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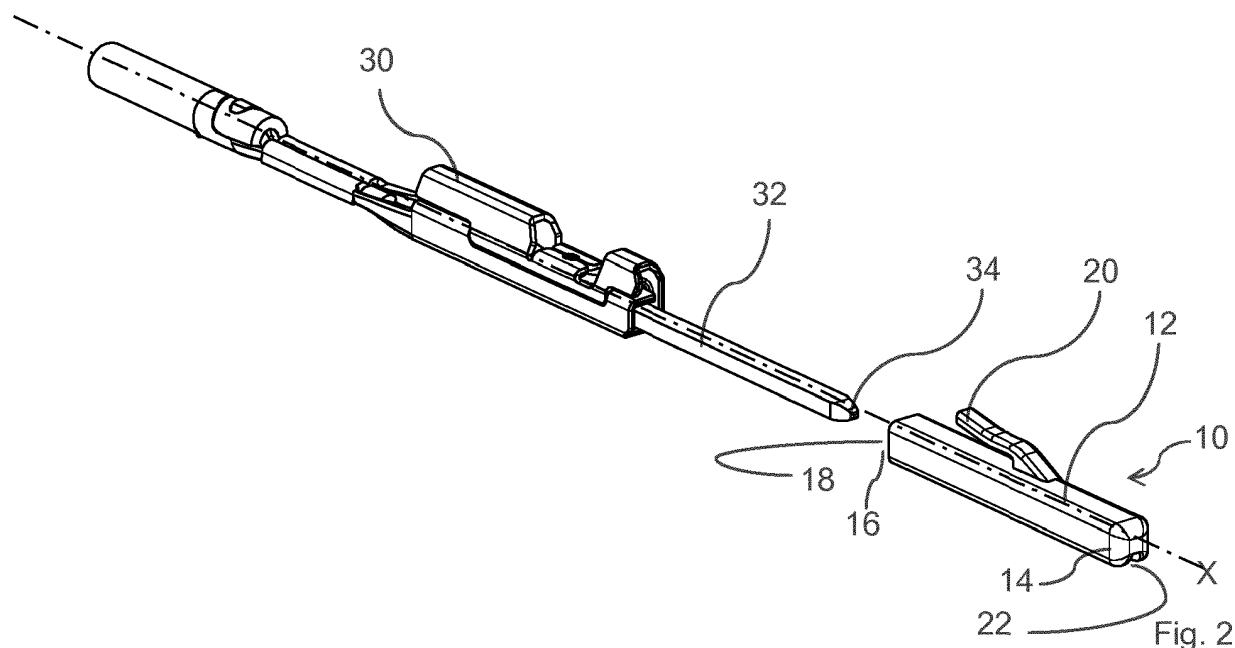
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(54) **PROTECTION DEVICE AND TERMINAL ASSEMBLY**

(57) A protection device (10) for protecting a seal (50) arranged in a sealed connector housing (100) from damage, while leading through an elongated blade (32) along a longitudinal axis (X), wherein the elongated blade protrudes from an electrical terminal (30), along the longitudinal axis, wherein the protective device comprises a tubular body (12) arranged along the longitudinal axis,

wherein a first end (14) of the tubular body is smoothed and a second end (16) comprises an opening (18) adapted to receive the elongated blade, whereby the tubular body (12) is adapted to cover at least a tip (34) of the elongated blade, when the elongated blade is received in the tubular body..



Description

TECHNICAL FIELD OF INVENTION

[0001] The present invention relates to protection device for protecting a seal arranged in a sealed connector housing from damage, while leading through an elongated blade. The invention also relates to a terminal assembly comprising such a protection device. Furthermore, a method for mounting an electrical terminal to a sealed plug housing is disclosed.

BACKGROUND OF INVENTION

[0002] In automotive industries electrical wire harnesses are used for transport of power and information. Dependent on purpose and equipment of the vehicles the electrical wire harnesses have to cover a lot of different requirements. New technologies, e.g. in the area of electro mobility or autonomous driving, require very special connector types. High numbers of connections have to be provided on limited amount of space. That forces the designers to provide smaller and smaller electrical terminals for usage in the connectors. In state-of-the-art connectors water tightness is mandatory. All this requirements guides to problems while manufacturing the connectors. Especially when inserting male type terminals into connector housings, that have elastic seals, to seal the single wires. While inserting the male terminal, the pin shaped front part easily stitches into the elastic seal and damage it. That happens quite fast when the position of the terminal is not exactly adjusted to the opening in the seal. Usually the pin shaped front part has a pointed tip what makes the situation even worse. Furthermore, the pin shaped front part can be bent accidentally while inserting the male terminal into the connector housing. The bent pin shaped front part cannot be used for being inserted into the connector housing needs to be replaced. The pin shaped front part can be coated with a silver or gold coating, that needs to be protected from scratches while transport.

[0003] Therefore, it is one aspect of the present invention to provide a protection device for protecting the pin shaped front part of a terminal from being bent or scratched. Furthermore, the protection device protects a seal arranged in a sealed connector housing from damage, while leading through the pin shaped front part, while assembling the terminal in the connector housing. Furthermore, a method to assemble the electrical terminal to a sealed connector housing without causing damages to the seal.

[0004] These and other objects which become apparent upon reading the following description are solved by a protection device according to independent claim 1 and a method according to claim 10.

SUMMARY OF THE INVENTION

[0005] The present application relates to a protection device for protecting a seal arranged in a sealed connector housing from damage, while leading through an elongated blade along a longitudinal axis. The elongated blade protrudes from an electrical terminal, along the longitudinal axis. The protective device comprises a tubular body arranged along the longitudinal axis. A first end of the tubular body is smoothed and a second end comprises an opening adapted to receive the elongated blade. The tubular body is adapted to cover at least a tip of the elongated blade, when the elongated blade is received in the tubular body.

[0006] The disclosed invention provides a protection device that has a tube shaped body. The dimension of the hollow inner channel of the tube shaped body is adapted to the outer dimension of the elongated blade of the terminal. The elongated blade can be inserted into the tube shaped body. Whereby the tube shaped body surrounds tightly the elongated blade. Because of the tight fit the tube shaped body can't fall down accidentally while transport or handling. This enables usage of the protection device also for protecting the sensitive elongated blade while transport, in case the cable harnesses are preassembled in different production plants and transported for marriage to finalize the cable harness. The first end of the tubular body is smoothed to enable guiding through the electrical terminal through the seal of the connector, without stitching into the seal material. The smooth end can be done by removing all sharp edges e.g. by grinding. If the protection device is made from plastics, the injection-molding tool can be designed accordingly to prevent sharp edges on the first end of the tubular body.

[0007] The disclosed invention provides a method to assemble an electrical terminal to a sealed connector housing. The method comprising the following steps:

- a) Providing the electrical terminal, the sealed connector housing and a protection device.
- b) Mounting the protection device over the elongated blade, so that the tubular body covers the tip of the elongated blade.
- c) Leading the elongated blade and the protection device through the seal of the sealed connector housing.
- d) Removing the protection device from the elongated blade.

[0008] The disclosed invention furthermore provides a method to assemble the electrical terminal to the sealed connector housing, preventing damages on the seal. The method can be conducted manually or by machines or in a mixed process, whereby the steps are partly done by humans and partly by machines. The process steps can be done immediately one after the other or separated by transport of the preassembled parts.

[0009] Preferably the first end of the tubular body comprises a straight wall arranged perpendicular to the longitudinal axis, defining the first end. The straight wall closes the tubular body on the first end. The outer surface of the tubular body in the straight wall meet in an angle of roundabout 90°. This angle is flat enough to prevent damages on the seal.

[0010] Advantageously, the first end of the tubular body is curved preventing sharp edges. To further improve the first end of the tubular body in causing no damages, the first end can be made curved. That means that the areas where the outer surface meets the straight wall the edges are rounded. The edges could be alternatively beveled to get a blunt contact angle.

[0011] Preferably the tubular body comprises removal means to support removal of the tubular body from the elongated blade after leading through the seal. The tubular body could, after insertion into the sealed connector, be difficult to grab. To improve the opportunity of removing the tubular body, removal means e.g. roughened areas on the surface can be foreseen. Also special designed areas on the surface of the tubular body, designed for cooperating with grippers, are considerable.

[0012] Advantageously, the removal means comprises a flexible arm, protruding diagonal with respect to the longitudinal axis, outwards from the tubular body and towards the second end. The flexible arm is adapted to cooperate with the removal device comprising a straight wall and an opening for feeding through the tubular body. The tubular body is fed through the opening, whereby the flexible arm is forced towards the tubular body while passing the opening. After passing the opening the flexible arm flexes back to the relaxed position. When the removal device is removed from the sealed connector, the flexible arm presses against the straight wall, whereby the removal device pulls down the tubular body from the elongated blade. This is a very easy assembly to remove the protecting device from the electrical terminal after insertion. It is robust and works with all materials used for the protection device.

[0013] Preferably the tubular body comprises a rectangular cross section. For an elongated blade having a rectangular cross-section a tubular body with a rectangular cross-section is obvious. For an elongated blade having a round cross-section the tubular body comprises a round cross section. But of course a combination works also the other way around but it is not the preferred embodiment.

[0014] Preferably the tubular body comprises a slot extending from the first end to the second end. The slot guides the protection device inside the housing cavity cooperating with a protrusion protruding inside the cavity. Whereby the protecting device is able to pass the protrusion and terminal is blocked by the protrusion, when reached a final position inside the connector housing.

[0015] Advantageously, the tubular body is made of or plastics. Usually the tubular body will be made of plastics because the parts are cheap and easy to produce by

injection molding. But there are also reasons to choose materials like TPE or Silicon for the tubular bodies.

[0016] Preferably, the terminal assembly comprises a protection device and an electrical terminal comprising the elongated blade.

[0017] Advantageously, the method step b comprises the moving of the tubular body and/ or the electrical terminal, aligned along the mating axis, towards each other, whereby the elongated blade is inserted into the opening, provided at the second end of the tubular body. Depending on how the workflow is designed, the movement can be done by moving only one part or simultaneously with the two parts. This increases flexibility of the process.

[0018] Preferably the step a comprises:

providing a removal device, and wherein the step d comprises:

removing the tubular body by using the removal device.

The use of the removal device makes it possible to conduct the removal part of the method by a machine. That makes the process more flexible and reduces costs.

[0019] Advantageously, the removal device comprises a flexible arm and a wall arranged perpendicular to the longitudinal axis said wall having an opening, wherein step a comprises:

passing the tubular body through the opening along the mating axis, when the flexible arm is flexed towards the tubular body and;
preventing passing of the tubular body when the flexible arm is not flexed towards the tubular body.

The flexible arm is adapted to cooperate with the removal device comprising a straight wall and an opening for feeding through the tubular body. The tubular body is fed through the opening, whereby the flexible arm is forced towards the tubular body while passing the opening. After passing the opening the flexible arm flexes back to the relaxed position. When the removal device is removed from the sealed connector, the flexible arm presses against the straight wall, whereby the removal device pulls down the tubular body from the elongated blade. This is a very easy assembly to remove the protecting device from the electrical terminal after insertion. It is robust and works with all materials used for the protection device.

[0020] Preferably the step d comprises:

that the removal device comprises clamping means and the step a comprises:

clamping the tubular body when the electrical terminal is pushed through the seal.

[0021] The removal device can also be designed with

clamping means that clamp the tubular body, and hold it while removing the removal device. This is alternative design is more costly than the design using the flexible arm. But maybe this design is preferred to solve special requirements.

[0022] Advantageously, the step d comprises:

removing the connector housing from the removal device.

The removal device may be designed as a part fixed to the assembly line. The connector housing will be removed from the removal device after inserting the electrical terminal. While removing the connector housing the protecting device is pulled off of the elongated blade and it stays at the removal device. The connector now equipped with the terminal and get rid of the protecting device, can be moved forward to the next place, where the next process step, to finish the wire harness will be conducted that. This method enables fast process flow.

Description of the preferred embodiments

[0023] In the following, the invention is described exemplarily with reference to the enclosed figures, in which

- Fig. 1 Figure 1 shows a method, known in the art, how to insert an electrical terminal into the sealed connector housing;
- Fig. 2 shows a perspective view of a protection device and then electrical terminal;
- Fig. 3 shows a perspective view of a protection device assembled on and electrical terminal;
- Fig. 4 shows a perspective view of a protection device assembled on and electrical terminal rotated by 180°;
- Fig. 5-8 shows the method steps that are necessary to assemble the electrical terminal into the sealed connector;
- Fig 9 shows the method step to remove the protection device;
- Fig 10 shows a cut view of the sealed connector housing

[0024] Figure 1 shows a method, known in the prior art, how to insert an electrical terminal 30 into a sealed connector housing 100. Figure 1 shows a cut view of the sealed connector 100, thereby assuming wrong adjustment between the electrical terminal 30 in the sealed connector housing 100. The tip 34 of the elongated blade 32, of the electrical terminal 30, stiches into the seal 50, because the terminal 30 is not precisely aligned along

the longitudinal axis X.

[0025] Figure 2 shows a perspective view of a protection device 10 for protecting a seal 50 arranged in a sealed connector housing 100 from damage, while leading trough an elongated blade 32 along a longitudinal axis X. The elongated blade 32 protrudes from an electrical terminal 30, along the longitudinal axis X. The protective device 10 comprises a tubular body 12 arranged along the longitudinal axis X, wherein a first end 14 of the tubular body 12 is smoothed and a second end 16 comprises an opening 18 adapted to receive the elongated blade 32. The tubular body 12 is adapted to cover at least a tip 34 of the elongated blade 32, when the elongated blade 32 is received in the tubular body 12. The first end 14 of the tubular body 12 comprises a straight wall arranged perpendicular to the longitudinal axis X, defining the first end. The first end 14 of the tubular body 12 is curved to prevent sharp edges. The tubular body 12 comprises removal means to support removal of the tubular body 12 from the elongated blade 32 after leading through the seal 50. The removal means comprises a flexible arm 20 protruding diagonal with respect to the longitudinal axis X, outwards from the tubular body 12 and towards the second end 16. The tubular body 12 comprises a rectangular cross section. Figure 3 shows a perspective view of a protection device 10 attached on the electrical terminal 30 ready to be inserted into the sealed connector housing 100. Figure 4 shows the assembly shown in figure 3, rotated by 180° around the longitudinal axis X, to expose the slot 22.

[0026] Figures 5 to 8 show the method steps how to assemble the electrical terminal 30 with attached protection device 10 into the sealed connector housing 100 and how the protection device 10 is removed after insertion. The sealed connector housing 100 and a removing device 110 are shown in a cut view. Figure 5 shows the method steps a and b.

[0027] The method step comprises: providing the electrical terminal 30, the sealed connector housing 100 and a protection device 10 mounting the protection device over the elongated blade 32 so that the tubular body 12 covers the tip 34 of the elongated blade 32. The step moving of the tubular body 12 and/ or the electrical terminal 30, aligned along the longitudinal axis X, towards each other, whereby the elongated blade 32 is inserted into the opening 18 provided at the second end 16 of the tubular body is (not shown in figure 5). The removal device 110 is arranged on the sealed connector housing 100 opposite to the entrance for the electrical terminal 20.

[0028] Figures 6 to 9 show the method step c. Method step c comprises: leading the elongated blade 32 and the protection device 10 through the seal 50 of the sealed connector housing 100. The removal device 110 comprises a wall 112, arranged perpendicular to the longitudinal axis X, said wall is having an opening 114. The method step comprises also further passing the tubular body 12 though the opening 114 along the longitudinal axis X whereby the flexible arm 20 is flexed towards the

tubular body.

[0029] Figure 9 shows the method step d, shows the removing of the protection device 10 from the elongated blade 32 by using the removal device 110. The flexible arm 20 is not flexed towards the tubular body 12. While separating the connector housing 100 from the removal device 110, the flexible arm 20 is pressed against the wall 112 whereby the protection device 10 is moved away from the sealed connector housing 100 and pulled off the elongated blade 32 of the electrical connector 20.

[0030] Figure 10 shows a cut view of the protection device 10 attached on the elongated blade 32 inside a cavity 102 of the sealed connector housing 100. The cut is carried out perpendicular to the longitudinal axis X.

A protrusion 104 protrudes into the cavity 102 and further into the slot 22 of the protection device 10. The electrical terminal 30 is blocked by the protrusion 104, whereby the protection device 10 is movable along the longitudinal axis X because the protrusion is received in the slot 22. The protrusion 104 furthermore guides the protection device 10 inside the cavity 102.

Claims

1. A protection device (10) for protecting a seal (50) arranged in a sealed connector housing (100) from damage, while leading through an elongated blade (32) along a longitudinal axis (X), wherein the elongated blade protrudes from an electrical terminal (30), along the longitudinal axis, wherein the protective device comprises a tubular body (12) arranged along the longitudinal axis, wherein a first end (14) of the tubular body is smoothed and a second end (16) comprises an opening (18) adapted to receive the elongated blade, whereby the tubular body (12) is adapted to cover at least a tip (34) of the elongated blade, when the elongated blade is received in the tubular body.
2. A protection device (10) according to claim 1, wherein the first end (14) of the tubular body (12) comprises a straight wall arranged perpendicular to the longitudinal axis (X), defining the first end.
3. A protection device (10) according to any of the preceding claims, wherein the first end (14) of the tubular body (12) is curved preventing sharp edges.
4. A protection device (10) according to any of the preceding claims, wherein the tubular body (12) comprises removal means to support removal of the tubular body (12) from the elongated blade (32) after leading through the seal (50).
5. A protection device (10) according to the preceding claim, wherein the removal means comprises a flexible arm (20) protruding diagonal with respect to the

longitudinal axis (X), outwards from the tubular body (12) and towards the second end (16).

6. A protection device (10) according to any one of the preceding claims, wherein the tubular body (12) comprises a rectangular cross section or wherein the tubular body (12) comprises a round cross section.
7. A protection device (10) according to any one of the preceding claims, wherein the tubular body (12) comprises a slot (22) extending from the first end (14) to the second end (16).
8. A protection device (10) according to any one of the preceding claims, wherein the tubular body (12) is made of plastics.
9. Terminal assembly, comprising
 - a protection device according to one of the preceding claims;
 - an electrical terminal comprising the elongated blade.
10. Method to assemble an electrical terminal (30) to a sealed connector housing (100) comprising the steps:
 - a) providing the electrical terminal (30), the sealed connector housing (100) and a protection device (10) according to any of claims 1-9;
 - b) mounting the protection device over the elongated blade (32) so that the tubular body (12) covers the tip (34) of the elongated blade (32);
 - c) leading the elongated blade and the protection device through the seal (50) of the sealed connector housing (100);
 - d) removing the protection device from the elongated blade.
11. Method according to the preceding claim, wherein step b comprises:
 - moving the tubular body (12) and/ or the electrical terminal (30), aligned along the mating axis (X), towards each other, whereby the elongated blade (32) is inserted into the opening (18) provided at the second end (16) of the tubular body.
12. Method according to any of claims 10 to 11, wherein step a comprises:
 - providing a removal device (110),
 - and wherein the step d comprises:
 - removing the tubular body (12) by using the re-

moval device.

13. Method according to the preceding claim, wherein the removal device (110) comprises a flexible arm (20) and a wall (112) arranged perpendicular to the longitudinal axis (X) said wall having an opening (114), wherein step a comprises:

passing the tubular body (12) through the opening along the mating axis (X), when the flexible arm (20) is flexed towards the tubular body and; preventing passing of the tubular body (12) when the flexible arm is not flexed towards the tubular body.

14. Method according to claim 12, wherein the removal device (110) comprises clamping means and the step a comprises:

clamping the tubular body (12) when the electrical terminal (30) is pushed through the seal (50).

15. Method according to claim 11, wherein the step d comprises:

removing the connector housing from the removal device (110).

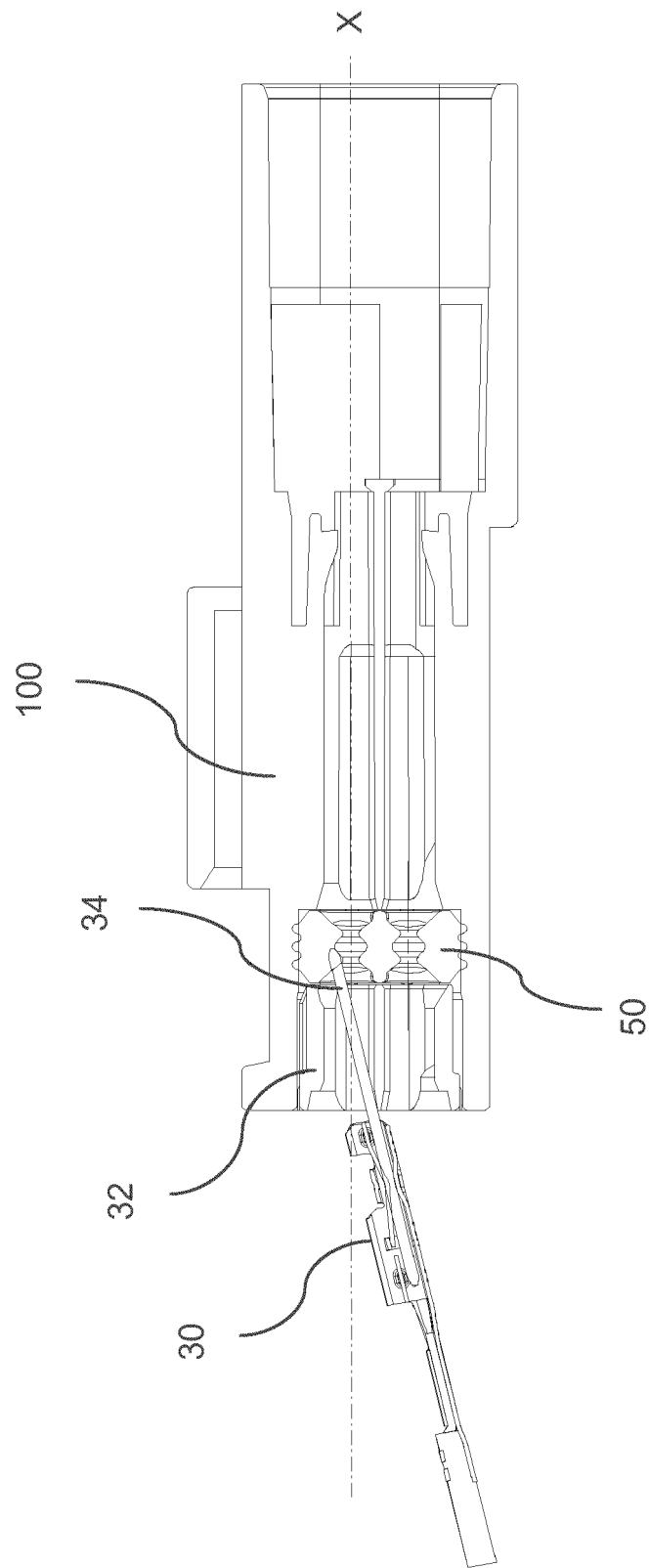
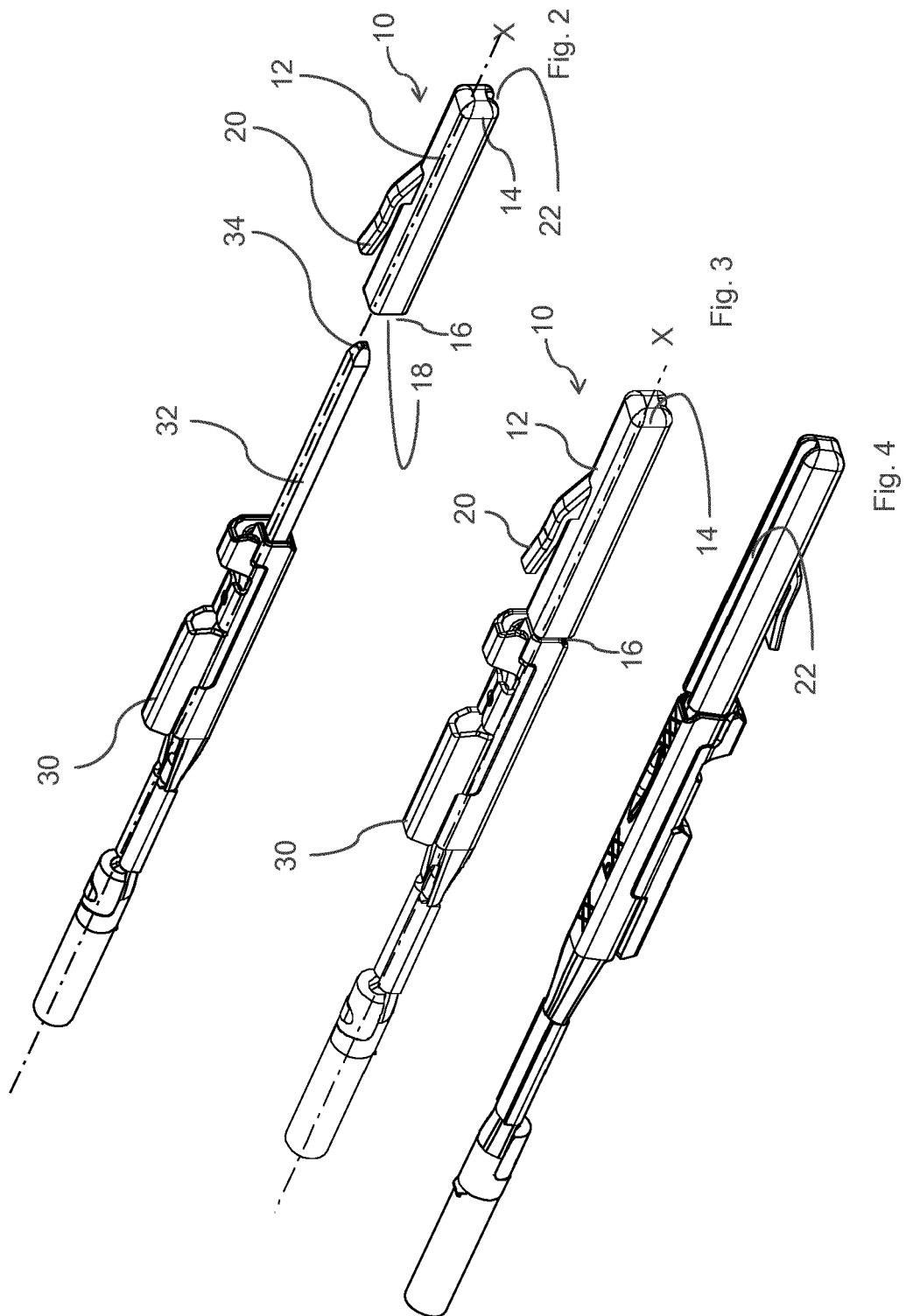
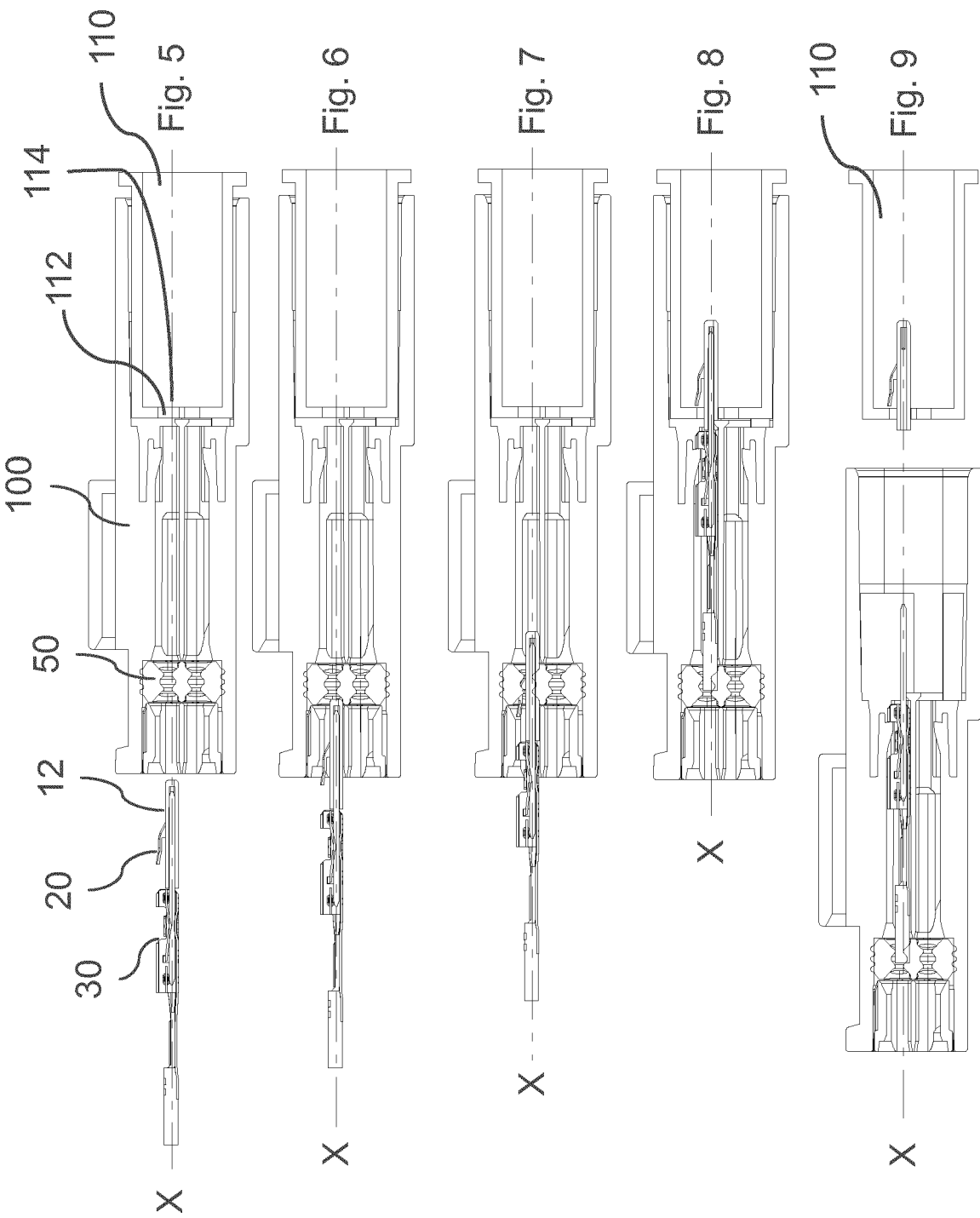


Fig. 1 prior art





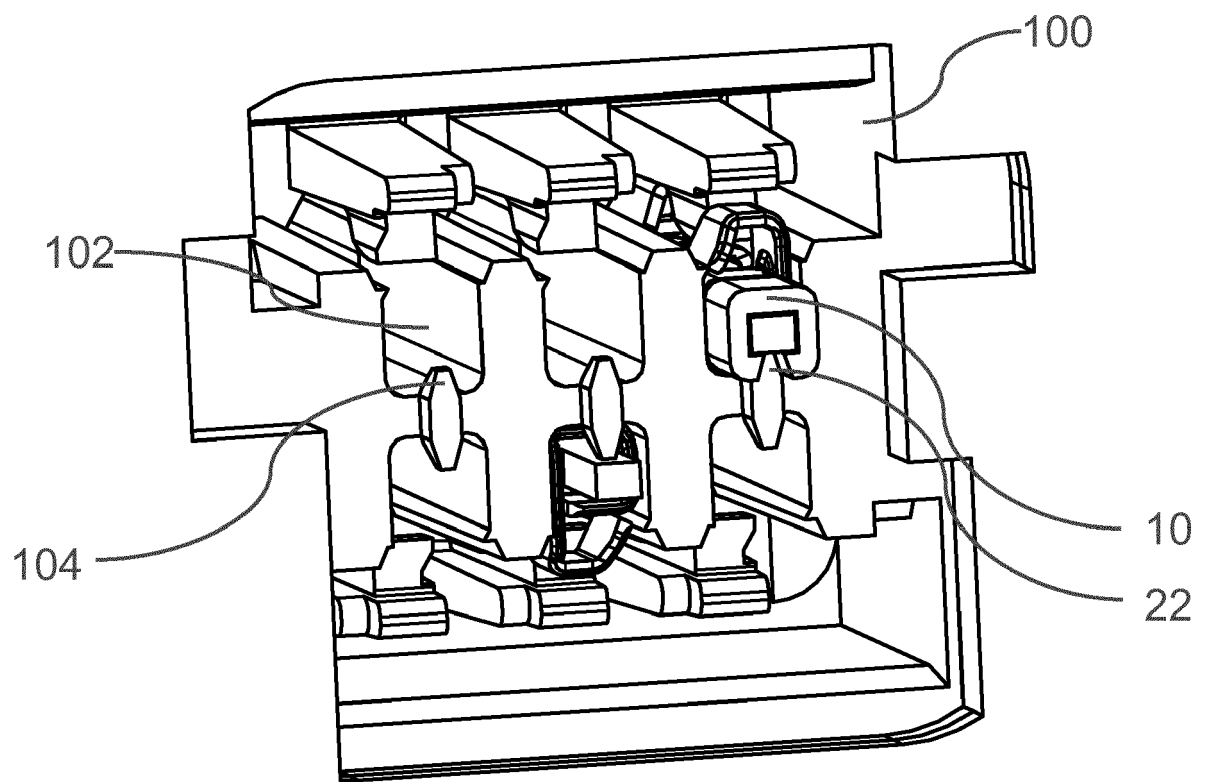


Fig. 10



EUROPEAN SEARCH REPORT

 Application Number
 EP 17 17 3590

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The present search report has been drawn up for all claims			
Place of search The Hague		Date of completion of the search 20 July 2017	Examiner Alberti, Michele
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			

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**ANNEX TO THE EUROPEAN SEARCH REPORT
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This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
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