating the CPA-actuator 23. The lever handle 97 connects the two lever members 89 with each other. The two lever members 89 are spaced apart from each other along the locking direction 59. Each of the abutment sections 93 of the housing are preferably arranged at ends of the grooves 37, said ends being oriented towards the ground 57 of the CPA 17.

[0076] The spring force exerted by the CPA 17 pulls the CPA-actuator 23 such that it permanently abuts the abutment sections 93 with the output portions 91.

[0077] The output portions 91 have surfaces 99 for abutting the abutment sections 93 of the housing 3 during rotation around the rotational axis 83. Each of the surfaces 99 runs around its corresponding joint section 79 or, in other words, around the rotational axis 83 such that a distance 101 between the rotational axis 83 and the surface 99 gradually increases.

[0078] In particular, the distance 101 increases from a first section 103, with which the CPA-actuator 23 abuts the abutment section 93 in the locking position 19 towards a second section 105, with which the CPA-actuator 23 abuts the abutment section 93 in the release position 21.

[0079] When the CPA-actuator 23 is operated by pulling the lever handle from the down position 77 to an up position 107, the surface 99 slides along the abutment section 93 from the first section 103 to the second section 105. Thereby, due to the increasing distance 101 between the rotational axis 83 and the abutment section 93, the joint portions 79 are moved further away from the housing 3, thereby moving the CPA 17 towards the release position 21 due to its coupling to the CPA-actuator 23.

[0080] As mentioned before, when the CPA 17 is moved in the direction of its ground 57, the sliding sections 63 slide along the outer surface 65 of the housing 3, thereby widening the CPA 17 and spreading the locking sections 61 apart from each other. Hence, the receptacle 5 is unblocked for the mating connector 7 to be removed.

[0081] Due to the spring bias, the CPA 17 generates, the CPA-actuator 23 is pulled back by the CPA 17 towards the down position 77 when no external force, for example from an operator, acts on the lever handle 97.

[0082] In the following, a second embodiment of a housing assembly 1 according to the invention is described with respect to Figures 10 and 11. For the sake of brevity, only the differences to the first described embodiment are mentioned.

[0083] The second embodiment of the housing assembly 1 is provided with a CPA-actuator 23 that is provided with a latching mechanism 109 for latching the CPA-actuator 23 to the housing 3 in the locking position 19.

[0084] The latching mechanism comprises a elastically deflectable spring arm 111, a latching receptacle 113 for receiving a complementary latching member 115 of the housing 3 and an operating section 117 for disengaging the latching receptacle 113 from the latching element 115 of the housing.

[0085] The latching receptacle 113 is arranged on a deflectable end of the spring arm 111, which exerts a spring force of the latching mechanism towards the latching element 115. Both the latching mechanism 109 and the latching member 115 are provided with inclined surfaces that can slide against each other when the CPA-actuator 23 is moved into the locking position 19.

[0086] When the locking position 19 is reached, the locking member 115 is arranged inside the latching receptacle 113. In order to move the CPA-actuator 23 into the release position 21 (not shown), the latching mechanism 109 must first be disengaged from the latching

member 115 in order to allow movement of the CPA-actuator 23 away from the locking position 19.

[0087] The second embodiment of the housing assembly 1 is provided with another element that increases the safety of the assembly 1. In each sliding section 63, the CPA 17 is provided with a slit 119. The slit extends along the shape of the CPA 17 basically longitudinally and parallel with the corresponding leg 55. The slit 119 is closed to all lateral sides but extends through the CPA 17 in a radial direction with respect to the axis 9.

[0088] The housing 3 is provided with a pin 121 for each of the slits 119. Each pin 121 extends into the corresponding slit 119. During movement between the locking position 19 and the release position 21, the pin 121 may slide with respect to the CPA 17 through the slit 119.

[0089] In the release position (not shown), the pin may abut a wall portion 123 of the CPA 17 which forms the lower end of the slit 119. This abutment may prevent removal of the CPA 17 from the housing 3. Thereby, the safety of the housing assembly is increased.

[0090] The lever handle 97 of the second embodiment extends in the direction of the housing 3 instead of in the direction of the mating connector 7 as in the first described embodiment. The direction of CPA-actuator 23 may be chosen depending on the requirements for the housing assembly 1 and is not restricted to one direction.

Reference Numerals

[0091]

1	Housing assembly
2	Electrical connector
3	Housing
5	Receptacle
7	Mating connector
9	Axis of receptacle
11	Opening
13	Receiving direction
15	Insertion direction
17	CPA
19	Locking position
21	Release position
23	CPA-actuator
25	Unit
27	CPA-opening
29	Offset sections
31	Wall
33	Inner sides of CPA
35	Inner side of wall
37	Grooves
39	CPA-moving direction
41	Complementary locking means
42	Latching hooks
43	Slope surface
45	Abutment wall
47	Sides
49	Connector assembly
51	Angle
53	Clip
55	Legs
57	Ground
59	Locking direction
61	Locking section
63	Sliding section
65	Outer surface
67	Distance between legs
69	Spring member
71	Chord
72	Inclined section
73	Contact points
75	Spring steel
77	Down position
79	Joint portions
81	Hinge
83	Rotational axis
85	Pin
87	Hole
89	Lever member
91	Output portion
93	Abutment section
95	Shoulder
97	Lever handle
99	Surfaces
101	Distance
103	First section
105	Second section
107	Up position
109	Latching mechanism
111	Spring arm
113	Latching receptacle
115	Latching member
117	Operating section
119	Slit
121	Pin
123	Wall portion

Claims

1. Housing assembly (1) for an electrical connector (2), the housing assembly (1) comprising a housing (3) having a receptacle (5) for receiving at least parts of a mating connector (7), at least one connector position assurance element (CPA) (17) for securing the position of the mating connector (7) in the receptacle (5), and at least one CPA-actuator (23) that is operationally coupled to the CPA (17) for driving the CPA (17) from a locking position 19 to a release position (21), wherein in the release position (21), the CPA (17) is moved away from the receptacle (5) in relation to the locking position (19), and wherein the at least one CPA (17) is spring biased into the locking position (19).

2. Housing assembly (1) according to claim 1, wherein

at least one elastically deflectable spring member (69) is integrated in the CPA (17) for generating the spring bias.

3. Housing assembly (1) according to claim 1 or 2, wherein the CPA (17) at least partially clasps the housing (3).

4. Housing assembly (1) according to any of claims 1 to 3, wherein the CPA (17) and the CPA-actuator (23) are combined unitarily with each other.

5. Housing assembly (1) according to claim 4, wherein the unit (25) comprising the CPA (17) and the CPA actuator (23) is captively connected to the housing (3).

6. Housing assembly (1) according to any of claims 1 to 5, wherein the CPA (17) is configured as a clip (53), the clip (53) having at least one leg (55) with a locking section (61) that at least partially extends into the receptacle (5) in the locking position (19).

7. Housing assembly (1) according to claim 6, wherein the clip (53) has two legs (55) which are spaced apart from each other across the receptacle (5).

8. Housing assembly (1) according to claim 6 or 7, wherein the at least one leg (55) has at least one sliding section (63) that is configured to slide along an outer surface (65) of the housing (3) at least during a movement between the locking position (19) and the release position (21).

9. Housing assembly (1) according to claim 8, wherein at least a section (72) of the outer surface (65) of the housing (3) is inclined with respect to a CPA moving direction (39) and wherein the inclined section (72) and the CPA (17) are configured for converting a sliding movement of the at least one sliding section (63) along the inclined section (72) into a movement of the at least one locking section (61) further away from the receptacle (5).

10. Housing assembly (1) according to any of claims 1 to 9, wherein at least one joint portion (79) is provided on the CPA-actuator (23), the joint portion (79) connecting the CPA (17) and the CPA-actuator (23) with each other, wherein the CPA-actuator (23) further comprises at least one lever member (89) of which at least an output portion (91) is arranged between the joint portion (79) and an abutment section (93) of the housing for abutting the CPA-actuator (23) on the housing (3).

11. Housing assembly (1) according to claim 10, wherein the CPA-actuator (23) is biased against the abutment section (93) by the spring bias.

12. Housing assembly (1) according to claim 10 or 11, wherein the output portion (91) of the at least one lever member (89) has a lever surface (99) extending around the at least one joint section (79) with a gradually changing distance (101) from the joint section (79).

13. Housing assembly (1) according to any of claims 10 to 12, wherein the CPA-actuator (23) comprises two lever members (89) which are spaced apart from each other and which are interconnected by at least one lever handle (97).

14. Housing assembly (1) according to any of claims 1 to 13, wherein the housing (3) is provided with at least one CPA opening (27) through which the CPA (17) at least partially extends in the locking position (19) for blocking a movement of the mating connector (7) and from which it is retracted in the release position (21).

15. Connector assembly (49) comprising a housing assembly (1) according to any of claims 1 to 14 and a mating connector (7), wherein the at least one mating connector (7) is provided with at least one complementary locking means (41) that is configured for abutting the CPA (17) in the locking position (19), preventing the removal of the mating connector (7) from the receptacle (5).

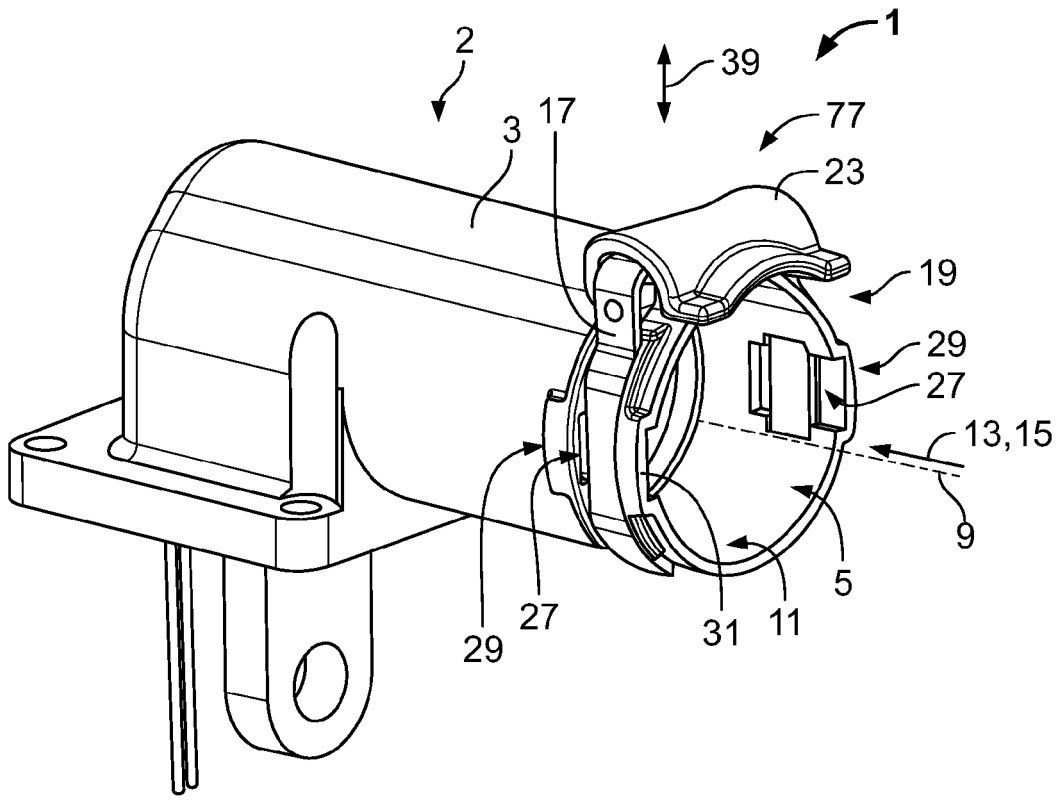


Fig. 1

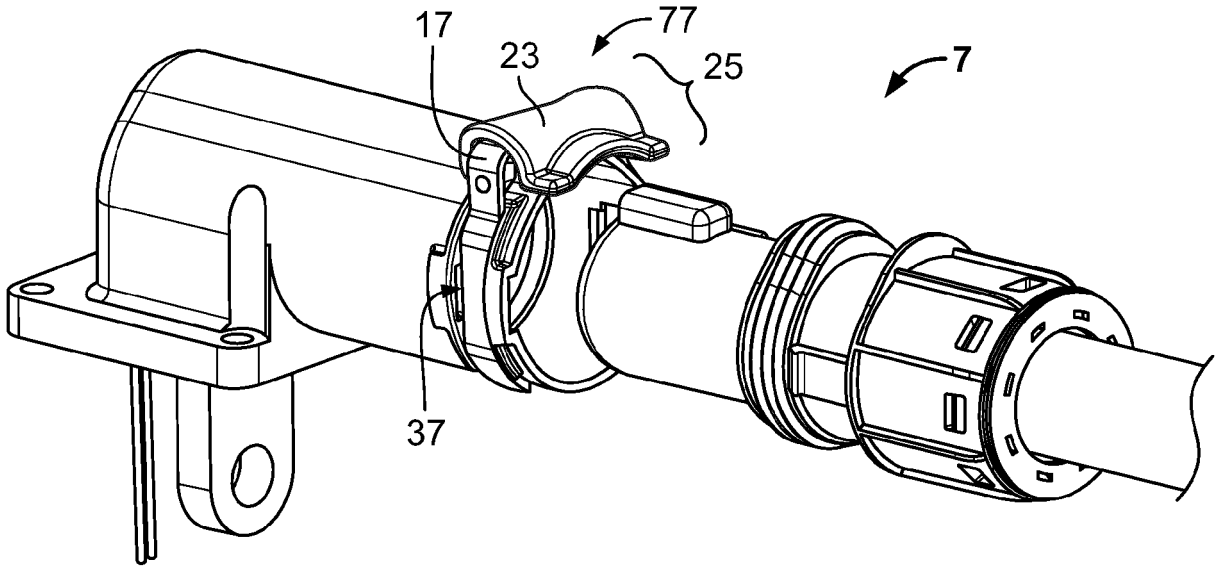


Fig. 2

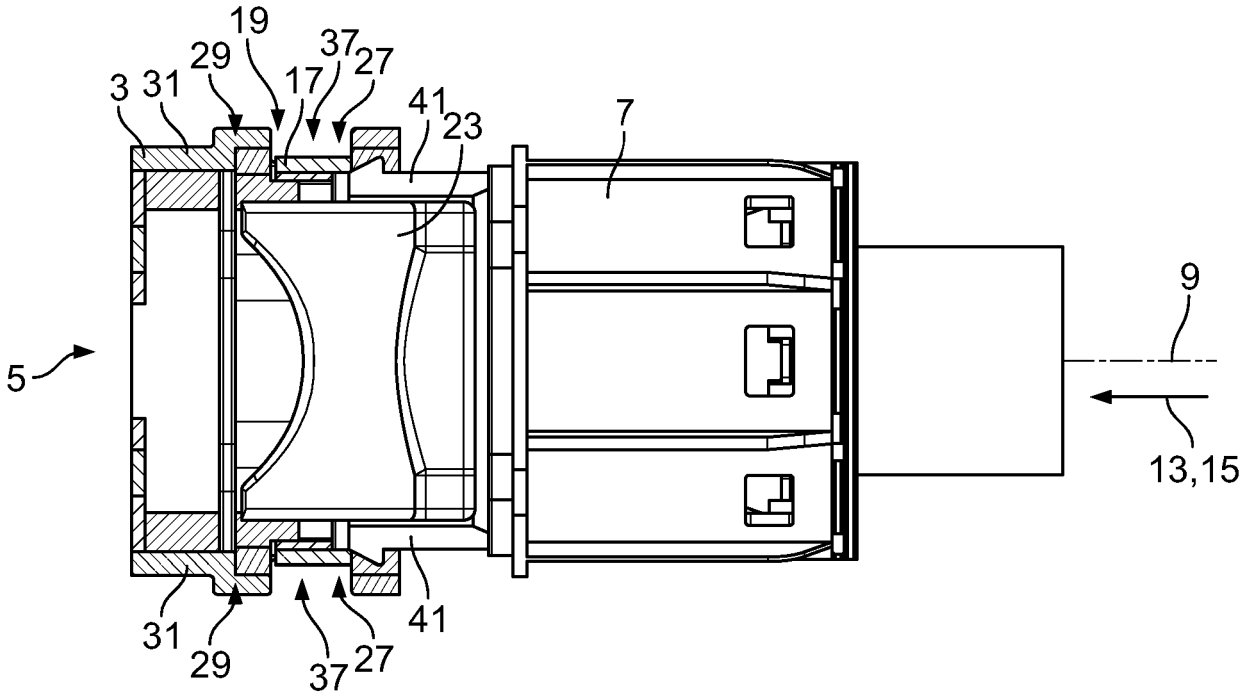

19
29
37
27
3
31
17
41
23
7
9
5
13,15
31
29
37
27
41

Fig. 3

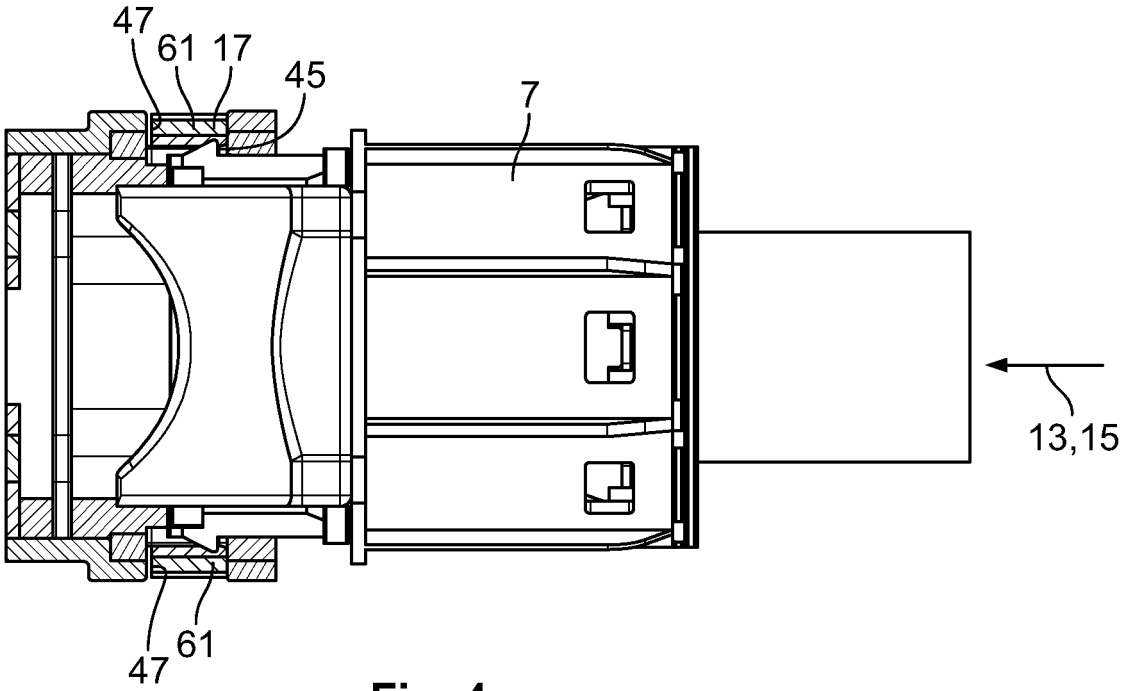

47
61
17
45
7
13,15
47
61

Fig. 4

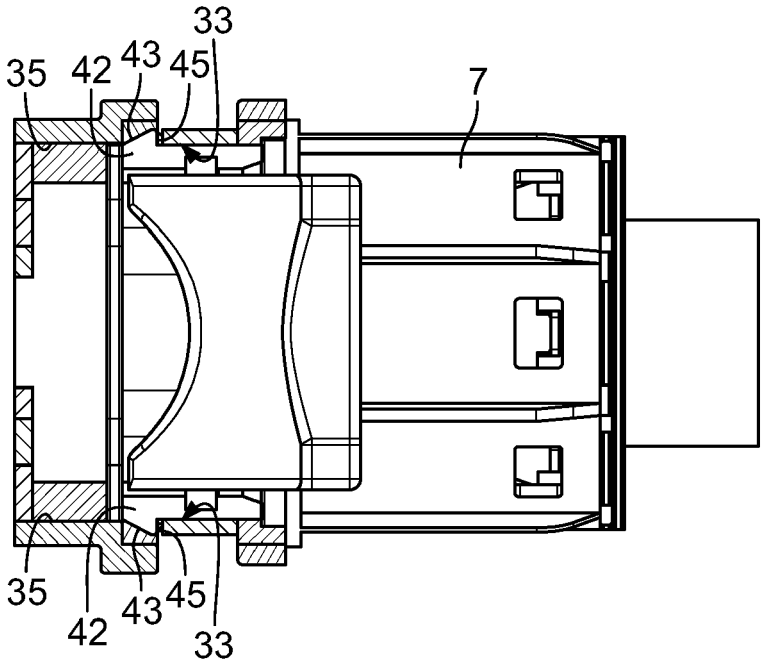


Fig. 5

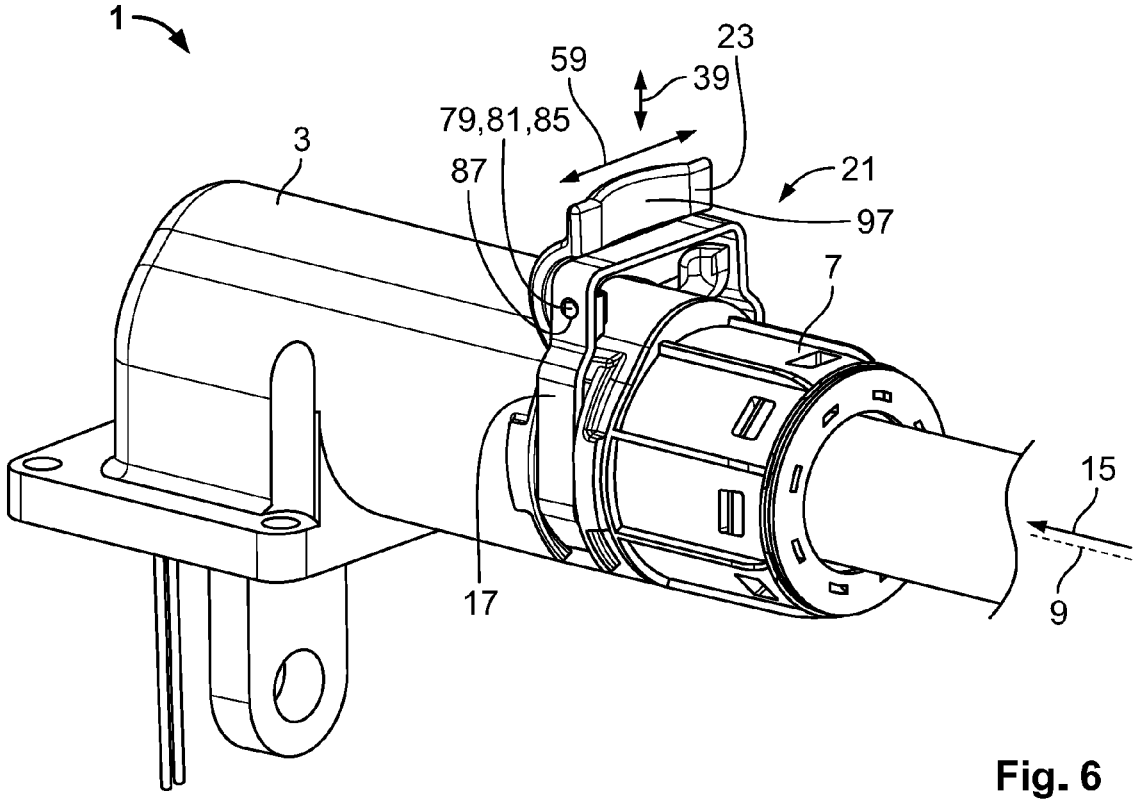

1
59
23
39
79,81,85
3
87
21
97
7
15
17
9

Fig. 6

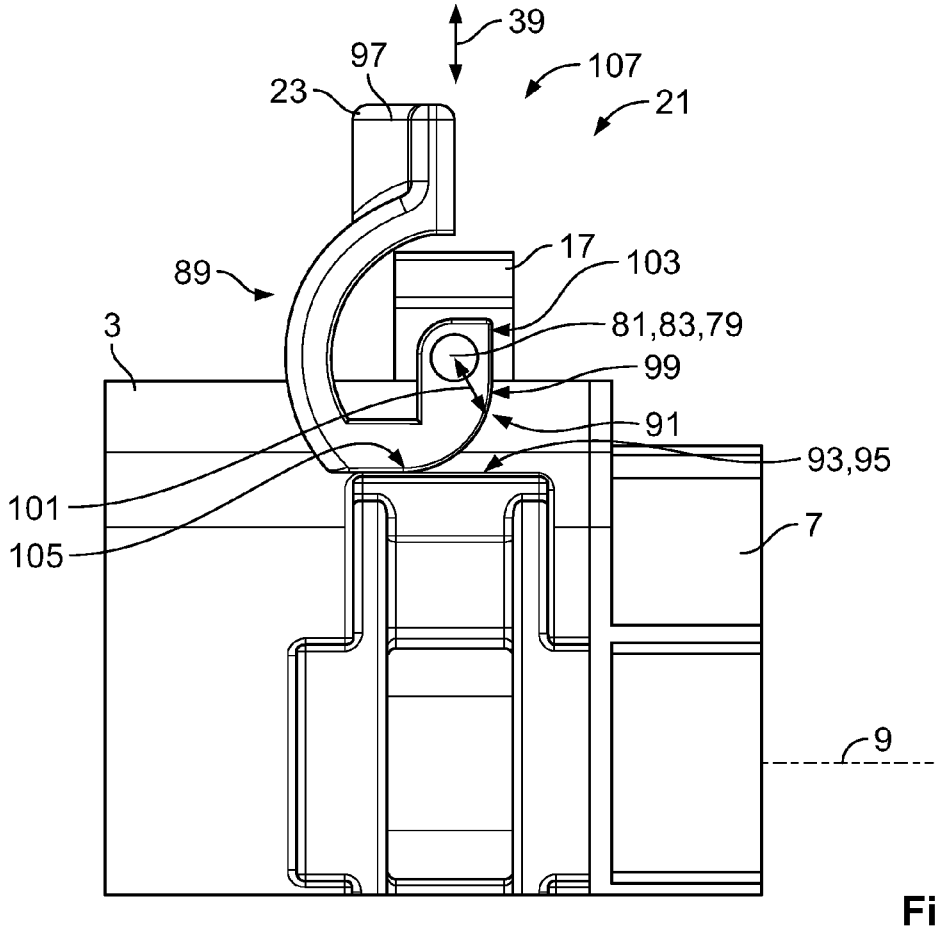

39
97
107
23
21
17
89
103
3
81,83,79
99
91
93,95
101
105
7
9

Fig. 7

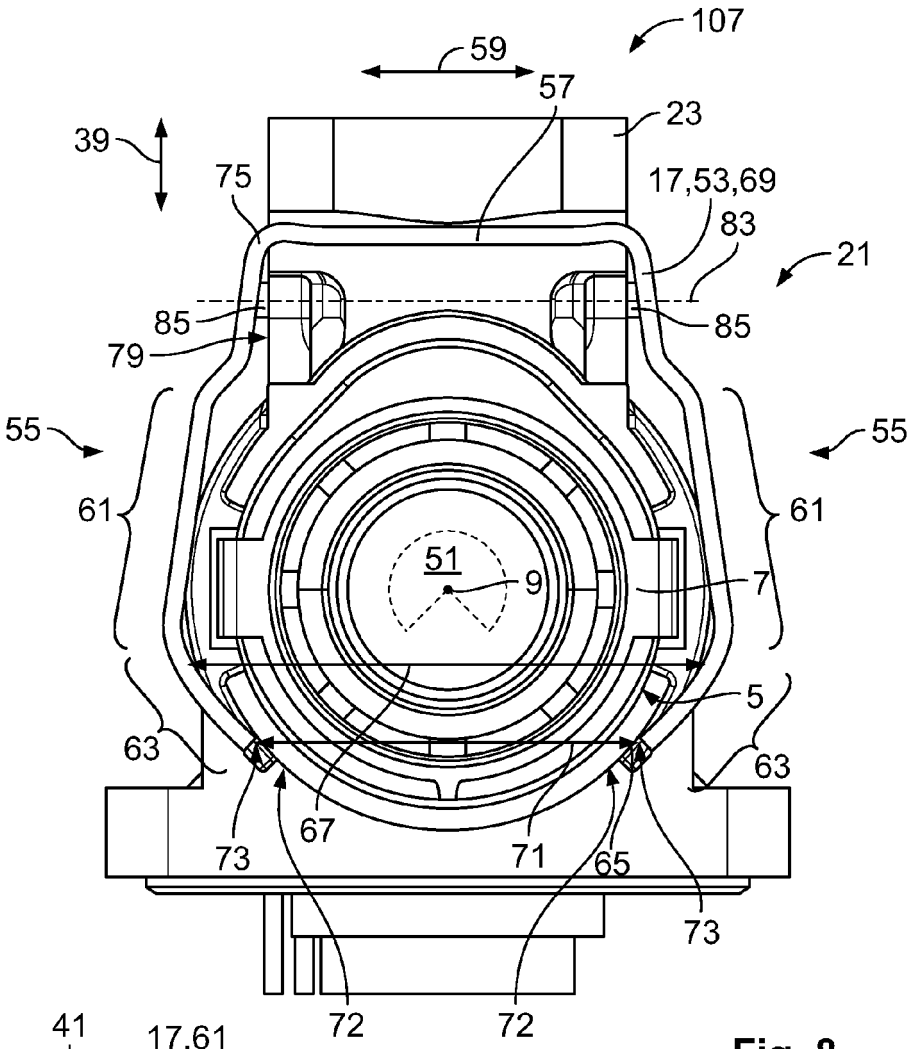

107
59
57
23
39
75
17,53,69
83
21
85
85
79
55
55
61
61
51
9
7
5
63
63
73
67
71
65
73
72
72

Fig. 8

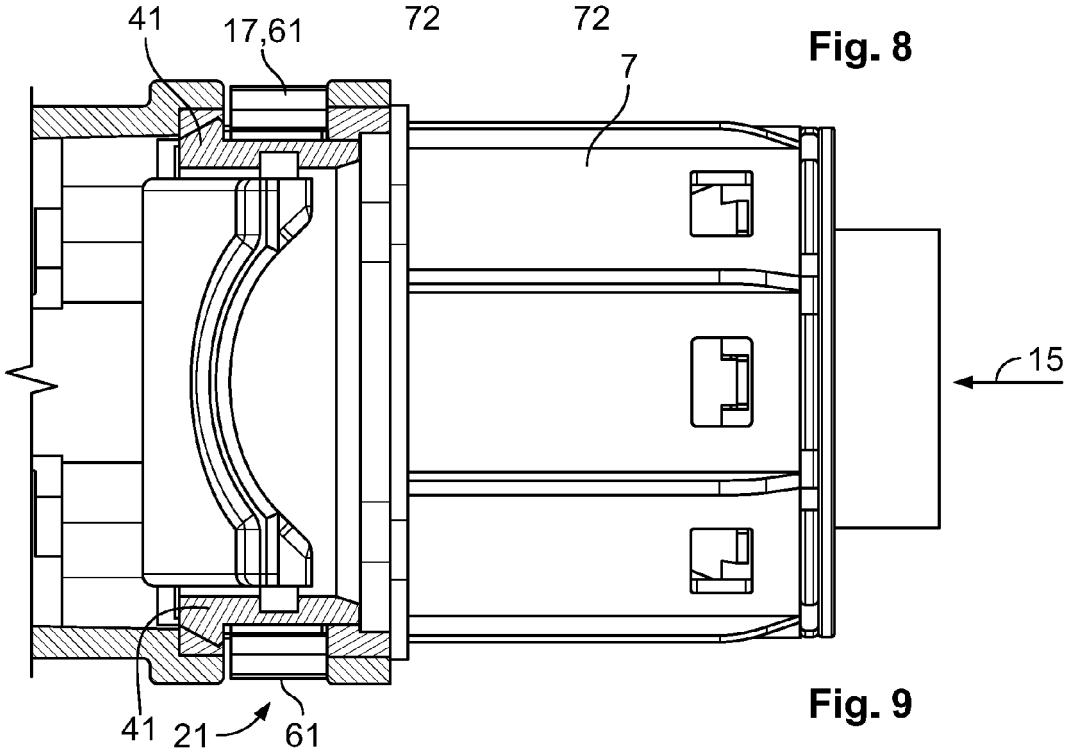

41
17,61
7
15
41
21
61

Fig. 9

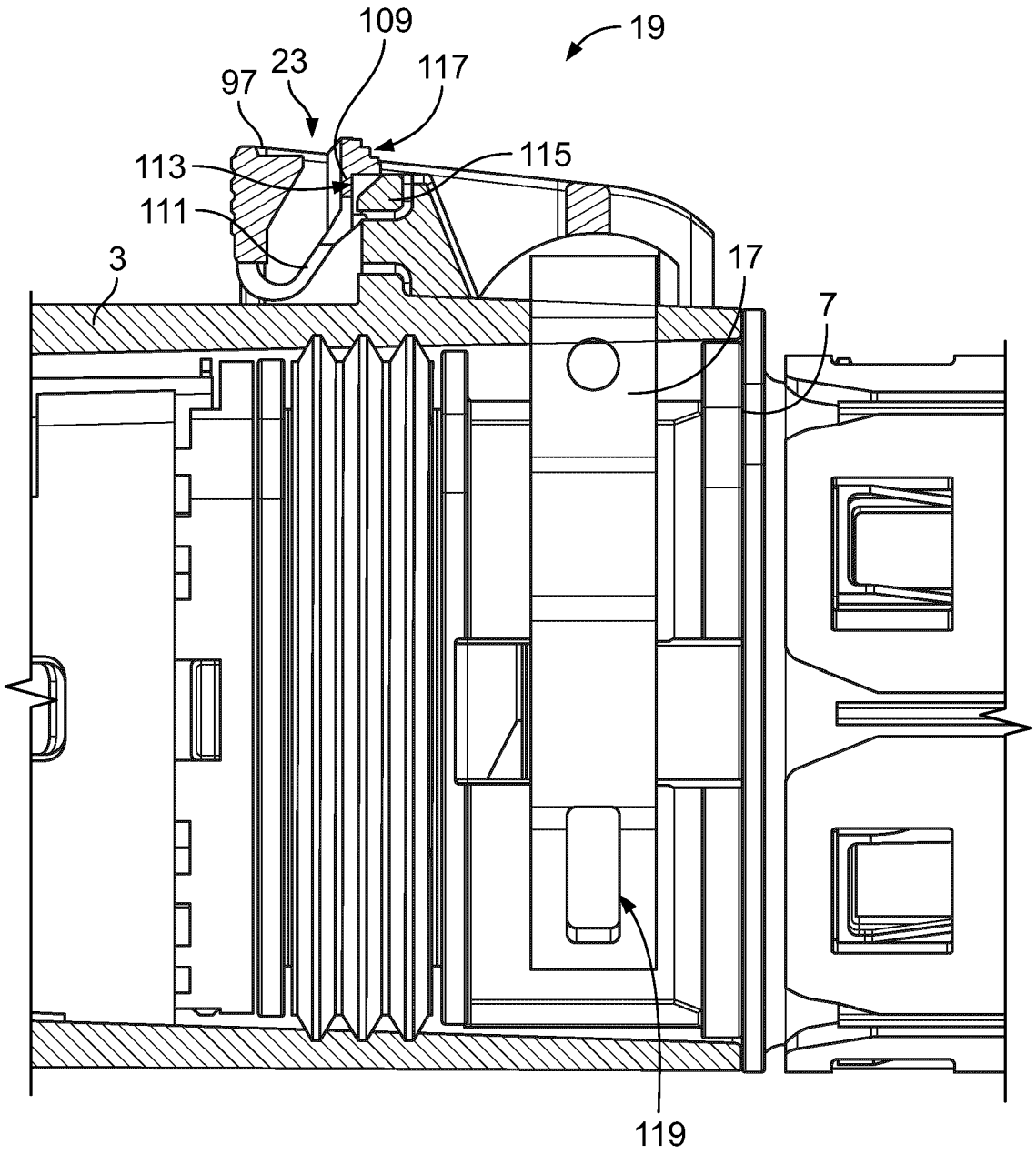
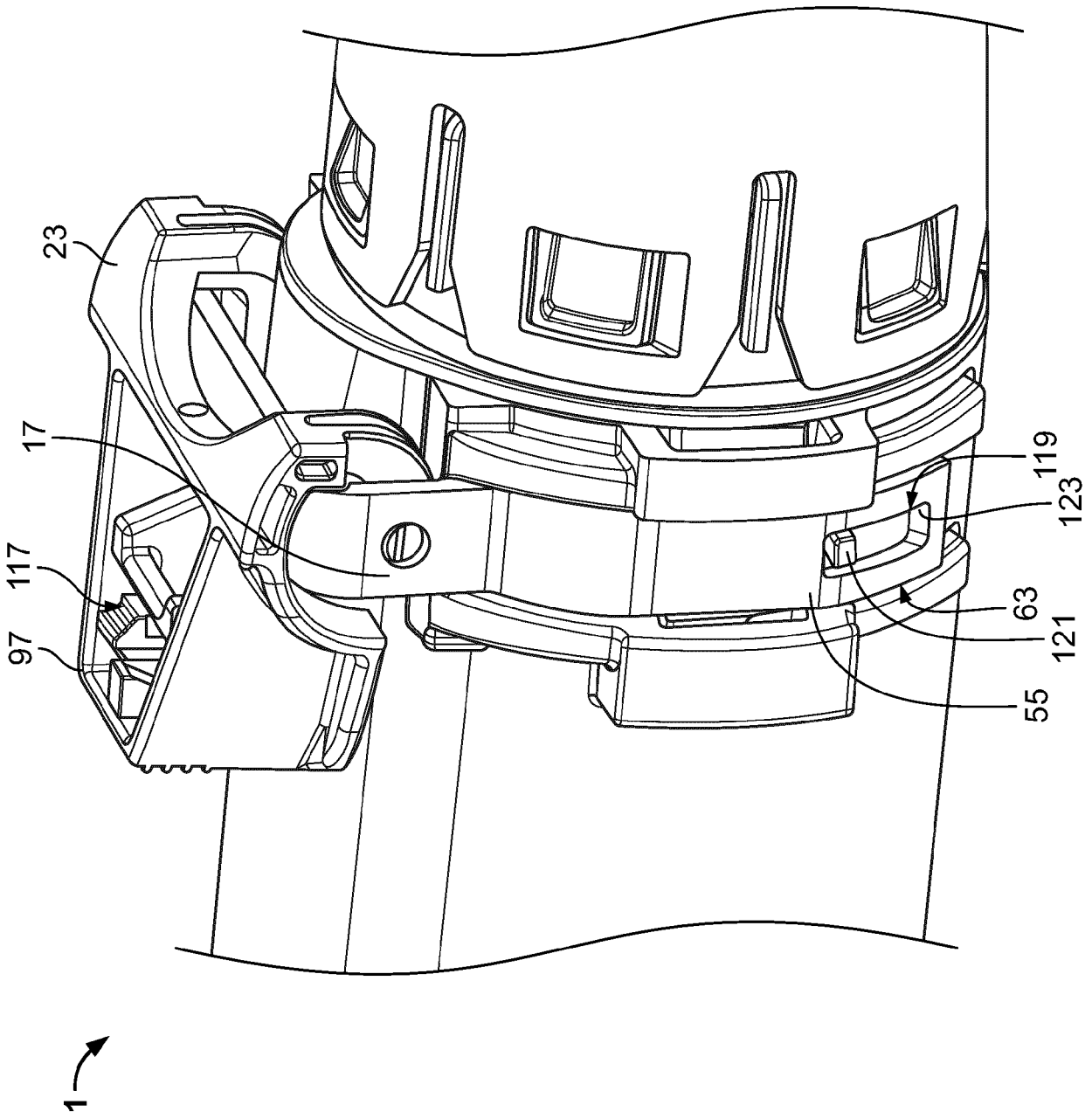


Fig. 10

Fig. 11



Europäisches Patentamt
European Patent Office
Office européen des brevets

EUROPEAN SEARCH REPORT

Application Number
EP 20 19 9648

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	EP 2 026 421 B1 (MOLEX INC [US]) 9 June 2010 (2010-06-09) * paragraph [0016] - paragraph [0031]; figures 1,2,4,6,7a-7e, 8a-8e, 9a-9c *	1-13,15	INV. H01R13/627 H01R13/629 ADD. H01R13/639 H01R13/703
X	US 5 616 045 A (GAUKER BRADFORD K [US]) 1 April 1997 (1997-04-01) * column 5, line 20 - column 6, line 10; figures 1,3,4,5 *	1-9	
A	WO 2012/007343 A1 (TYCO ELECTRONICS FRANCE SAS [FR]; CHATELUS ERIC [FR]) 19 January 2012 (2012-01-19) * page 10 - page 11; figures 6,9 *	1-15	
A	US 2017/214168 A1 (SCHROLL NEIL FRANKLIN [US] ET AL) 27 July 2017 (2017-07-27) * paragraph [0027] - paragraph [0028]; figure 1 *	1-15	

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	16 February 2021	Mateo Segura, C

CATEGORY OF CITED DOCUMENTS

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

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

EPO FORM 1503 03.82 (P04C01)

ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 20 19 9648

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
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

16-02-2021

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
EP 2026421 B1	09-06-2010	AT 470970 T	15-06-2010
		BR PI0815486 A2	24-02-2015
		CN 101821910 A	01-09-2010
		EP 2026421 A1	18-02-2009
		JP 4922452 B2	25-04-2012
		JP 2010537370 A	02-12-2010
		KR 20100053658 A	20-05-2010
		WO 2009023200 A2	19-02-2009
US 5616045 A	01-04-1997	US 5616045 A	01-04-1997
		US 5746618 A	05-05-1998
		WO 9704504 A1	06-02-1997
WO 2012007343 A1	19-01-2012	FR 2962857 A1	20-01-2012
		WO 2012007343 A1	19-01-2012
US 2017214168 A1	27-07-2017	CN 108475884 A	31-08-2018
		DE 112016006292 T5	15-11-2018
		JP 6678753 B2	08-04-2020
		JP 2019505070 A	21-02-2019
		KR 20180100239 A	07-09-2018
		US 2017214168 A1	27-07-2017
		WO 2017127200 A1	27-07-2017

EPO FORM P0459

For more details about this annex : see Official Journal of the European Patent Office, No. 12/82