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(54) **SERRATION FEATURE BASED CLEARANCE COMPENSATION MECHANISM FOR AN ELECTRICAL CONNECTOR**

(57) The present disclosure relates to a mechanism for clearance compensation in an electrical connector system. An electrical connector system (100) is provided. The electrical connector system (100) comprises a connector housing (102) adapted for holding one or more electrical contact elements, a mate assist device (150) associated with the connector housing (102), and locking means for locking the mate assist device (150) relative to the connector housing. The locking means comprise a first plurality of teeth (110) associated with the connector housing (102) and a second plurality of teeth (156) associated with the mate assist device (150). The first plurality of teeth (110) and the second plurality of teeth (156) are adapted to be engaged with each other and thereby to enable different locking positions of the mate assist device (150) relative to the connector housing (102) in a mated state of the connector housing (102) with a corresponding counter connector housing.

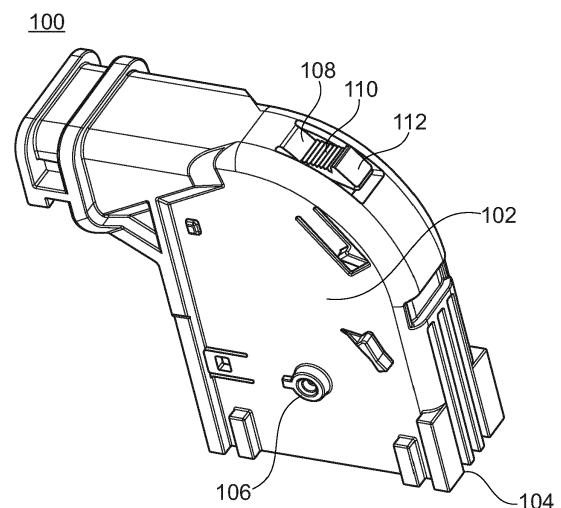


Fig. 1A

100

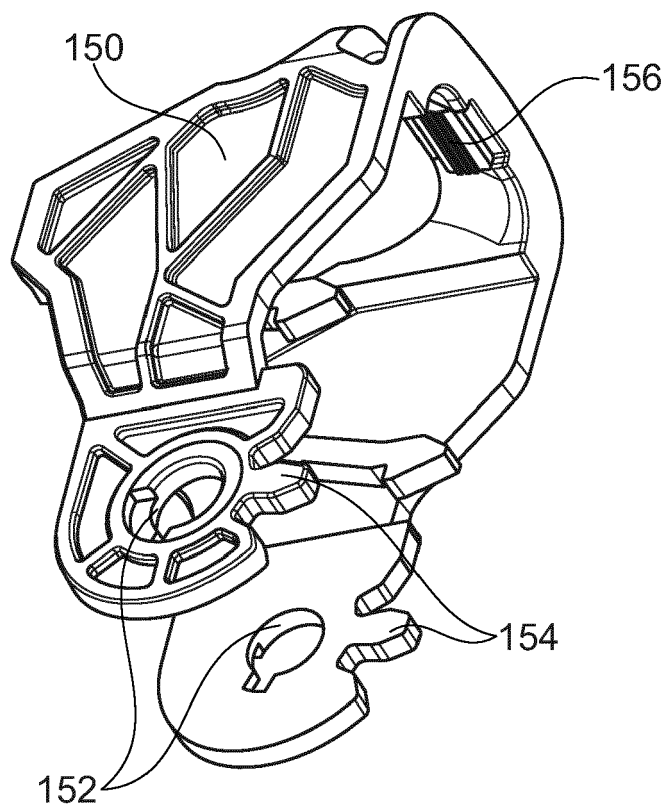


Fig. 1B

Description

1. Field of the invention

[0001] The present disclosure generally relates to a mechanism for clearance compensation in an electrical connector system. More specifically, it discloses an electrical connector system having pluralities of teeth provided on members thereof which are adapted to be engaged with each other and thereby to enable different locking positions of the electrical connector system.

2. Prior art

[0002] Electrical connector systems are generally used to provide a removable electrical connection between respective electrical contact elements arranged in their members. Typically, an electrical connector system comprises a first member, for example, a female component which is often referred to as a socket, and a corresponding second member, for example, a male component which is often referred to as a plug. In some cases, an electrical connector system additionally comprises a mate assist device to facilitate establishing a mated state of the members of the electrical connector system. When the members of the electrical connector system are mated in accordance with their respective positions defined solely by design, various factors such as manufacturing tolerances affect the clearance and hence the quality of electrical contact between respective electrical contact elements. In many applications, the quality of the electrical contact plays an important role in ensuring desired signal quality, connector durability, or the like. While generally plural clearance compensation mechanisms exist, these mechanisms do not enable altering their fixed locking position.

[0003] The object of the disclosed subject matter is to overcome disadvantages of the prior art electrical connector systems, particularly, to provide an electrical connector system that is adapted to advantageously provide compensation of manufacturing tolerances of components of such electrical connector system.

3. Summary of the invention

[0004] The above-mentioned object is realized by each of an electrical connector system according to claim 1 and by an electrical connector system according to claim 2.

[0005] Particularly, the above mentioned object is realized by an electrical connector system comprising a connector housing, a mate assist device and locking means. The connector housing holds (is adapted for holding) one or more electrical contact elements. The mate assist device is associated with the connector housing and, as generally known to the skilled person, is adapted to facilitate establishing a mate state of the connector housing with a corresponding counter con-

connector housing. The locking means are adapted for locking the mate assist device relative to the connector housing such that, as generally known to the skilled person, relative movement of the mate assist device relative to the connector housing is blocked (e.g., until the locking means are unlocked). The locking means comprise a first plurality of teeth associated with (e.g., attached to, formed on, or the like) the connector housing. Further, the locking means comprise a second plurality of teeth associated with (e.g., attached to, formed on, or the like) the mate assist device. The first and second plurality of teeth are adapted to be engaged with each other. Engaging the teeth enables establishing different locking positions of the mate assist device relative to the connector housing in a mated state of the connector housing with a corresponding counter connector housing. As a result, the mate assist device may be locked relative to the connector housing (and hence the connector housing relative to the corresponding counter connector housing) in a position that advantageously compensates manufacturing tolerances of various components of the electrical connector system.

[0006] Further particularly, the above mentioned object is realized by an electrical connector system comprising a first connector housing, a corresponding second connector housing and locking means. Each of the two connector housings holds (is adapted for holding) one or more electrical contact elements. The locking means are adapted for locking the two housings with each other such that, as generally known by the skilled person, relative movement of the two housings relative to each other is blocked (e.g., until the locking means are unlocked). The locking means comprise a first plurality of teeth associated with (e.g., attached to, formed on, or the like) the first connector housing. Further, the locking means comprise a second plurality of teeth associated with (e.g., attached to, formed on, or the like) the corresponding second plurality of teeth. The first and second plurality of teeth are adapted to be engaged with each other. Engaging the teeth enables establishing different locking positions of the first connector housing relative to the corresponding second connector housing in a mated state of the electrical connector system. As a result, the first connector housing may be locked relative to the corresponding second connector housing in a position that advantageously compensates manufacturing tolerances of various components of the electrical connector system.

[0007] In an aspect of the present disclosure, each of the first plurality of teeth and the second plurality of teeth comprises a saw-tooth geometry. As a result, the locking means, when engaged, may advantageously withstand forces acting upon the locking means which are transferred thereon from other components of the electrical connector system.

[0008] In a further aspect of the present disclosure, the first plurality of teeth and the second plurality are each respectively arranged in a tooth rack. As a result, the

respective electrical connector system may advantageously assume different locking positions in a stepwise manner, for example, in equidistant steps.

[0009] In a further aspect of the present disclosure, the first plurality of teeth and the second plurality of teeth are adapted to allow relative movement with each other in only one direction, when engaged. As a result, the respective electrical connector system, when the locking means are engaged, may advantageously offer a ratchet-like functionality.

[0010] In a further aspect of the present disclosure, the connector housing comprises a locking latch for locking the mate assist device in the mated state. In this aspect, the first plurality of teeth is provided on the locking latch. As a result, the locking means may be advantageously locked and unlocked by operating the locking latch to respectively engage or disengage the first and second plurality of teeth with each other. Preferably, the locking latch may be at least partially accessible in the mated state of the connector housing with the corresponding counter connector housing.

[0011] In a further aspect of the present disclosure, the electrical connector system further comprises an unlocking arm. In this aspect, the unlocking arm is accessible when the two housings are in the mated state. The unlocking arm is arranged such that, when the unlocking arm is operated, the unlocking arm disengages the first and second plurality of teeth. As a result, the electrical connector system may be advantageously unmated.

[0012] In a further aspect of the present disclosure, the mate assist device comprises a lever. In this aspect, the second plurality of teeth is provided on the lever. As a result, the locking means are advantageously applied to a lever-based mate assist system.

[0013] In a further aspect of the present disclosure, the mate assist device comprises a slider. In this aspect, the second plurality of teeth is provided on the slide. As a result, the locking means are advantageously applied to a slider-based mate assist system.

[0014] In a further aspect of the present disclosure, the mate assist device comprises a cam-lever system. In this aspect, the second plurality of teeth is provided on a cam of the cam-lever system. As a result, the locking means are advantageously applied to a cam-lever mate assist system.

[0015] In a further aspect of the present disclosure, each of the first plurality of teeth and the second plurality of teeth comprises at least two teeth. As a result, plural different locking positions may be advantageously enabled while the number of teeth and their footprint may be advantageously optimized. Preferably, each of the first plurality of teeth and the second plurality of teeth comprises at least three teeth, at least four teeth, or at least five teeth. As a result, a tradeoff between a number of teeth (and hence a number of different locking positions) and their footprint may be advantageously established.

[0016] In a further aspect of the present disclosure, a number of the first plurality of teeth and a number of the

second plurality of teeth are different. As a result, footprint may be advantageously saved at one of the first or second plurality of teeth and the other plurality of teeth may ensure sufficient number of locking positions.

[0017] In a further aspect of the present disclosure, the different locking positions are at least two locking positions. As a result, plural different locking positions may be advantageously enabled while the number of teeth and their footprint may be optimized. Preferably, the different locking position are at least three locking positions, at least four locking positions, or at least five locking positions. As a result, a tradeoff between a number of different locking positions (and hence a number of teeth) and their footprint may be advantageously established.

[0018] In a further aspect of the present disclosure, the different locking positions are arranged to provide compensation of manufacturing tolerances of components of the electrical connector system. As a result, quality of the electrical contact between respective electrical contact elements of the electrical connector systems may be advantageously enhanced.

[0019] In a further aspect of the present disclosure, the electrical connector system further comprises the corresponding counter connector housing.

4. Brief description of the drawings

[0020] In the following, various aspects of the disclosed subject matter are described in detail with reference to the accompanying figures, in which:

Fig. 1A shows a three-dimensional view of an embodiment of a connector housing;

Fig. 1B shows a three-dimensional view of an embodiment of a mate assist device;

Fig. 2A shows a cross section view of an embodiment of a connector housing and a mate assist device in an unmated state;

Fig. 2B shows a cross section view of an embodiment of a connector housing and a mate assist device in a mated state in a locking position defined solely by design;

Fig. 2C shows a cross section view of an embodiment of a connector housing and a mate assist device in a mated state in a locking position with compensated tolerances;

Fig. 2D shows a cross section view of an embodiment of a connector housing, a mate assist device and a corresponding counter connector housing in a mated state in a locking position with compensated tolerances;

Fig. 3A shows schematically an initial phase of an

- unlocking process of an embodiment of a connector housing and a mate assist device;
- Fig. 3B shows schematically a further phase of an unlocking process of an embodiment of a connector housing and a mate assist device;
- Fig. 4A shows a three-dimensional view of a further embodiment of an electrical connector system;
- Fig. 4B shows a cross section view of a further embodiment of an electrical connector system.

5. Detailed description

[0021] Fig. 1A shows - in a three-dimensional view - a connector housing 102 of an electrical connector system 100 according to an embodiment of the present disclosure. The connector housing 102 comprises a portion 104 for mating with a corresponding counter connectors housing (not shown). Further, the connector housing 102 comprises a portion 106 adapted for associating the connector housing 102 with a mate assist device 150 (not shown in Fig. 1A but explained in conjunction with Fig. 1B). The mate assist device 150 is associated with the connector housing 102 such that it is rotatably movable around the axis of the hole in the portion 106 of the connector housing 102. The connector housing 102 further comprises a locking latch 108 having a plurality of teeth 110 formed thereon. The plurality of teeth 110 and a further plurality of teeth 156 (not shown in Fig. 1A but explained in conjunction with Fig. 1B) formed on the mate assist device 150 compose an embodiment of locking means of the present disclosure. A portion 112 of the locking latch 108 is accessible and is adapted to be operable (e.g., by the user) to facilitate locking and unlocking the locking means. The first plurality of teeth 110 comprises a saw-tooth geometry and is formed as a tooth rack.

[0022] Fig. 1B shows - in a three-dimensional view - a mate assist device 150 of the electrical connector system 100 according to an embodiment of the present disclosure. The mate assist device 150 comprises portions 152 (corresponding to the portion 106 of the connector housing 102) which is adapted for associating the mate assist device 150 with the connector housing 102. Furthermore, the mate assist device 150 comprises gear elements 154 which are adapted for meshing with corresponding gear elements 206 (not shown in Fig. 1B but explained in conjunction with Fig. 2D) of the counter connector housing (not shown). In addition, the mate assist device 150 comprises a plurality of teeth 156 formed thereon. The second plurality of teeth 156 comprises a saw-tooth geometry and is formed as a tooth rack. The number of teeth of the second plurality of teeth 156 of the mate assist device 150 is less than the number of teeth of the first plurality of teeth 110 of the connector housing 102

(explained in conjunction with Fig. 1A). However, the skilled person recognizes that various constellations of the respective numbers of teeth may be advantageously applied. The plurality of teeth 110 (shown in Fig. 1A) and the plurality of teeth 156 compose an embodiment of locking means of the present disclosure. The second plurality of teeth 156 comprises a saw-tooth geometry and is formed as a tooth rack.

[0023] Fig. 2A shows - in a cross section view - a section of the connector housing 102 and a section of the mate assist device 150 of the electrical connector system 100 according to an embodiment of the present disclosure. The position of the connector housing 102 and the mate assist device 150 relative to each other corresponds to an unmated state of the connector housing 102 with the corresponding counter connector housing (not shown). In the unmated state, the plurality of teeth 110 and the plurality of teeth 156 are not engaged with each other. Furthermore, Fig. 2A shows the locking latch 108 and the portion 112 of the locking latch 108 which are described in the context of Fig. 1A. For simplicity, these two portions are not referenced again in Figs. 2B and 2C.

[0024] Fig. 2B shows - in a cross section view - a section of the connector housing 102 and a section of the mate assist device 150 of the electrical connector system 100 according to an embodiment of the present disclosure. The position of the connector housing 102 and the mate assist device 150 relative to each other corresponds to a mated state of the connector housing and the corresponding counter connector housing (not shown). In the mated state, the plurality of teeth 110 of the connector housing 102 and the plurality of teeth 156 of the mate assist device 150 are engaged with each other. This means that relative movement of the mate assist device 150 relative to the connector housing 102 is blocked. Hence, the position of the connector housing 102 and the mate assist device 150 relative to each other may be referred to as a locking position of the electrical connector systems. The skilled person recognizes that the two pluralities of teeth 110 and 156 provide different locking positions. The locking position shown in Fig. 2B is a position defined solely by design of components of the electrical connector system 100 and is marked by a dashed line 200. In other words, the locking position indicated by the line 200 corresponds to the theoretical case in which manufacturing tolerances are neglected. Furthermore, as generally known to the skilled person, when the first plurality of teeth 110 and the second plurality of teeth 156 are engaged with each other, the saw-tooth geometry allows their relative movement with each other in only one direction and may be regarded as offering a ratchet-like functionality.

[0025] Fig. 2C shows - in a cross section view - a section of the connector housing 102 and a section of the mate assist device 150 of the electrical connector system 100 according to an embodiment of the present disclosure. The position of the connector housing 102

and the mate assist device 150 relative to each other correspond to the mated state. However, unlike in Fig. 2B, in Fig. 2C manufacturing tolerances are considered. This results in the locking position of the plurality of teeth 110 and the plurality of teeth 156 being shifted from the theoretical case indicated by the line 200 to the left-hand side (counterclockwise). The actual locking position is marked by a dashed line 202 and its deviation from theoretical case is indicated by two curved arrows pointing respectively to the lines 200 and 202. The locking position indicated by the line 202 corresponds to the mated state in which manufacturing tolerances are compensated due to displacement of the mate assist device 150 anticlockwise beyond the line 200. This displacement results in enhanced quality of electrical contact between respective electrical contact elements (for holding of which the connector housing 102 and the corresponding counter connector housing are adapted). Due to integration of the locking means (the first plurality of teeth 110 and the second plurality of teeth 156) with the connector housing 102 and the mate assist device 150 no additional burden for the user of the electrical connector system 100 arises - beyond the usual mating of the connector housing 102 with the mate assist device 150.

[0026] Fig. 2D shows - in a cross section view - a section of the connector housing 102, a section of the mate assist device 150 and a section of the corresponding counter connector housing 204 of the electrical connector system 100 according to an embodiment of the present disclosure. Further, one of the gear elements 154 of the mate assist device 150 and corresponding gear elements 206 of the counter connector housing 204 are shown. The displacement between the lines 200 and 202 explained in Fig. 2C results in an angular displacement of the mate assist device 150 in a counterclockwise direction which leads to a force acting upon the gear elements 206 as indicated by an arrow 208. This force results in tightening of the mating state of the connector housing 102 and the counter connector housing 204 along their mating direction indicated by an arrow 210.

[0027] Fig. 3A shows schematically an initial phase of an unlocking process of the connector housing 102 and the mate assist device 150 of the electrical connector system 100 according to an embodiment of the present disclosure. Prior to the initial phase of the unlocking process, the connector housing 102 and their mate assist device 150 are in the mated state; the first plurality of teeth 110 and the second plurality of teeth 156 are engaged with each other in their locking position. An arrow 300 indicates a direction of a force to be exerted upon the portion 112 of the locking latch 108 in order to unlock the locking means (i.e., to effectuate disengagement of the first plurality of teeth 110 and the second plurality of teeth 156 from each other). This direction is essentially parallel to teeth flanks carrying engaging forces between the first plurality of teeth 110 and the second plurality of teeth 156.

[0028] Fig. 3B shows schematically a further phase of an unlocking process of the connector housing 102 and

the mate assist device 150 of the electrical connector system 100 according to an embodiment of the present disclosure. Pressing the portion 112 of the locking latch 108 in the direction explained in Fig. 3A results in disengagement of the first plurality of teeth 110 and the second plurality of teeth 156 from each other. Thereupon, rotating the mate assist device 150 clockwise - as indicated by an arrow 302 - transitions the electrical connector system 100 to its unmated state.

[0029] Fig. 4A shows - in a three-dimensional view - an electrical connector system 400 comprising a first connector housing 402 and a second connector housing 404. The electrical connector system 400 further comprises an unlocking arm 406 which is accessible and adapted to be operable (e.g., by the user) to facilitate unlocking the electrical connector system as explained in conjunction with Fig. 4B below. Unlike the electrical connector system 100 explained in the context of Figs. 1A, 1B, 2A, 2B, 2C, 2D, 3A and 3B, the electrical connector system 400 is not equipped with any mate assist.

[0030] Fig. 4B shows - in a cross section view - a section of the electrical connector system 400. The first connector housing 402 comprises an interface member 408 adapted to (e.g., in a mated state of the electrical connector system 400) penetrate the second connector housing 404. The first connector housing 402 further comprises a first plurality of teeth 410 formed on the interface member 408. The second connector housing 404 comprises a locking tongue member 412 having a second plurality of teeth 414 formed thereon. The first plurality of teeth 410 and the second plurality of teeth 414 compose an embodiment of locking means of the present disclosure. In the mated state of the electrical connector system 400 (as shown in Fig. 4B), the first plurality of teeth 410 and the second plurality of teeth 414 are engaged with each other. Hence, the position of the first connector housing 402 and the second connector housing 404 relative to each other may be referred to as a locking position of the electrical connector system 400. The skilled person recognizes that the two pluralities of teeth 410 and 414 provide different locking positions - similar as the locking means explained above in conjunction with the electric connector 100. The unlocking arm 406 is arranged such that, when the unlocking arm is operated (e.g., by the user), the unlocking arm exerts a force upon the interface member 408 resulting in disengagement of the first plurality of teeth 410 and the second plurality of teeth 414 from each other and thereby enables transition of the electrical connector system 400 to its unmated state.

Claims

1. An electrical connector system comprising:
 - a. a connector housing adapted for holding one or more electrical contact elements,

- b. a mate assist device associated with the connector housing, and
- c. locking means for locking the mate assist device relative to the connector housing;

characterized in that

- d. the locking means comprise a first plurality of teeth associated with the connector housing and a second plurality of teeth associated with the mate assist device;
- e. wherein the first plurality of teeth and the second plurality of teeth are adapted to be engaged with each other and thereby to enable different locking positions of the mate assist device relative to the connector housing in a mated state of the connector housing with a corresponding counter connector housing.

2. An electrical connector system comprising:

- a. a first connector housing adapted for holding one or more electrical contact elements and a corresponding second connector housing adapted for holding one or more electrical contact elements, and
- b. locking means for locking the two housings with each other;

characterized in that

- c. the locking means comprise a first plurality of teeth associated with the first connector housing and a second plurality of teeth associated with the corresponding second connector housing;
- d. wherein the first plurality of teeth and the second plurality of teeth are adapted to be engaged with each and thereby to enable different locking positions of the first connector housing relative to the corresponding second connector housing in a mated state of the electrical connector system.

- 3. The electrical connector system of claim 1 or 2, wherein each of the first plurality of teeth and the second plurality of teeth comprise a saw-tooth geometry.
- 4. The electrical connector system of any one of the preceding claims, wherein the first plurality of teeth and the second plurality of teeth are each respectively arranged in a tooth rack.
- 5. The electrical connector system of any one of the preceding claims, wherein the first plurality of teeth and the second plurality of teeth are adapted to allow relative movement with each other in only one direction, when engaged.

- 6. The electrical connector system of claim 1, wherein the connector housing comprises a locking latch for locking the mate assist device in the mated state, and wherein the first plurality of teeth is provided on the locking latch.

- 7. The electrical connector system of claim 2, wherein the electrical connector system further comprises an unlocking arm, wherein the unlocking arm is accessible when the two housings are in the mated state, and wherein the unlocking arm is arranged such that, when the unlocking arm is operated, the unlocking arm disengages the first and second plurality of teeth.

- 8. The electrical connector system of claim 1, wherein the mate assist device comprises a lever and wherein the second plurality of teeth is provided on the lever.

- 9. The electrical connector system of claim 1, wherein the mate assist device comprises a slider and wherein the second plurality of teeth is provided on the slider.

- 10. The electrical connector system of claim 1, wherein the mate assist device comprises a cam-lever system and wherein the second plurality of teeth is provided on a cam of the cam-lever system.

- 11. The electrical connector system of any of the preceding claims, wherein the first and second plurality of teeth each comprises at least two teeth, preferably at least three teeth, at least four teeth, or at least five teeth.

- 12. The electrical connector system of any of claims 1 to 10, wherein a number of the first plurality of teeth and a number of the second plurality of teeth are different.

- 13. The electrical connector system of any of the preceding claims, wherein the different locking positions are at least two locking positions, preferably at least three locking positions, at least four locking positions, or at least five locking positions.

- 14. The electrical connector system of any of the preceding claims, wherein the different locking positions are arranged to provide compensation of manufacturing tolerances of components of the electrical connector system.

- 15. The electrical connector system of any of claim 1, wherein the electrical connector system further comprises the corresponding counter connector housing.

100

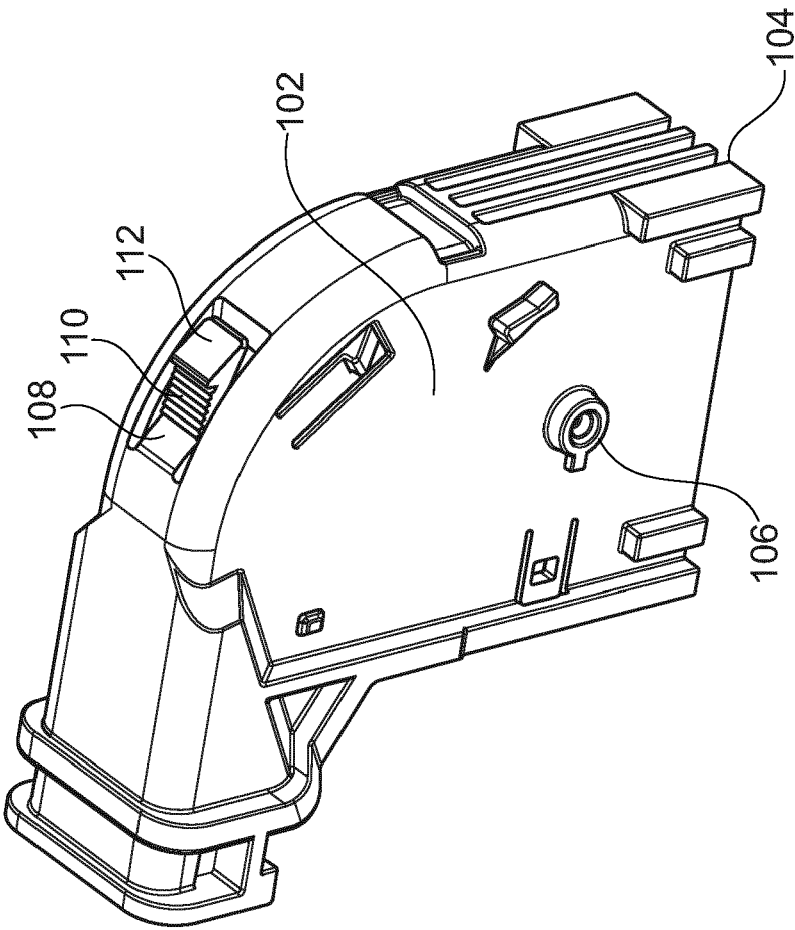


Fig. 1A

100

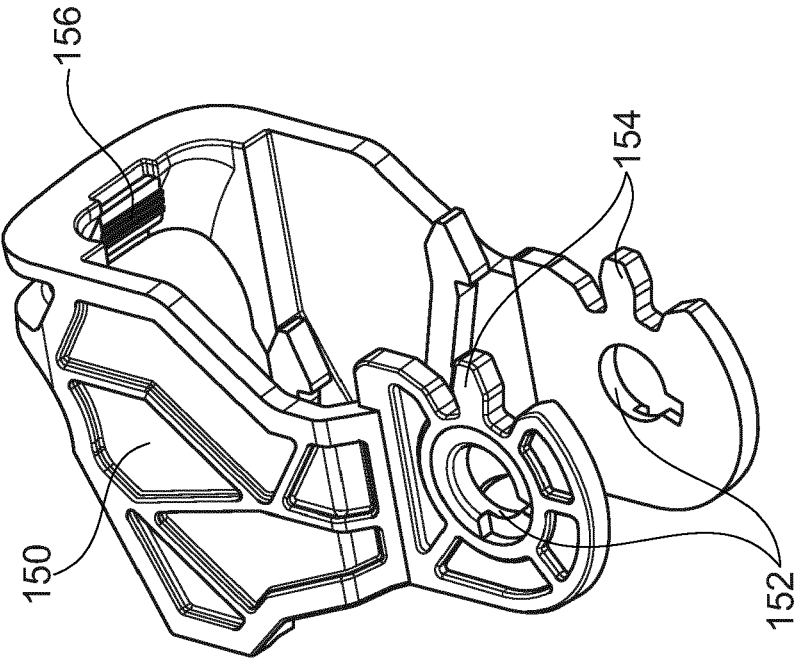


Fig. 1B

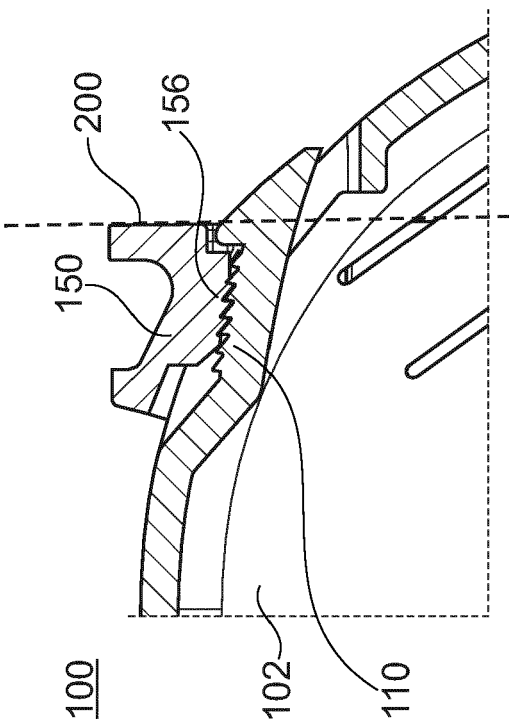


Fig. 2A

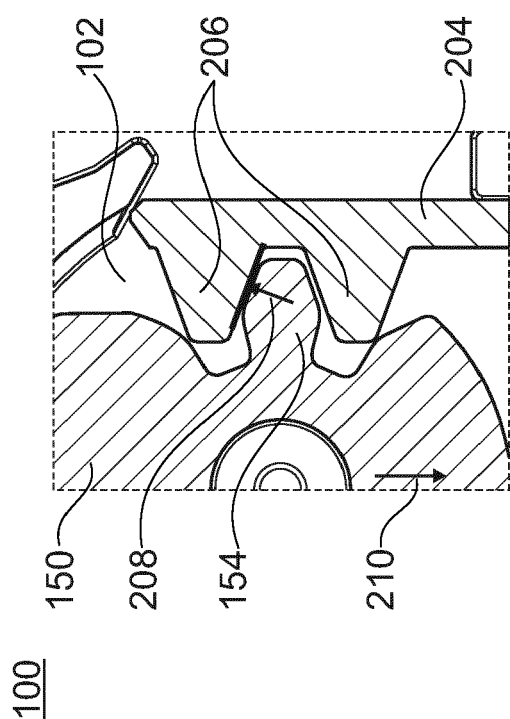


Fig. 2B

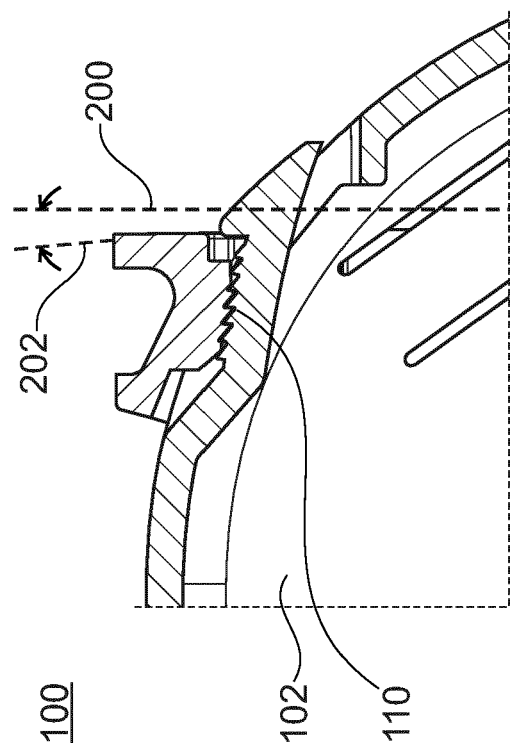


Fig. 2C

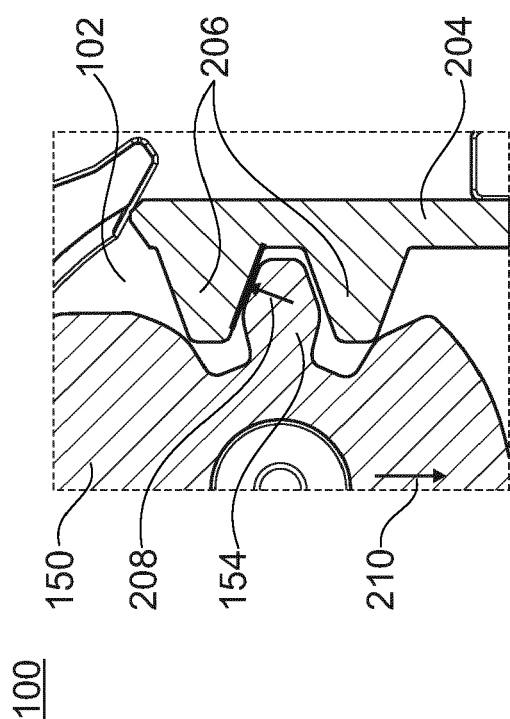


Fig. 2D

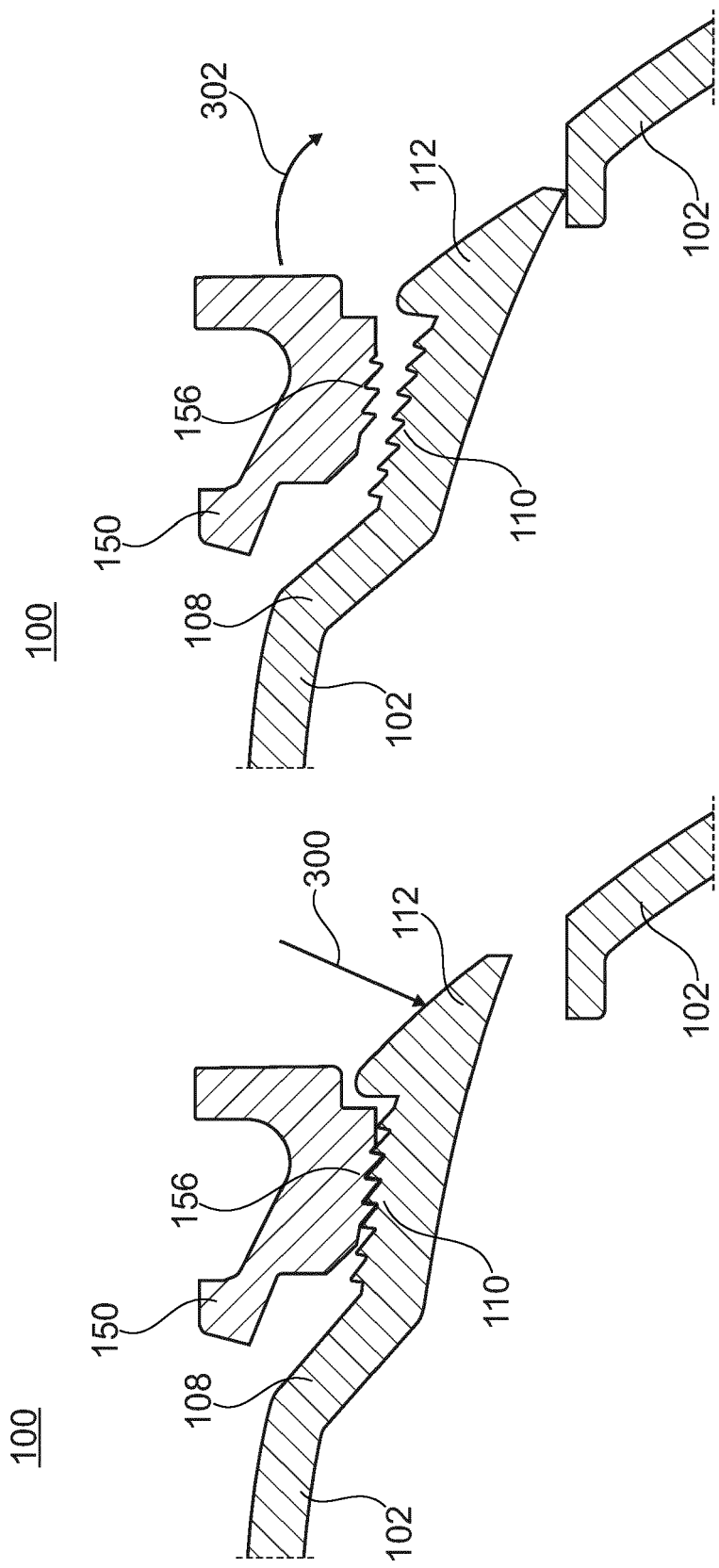


Fig. 3B

Fig. 3A

400

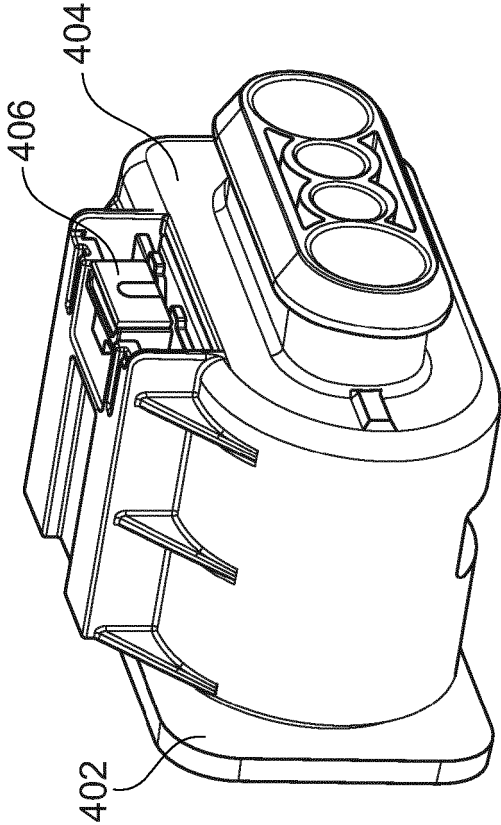


Fig. 4A

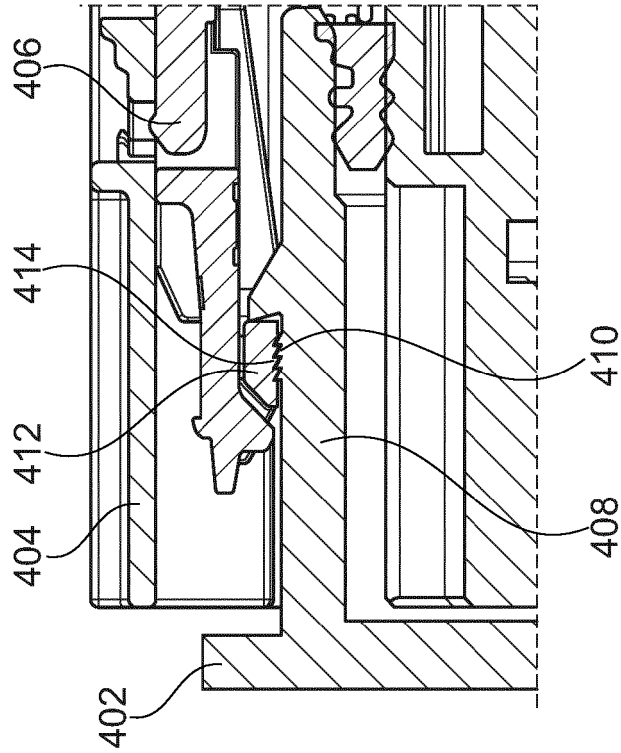


Fig. 4B



EUROPEAN SEARCH REPORT

Application Number

EP 23 20 6989

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	KR 2015 0047985 A (HYUNDAI MOBIS CO LTD [KR]) 6 May 2015 (2015-05-06)	1, 3-6, 8, 10-15	INV. H01R13/627
Y	* paragraph [0021] - paragraph [0041]; figures 1,3,4,5,6 *	9	H01R13/629 H01R13/639
X	US 2022/376435 A1 (BUCK CARSTEN [DE] ET AL) 24 November 2022 (2022-11-24)	1	
Y	* paragraph [0042] - paragraph [0050]; figures 3,4,8,9,10,12 *	9	
X	EP 3 171 462 A1 (TE CONNECTIVITY GERMANY GMBH [DE]) 24 May 2017 (2017-05-24)	1, 3-5, 8, 11	
Y	* paragraph [0095] - paragraph [0116]; figures 1,2,4,6,7a, 7b *	9	
Y	EP 3 361 580 A1 (DELPHI TECH LLC [US]) 15 August 2018 (2018-08-15) * figure 5a *	9	
X	CN 115 528 489 A (ZHONG SHIYU) 27 December 2022 (2022-12-27) * paragraph [0042] - paragraph [0061]; figures 2,4 *	2-5, 7, 11-14	TECHNICAL FIELDS SEARCHED (IPC) H01R
X	CN 115 149 345 A (K TRONICS SUZHOU TECH CO LTD; BOE TECHNOLOGY GROUP CO LTD) 4 October 2022 (2022-10-04) * paragraph [0046] - paragraph [0072]; figures 1,3,4,5 *	2-4	
The present search report has been drawn up for all claims			
Place of search The Hague		Date of completion of the search 27 June 2024	Examiner 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)



Application Number

EP 23 20 6989

CLAIMS INCURRING FEES

The present European patent application comprised at the time of filing claims for which payment was due.

☐ Only part of the claims have been paid within the prescribed time limit. The present European search report has been drawn up for those claims for which no payment was due and for those claims for which claims fees have been paid, namely claim(s):

☐ No claims fees have been paid within the prescribed time limit. The present European search report has been drawn up for those claims for which no payment was due.

LACK OF UNITY OF INVENTION

The Search Division considers that the present European patent application does not comply with the requirements of unity of invention and relates to several inventions or groups of inventions, namely:

see sheet B

☒ All further search fees have been paid within the fixed time limit. The present European search report has been drawn up for all claims.

☐ As all searchable claims could be searched without effort justifying an additional fee, the Search Division did not invite payment of any additional fee.

☐ Only part of the further search fees have been paid within the fixed time limit. The present European search report has been drawn up for those parts of the European patent application which relate to the inventions in respect of which search fees have been paid, namely claims:

☐ None of the further search fees have been paid within the fixed time limit. The present European search report has been drawn up for those parts of the European patent application which relate to the invention first mentioned in the claims, namely claims:

☐ The present supplementary European search report has been drawn up for those parts of the European patent application which relate to the invention first mentioned in the claims (Rule 164 (1) EPC).

**LACK OF UNITY OF INVENTION
SHEET B**

Application Number

EP 23 20 6989

The Search Division considers that the present European patent application does not comply with the requirements of unity of invention and relates to several inventions or groups of inventions, namely:

1. claims: 1, 3-6, 8-15

Invention I: Electrical connector system comprising a connector and a mate assist device having locking means which interlock thus allowing different positions of the mate assist device with respect the connector housing

2. claims: 2-5, 7, 11-14

Invention II: Electrical connector system comprising two connectors having locking means which interlock thus allowing different positions of one connector with with respect to the other connector when mated

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

EP 23 20 6989

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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.

27-06-2024

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Patent document cited in search report	Publication date	Patent family member(s)	Publication date
KR 20150047985 A	06-05-2015	NONE	

US 2022376435 A1	24-11-2022	CN 115377728 A	22-11-2022
		DE 102021112898 A1	24-11-2022
		EP 4092841 A1	23-11-2022
		JP 7434411 B2	20-02-2024
		JP 2022177809 A	01-12-2022
		KR 20220156451 A	25-11-2022
		US 2022376435 A1	24-11-2022

EP 3171462 A1	24-05-2017	NONE	

EP 3361580 A1	15-08-2018	EP 3361580 A1	15-08-2018
		EP 3823106 A1	19-05-2021
		EP 4235978 A2	30-08-2023
		US 2018226749 A1	09-08-2018

CN 115528489 A	27-12-2022	NONE	

CN 115149345 A	04-10-2022	NONE	

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EPO FORM P0459

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