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(54) **CONNECTOR ASSEMBLY WITH IMPROVED LEVER GEAR TRANSMISSION**

VERBINDERANORDNUNG MIT VERBESSERTER HEBELGETRIEBEÜBERSETZUNG

ENSEMBLE DE CONNECTEUR PRÉSENTANT UNE MEILLEURE TRANSMISSION D'ENGRENAGE À LEVIER

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Description

[0001] The invention relates to a connector assembly configured to provide a lever gear ratio allowing a user to couple the connector to a mating connector with a limited manual force applicable by the user, comprising a connector, a mating connector adapted to be coupled to the connector in a mating direction, and a lever assembly.

[0002] Connector assemblies may comprise a multitude of wires terminating into contact pins or tabs that need to be plugged to receiving members of the connector or mating connector. With an increased number of individual contact pins, the plug-in force for moving a mating connector towards a connector for coupling the connector and mating connector increases as well. Furthermore, certain plug designs, for instance a so called insulation displacement contact in which the insulation of an insulated wire is displaced by a contact member, further increase the plug-in force.

[0003] An increased plug-in force may result in that a user may not be capable of coupling the connector to the mating connector. In particular, if there is only limited space for handling the connector assembly, a user may have difficulties exerting the plug-in force.

[0004] Solutions known in the prior art comprise a thread and a coupling nut which perform a gear function. Such a design, however, requires use of a tool and thus also of sufficient space around the connector assembly to handle the tool.

[0005] DE 43 27 648 A1 discloses a latching mechanism for a connector with a low coupling/decoupling force, comprising a coupling lever attached to the connector, wherein the mating connector comprises a pin on each side which may be inserted into a contour provided in the latch lever. EP 1 882 287 B1 discloses an electrical connector with a locking mechanism that assures a connection with a mating electrical connector. The electrical connector includes a housing and a lever supported on a pivot disposed on the housing for assisting the insertion of the mating connector.

[0006] US 6,186,819 B1 discloses a latching mechanism for a connector with a first and a second connector half. The first connector half includes a raised stop and the second connector half a latching mechanism. A latch member with a forwardly extending spring arm and a (lower) latch arm is provided. The latch member is used for securing two connectors that are already connected to one another.

[0007] US 7,476,117 B1 discloses an electrical connector that includes a main body, a pressing piece, a latch and an activation piece. Two hooks are provided to lock the electrical connector firmly to a guiding frame thus providing an engagement between the hooks and holes in the guiding frame at least in the mating direction.

[0008] Other designs of connector assemblies use levers which engage the connector and/or the mating connector and drive the two together via gears. Such a design is expensive to manufacture.

[0009] The object of the present invention is therefore to provide a connector assembly which requires little manual force for coupling and has a simple design that is easy to manufacture.

[0010] The connector assembly mentioned in the beginning solves the above problem in that the lever assembly comprises at least one lever, the lever being arranged on the connector pivotally about a pivot axis, wherein the pivot axis being oriented essentially perpendicular to the mating direction. Furthermore, the lever at least partly covers the mating connector in a coupled state of the connector assembly, the lever further comprises an inner lever member and an outer lever member, the inner lever member being connected to the outer lever member at a position distal from the pivot axis. The inner lever member is arranged between the outer lever member and a mating connector in the coupled state of the connector assembly and the inner lever member engages the mating connector, at least in the mating direction.

[0011] The inventive connector assembly has the advantage that a high axial force may be obtained with a limited manual force, even within a small installation space.

[0012] The inventive connector assembly may be improved by embodiments described in the following. Each of the embodiments is advantageous on its own and technical features may be arbitrarily combined or omitted, depending on which technical effects are needed in a particular application.

[0013] The inner lever member of the inventive connector may for instance be releasably engaged with the mating connector wherein the engagement may be located at an outer circumferential portion of the mating connector.

[0014] The pivot axis may be located at the inner or outer lever member.

[0015] The inventive connector assembly may be improved in that the lever is a monolithic piece. A monolithic design of the lever is simple and much easier to manufacture than e.g. the known levers which use gears for coupling the connector and the mating connector.

[0016] The two-piece design of the inventive connector assembly is beneficial if a torque-free pivotable connection between the inner and outer lever member is desired and if the connector and mating connector are frequently coupled and de-coupled. The two-piece design eliminates bending of material such that wear and material fatigue may be minimized.

[0017] The two-piece design of the inventive connector assembly is, however, more difficult to fabricate than the monolithic design.

[0018] In a further embodiment of the inventive connector assembly, the inner lever member extends obliquely away from the outer lever member towards the mating connector in a pre-coupled state of the connector assembly and/or if no forces are exerted on the inner lever. In the pre-coupled state, the connector and the mating connector are not yet fully coupled. In the pre-

coupled state, the inner lever member is therefore already positioned such that coupling of the connector and the mating connector may be performed. Therefore, no special care has to be taken to position the inner lever member correctly prior to coupling the connector and the mating connector.

[0019] Positioning of the inner lever member with respect to the outer lever member may be achieved intrinsically by means of the monolithic design, or by means of a resilient member attached to both, the inner and the outer lever member.

[0020] In a further embodiment of the inventive connector assembly the inner lever member is arranged at least partly within a recess of the outer lever member in the coupled state of the connector assembly. Arranging the inner lever member within a recess of the outer lever member prevents an unnecessary increase of a radial thickness of the connector assembly, which is especially helpful with the connector assembly applied within a small space.

[0021] Furthermore, the inner lever member may at least partly be formed of the outer lever member. In particular, the inner lever may be formed from material which is taken from the outer lever member's recess. Furthermore, the inner lever member may be oriented substantially parallel to the outer lever member in the coupled state of the connector assembly.

[0022] The inventive connector assembly may be further improved in that the outer lever member. comprises a curved shape, wherein a concave side of the curved outer lever member faces towards the mating connector in a direction essentially perpendicular to the mating direction. The outer lever member may therefore be at least partly positioned around the mating connector. It may thus form a housing, in which the mating connector is partly received.

[0023] In another embodiment of the inventive connector assembly the inner lever member may be substantially planar. A planar inner lever has the advantage of being flexible and may allow for lever gear transmission of force exerted onto the outer lever member, transferred to the inner lever member and finally transformed into an axial force onto the mating connector. The inner lever may thus be understood as a spring leaf, which may be elastically deformed in the coupled state.

[0024] If the inner lever member of the inventive connector assembly is deformed elastically in the coupled state of the connector assembly, permanent force maintaining the coupled state can be generated.

[0025] In another embodiment of the inventive connector assembly the inner lever member comprises a deformation portion which is arranged between the outer lever member and the inner lever member, wherein the deformation portion being deformed in the coupled state of the connector assembly. The deformation portion may be an area of the inner lever, especially at the base of the inner lever where it is fixed to the outer lever, which has an increased flexibility with respect to its immediate surrounding.

[0026] Such a deformation portion has the advantage that the deformation of the inner lever member may be pre-defined, which prevents unwanted deformation at other portions of the connector assembly.

[0027] The deformation region may further merge into a cantilevered portion of the inner lever member, which cantilevered portion may remain un-deformed in the coupled state of the connector assembly.

[0028] The cantilevered portion of the inner lever member may extend towards a free and of the inner lever member. The deformation portion of the inner lever member may comprise a region of increased flexibility in order to define the position at which the inner lever member is deformed upon exertion of the manual force onto the outer lever member which is transferred towards the inner lever member and finally towards the mating connector.

[0029] In the two-piece design, the inventive connector assembly may comprise a hinge portion comprising a tilt axis.

[0030] The region of increased flexibility may be embodied as a region with a thinner material thickness or a reduced material cross-section than the base portion and cantilevered portion and/or may comprise weakening structures which reduce the rigidity of the region of increased flexibility.

[0031] Said weakening structures may be embodied as holes, through-holes a portion of decreased material thickness or decreased width of the inner lever member.

[0032] The inner lever member may engage the mating connector with an abutment portion. The abutment portion may be formed at or by a free end of the inner lever member.

[0033] In a further embodiment of the inventive connector assembly, the inner lever member comprises a free end with an embossing and/or a concave shape of the inner lever member towards the mating connector. The embossing and/or a concave shape may be the abutment portion of the inner lever member, which pre-defines a position, an angle and an abutment surface between the inner lever member and the mating connector.

[0034] The concave shape of the inner lever member towards the mating connector may comprise a same or similar curvature as the concave shape of the outer lever member, such that the outer lever member and inner lever member may nest in each other and form an outer shell in the coupled state of the connector assembly.

[0035] The inventive connector assembly may be further improved in that the inner lever member engages the mating connector in a direction both in and opposite to the mating direction, at least in the coupled state of the connector assembly.

[0036] Such an embodiment of the inventive connector assembly has the advantage that opening the lever assembly when the connector assembly is in the coupled state will result in exertion of an opening force from the inner lever member on the mating connector along the mating axis but in a direction opposite the mating direc-

tion. The connector assembly may therefore at least partly be decoupled by the lever assembly.

[0037] The inner lever member may comprise a cut-out which may engage in a form fit with a lug embodied at the mating connector, wherein the form fit may be released with the connector assembly approaching a pre-coupled state from the coupled state.

[0038] A bi-directional engagement between the inner lever member and a mating connector may also be realized by a pin and an opening, wherein the pin may either be embodied at the mating connector or at the free end of the inner lever member.

[0039] At least in the coupled position, the pin may be completely received within the opening. This engagement may firstly allow for the bi-directional engagement between the inner lever member and the mating connector and may secondly prevent the lever assembly from automatically opening due to the pre-tension of the inner lever member with respect to the outer lever member.

[0040] The pre-tension of the inner lever member may result in a movement and/or a bias of movement of the inner lever member opposite the mating direction, such that the wall of the opening abuts the pin of the mating connector along the direction opposite the mating direction and engages the pin in a frictional fit. This frictional fit may prevent the free end of the inner lever member from being moved away from the pin in a direction essentially perpendicular to the mating direction and away from the mating axis.

[0041] In a further embodiment of the inventive connector assembly, the outer lever member and/or the inner lever member at least partly receive the mating connector in the coupled state of the connector assembly. This embodiment has the advantage that curvatures of the inner and outer members may correspond to curvatures of the mating connector, such that only a small space is needed if the connector assembly is in the coupled state. Additionally, positioning of the inner and outer lever member closely to the mating connector may at least partly constitute an electro-magnetic shielding. For this, the lever may be formed from dielectric material.

[0042] In a further embodiment of the inventive connector assembly an attachment portion of the lever is received in a receiving contour of the connector. Such a receiving contour may have the advantage that the pivot member may be easily removed out of the receiving contour for an easy maintenance and/or replacement.

[0043] The receiving contour may in particular be embodied in an outer shell of the connector and may effect outer structures of the connector as for instance a thread.

[0044] The receiving contour of the connector may on the one hand receive the pivot member of the lever but may additionally also be adapted to receive, at least partly, the free end and parts of the cantilevered portion of the inner lever member.

[0045] In a further embodiment of the inventive assembly, the connector and the lever are connected pivotable relative to each other by stub shafts. Stub shafts may be easily formed at the lever member, wherein the pivot member embodied as stub shafts may in particular be embodied at an extension of the outer lever member located distant to a pressing portion. The pressing portion may be understood as a portion on which the user applies a manual force.

[0046] The inventive connector assembly may in particular comprise two stub shafts, wherein said two stub shafts may extend into opposite facing directions forming a T-shape.

[0047] Accordingly, the receiving contour of the connector may be embodied complementary to the stub shaft in order to receive them.

[0048] In another embodiment the stub shafts may be embodied at the connector and/or mating connector, wherein the lever comprises the complementary receiving contour.

[0049] In a further embodiment of the inventive connector assembly the stub shafts received in the connector are deformed and are engaged in a positive fit with the receiving contour of the connector. The positive fit between the stub shafts and the receiving contour protect the lever assembly from being lost from the connector assembly. The same advantage is obtained if the receiving contour is embodied at the lever and the stub shafts are embodied at the connector or mating connector.

[0050] The stub shafts or receiving contour embodied at an extension member of the outer lever member distal to the pressing portion may be received within the receiving contour or may receive the stub shafts along a receiving direction. The receiving direction may be tilted with respect to the mating direction of the connector assembly and may also be tilted with respect to a direction perpendicular to the mating direction.

[0051] If the direction perpendicular to the mating direction separates two quadrants between the mating direction and said perpendicular direction, the receiving direction along which the stub shafts are received in the receiving contour may be located in a quadrant different than the quadrant of an operating angular range of the outer lever member in an installed state.

[0052] The operating angular range of the outer lever member may be understood as a range of angles of the outer lever member with respect to the mating direction within which the outer lever member is tilted around the pivot axis when the connector assembly is coupled, that is the range of angles along which the outer lever member is tilted when the connector assembly is transferred from the pre-coupled state to the coupled state.

[0053] The stub shafts of the outer lever member, or the connector and/or mating connector may be releasably inserted into the receiving contour of the connector or the outer lever member, even if the outer lever member is moved into the operation position.

[0054] However, if the outer lever member is rotated around the pivot axis in a direction away from the operating position of the outer lever member, the stub shafts may abut an inner surface of the receiving contour of the

connector, or of the outer lever member. A force exerted on the outer lever member in a direction away from the operating position may be transmitted via the outer lever member onto the stub shafts, which, due to the abutment with the inner surface of the receiving contour, are mechanically deformed.

[0055] The deformation of the stub shafts is preferentially inelastic or plastic. By rotating the outer lever member towards its operating position, the stub shafts may be freely rotated within the receiving contour, whereas the stub shafts may not be removed from the receiving contour, even if oriented and moved in a direction opposite the receiving direction.

[0056] The deformed stub shafts therefore prevent the outer lever member and thus the whole lever assembly from being removed or lost from the connector assembly.

[0057] In a further embodiment of the inventive connector assembly, the lever is a stamped and at least one of bent or folded sheet metal part. Such sheet metal parts may be easily fabricated at low costs and high production rates. Furthermore, certain structures as for instance embodied at the abutment portion of the inner lever member in form of an embossing and/or a concave shape, as well as the shape of the outer lever member may be easily obtained from a sheet metal part.

[0058] Also strengthening structures as for instance, ribs, fins and the like are easily produced by embossing or bending of a sheet metal part.

[0059] Although the deformation of the inner lever member's deformation portion has been described as elastic, an inelastic deformation of the deformation portion may also be conceivable.

[0060] The lever assembly may be received in a cable bushing when the plug assembly is in the coupled state, wherein a front edge of the inner lever member may be engaged in a positive lock. The bushing may enclose the lever and thus prevent any pivoting of the lever.

[0061] The connector assembly may preferentially comprise two lever assemblies which are arranged symmetrically around the connector and the mating connector, whereas also one single lever assembly may be applied.

[0062] In such a case the attachment between the outer lever member and the connector is accordingly positioned at the connector or guiding means are provided between the connector and the mating connector. The guiding means may provide a sufficient stabilization against a tilt of the connector and the mating connector with respect to each other. This may prevent blocking of the coupling due to canted connector and mating connector.

[0063] The inventive connector assembly provides a lever gear ratio allowing a user to couple the connector to the mating connector with a limited manual force applicable by the user within a limited space in which the connector assembly is installed or provided.

[0064] Plug in forces higher than applicable by the user may therefore be overcome by the inventive lever assembly. This allows for simultaneously contacting a multitude of pins or tabs and/or contacting technologies requiring additional force, as for instance in the case of insulation displacement contacts.

[0065] In the following, the invention will be described with reference to the accompanied figures. The figures show specific embodiments of the present invention, whereas technical features of said embodiments may be arbitrarily combined or omitted. Similar technical features and technical features providing a similar technical effect are provided with the same reference numeral.

[0066] In the figures:

Fig 1	shows a perspective view of the inventive connector assembly in a pre-mated state;
Fig 2	shows the inventive connector assembly of Fig 1 in a side view with a semitransparent lever assembly;
Fig 3	shows the inventive connector assembly in a coupled state with a semitransparent lever assembly;
Fig 4	shows a force-distance characteristic of the inventive connector assembly;
Figs 5a, 5b	show an inventive lever assembly in two perspective views; and
Figs 6a, 6b	show the lever assembly of Figs 5a and 5b with bent stub shafts.

[0067] Fig 1 shows a perspective view of the inventive connector assembly 1. The connector assembly 1 comprises a connector 3 and a mating connector 5. The embodiment of the connector assembly 1 shown in Fig 1 furthermore comprises a lever assembly 7 which comprises two levers 11.

[0068] Each of the levers 11 further comprises an outer lever member 13 and an inner lever member 15, wherein the outer lever member 13 and the inner lever member 15 comprise a deformation portion 17 which is arranged between the outer lever member 13 and the inner lever member 15.

[0069] The figures show a monolithic embodiment of the inventive connector assembly 1. The two-piece embodiment, which is not shown, comprises a hinge portion (not shown) instead of the deformation portion 17 of the embodiment shown in the figures.

[0070] The connector assembly 1 of Fig 1 is shown in a pre-coupled state 19 in which the connector 3 and the mating connector 5 are not coupled to each other yet. Furthermore, in the pre-coupled state 19 the levers 11 are in an open state 21, which is characterized by the inner lever member 15 extending obliquely away from the outer lever member 13 towards the mating connector 5.

[0071] In the embodiment of the inventive connector assembly 1 shown in Fig 1, the deformation portion 17 is embodied by a weakening zone 23 which comprises a recess 25 between a base portion 27 and a cantilevered portion 29. The deformation portion 17 comprises a region of increased flexibility 63.

[0072] It should be noted that several reference numerals will only be provided at one of the two levers 11 shown in Fig 1.

[0073] The levers 11 of Fig 1 are each monolithic pieces 31, in particular sheet metal parts 33 which are stamped, bent and folded.

[0074] In the pre-coupled state 19, the inner lever member 15 is positioned between the mating connector 5 and the outer lever member 13 and is connected to the outer lever member 13 at the deformation portion 17, which is located distal to a pivot axis 35. The pivot axis 35 is indicated by a dashed line, wherein the pivot axis 35 is not represented by a physical axis, i.e. a longitudinal structure, but is rather defined by an attachment portion 37 of the outer lever member 13, which is located at an end 39 of the outer lever member 13 distal to the base portion 27, which also acts as a pressing portion 41.

[0075] The attachment portion 37 is received within a receiving contour 43 of the connector 3.

[0076] The inner lever member 15 comprises a free end 45 which is embodied as an abutment portion 47. The abutment portion 47 may be embodied as an embossing 49 or may comprise a concave shape 51, which is indicated in optional embodiments of the inventive lever 11 in the circles 53 showing only the free ends 45 of alternatively embodied inner lever member 15. The inner lever member 15 of the embodiment of the connector assembly 1 shown in Fig 1 is planar.

[0077] The embodiments of the levers 11 shown in Fig 1 allow for an uni-directional abutment 55 and transmission of a coupling force 57 along a mating direction 9. The pivot axis is essentially perpendicular to the mating direction 9.

[0078] Fig 1 further shows that a further recess 25a is formed in the outer lever member 13, wherein the further recess 25a at least partly receives the inner lever member 15.

[0079] As the lever 11 is a stamped sheet metal part 33, the inner lever member 15 is formed from the material of the recess 25a of the outer lever member 13.

[0080] Furthermore, Fig 1 shows that the outer lever member 13 also comprises a concave shape 51 which is one embodiment of a curved shape 59. A concave side 61 of the levers 11 faces towards the mating connector 5 in a direction essentially perpendicular to the mating direction 9. The concave side 61 is indicated in Fig 1 for the lower lever 11 only.

[0081] Fig 2 shows a side view of the inventive connector assembly 1, wherein the levers 11 are drawn semi-transparent.

[0082] In Fig 2 the receiving contour 43, respectively the two receiving contours 43 are shown, wherein each of the receiving contours 43 opens into a direction opposite a receiving direction 65. It is to be noted that each receiving contour 43 has an individual receiving direction 65.

[0083] The receiving contour 43 comprises a straight portion 67 and an end portion 69, wherein the attachment portion 37 of the levers 11 is received within the end portion 69 of the receiving contour 43 in Fig 2.

[0084] In the pre-coupled state 19 of the inventive connector assembly 1 shown in Fig 2, an extension portion 71 of the outer lever member 13 is received within a cutout portion 73 of a thread 75 of the connector 3 (compare Fig 1).

[0085] In Fig 2 a trigger force 77 exerted by the user is indicated, wherein the trigger force 77 is exerted on both levers 11 each along a force direction 79 oriented essentially perpendicular to the mating direction 9 and oriented towards the mating connector 5.

[0086] The levers 11 are attached to the connector 3 by the attachment portion 37 received within the receiving contour 43.

[0087] The trigger force 77 results in a pivotal movement 81 of both levers 11 towards the mating connector 5 as the free end 45, more particular the abutment portion 47 of the inner lever member 15, abuts a counter abutment member 83 of the mating connector 5.

[0088] The pivotal movement 81 is transformed into an axial force 85 exerted on the mating connector 5 which results in an axial movement 87 along the mating direction 9.

[0089] In circle 53, an alternative embodiment of the free end 45 of the inner lever member 15 is indicated, wherein the free end 45 abuts the counter abutment member 83 of the mating connector 5 in the mating direction 9 in the pre-covered state 19.

[0090] The free end 45 of the alternative embodiment comprises a cutout portion 73 into which a lug 89 of the mating connector 5 may be inserted in a coupled state 91 of the connector assembly 1. The coupled state 91 is shown in circle 53a. This alternative embodiment of the free end 45 allows for a bi-directional engagement 93 between the inner lever member 15 and the mating connector 5.

[0091] Fig 3 shows the inventive connector assembly 1 in the coupled state 91, wherein the outer lever members 13 of the two levers 11 at least partially receive the mating connector 5 and firmly abut each other at an abutment line 95.

[0092] In the coupled state 91 the deformation portions 17 are elastically deformed such that the inner lever members 15 are received within the recess 25a of the outer lever members13.

[0093] The inner lever members 15 as well as the outer lever members 13 comprise a concave shape 51 such that the inner lever members 15 and the outer lever members 13 receive the mating connector 5 and circumferentially surround the mating connector 5.

[0094] In the coupled state 91 shown in Fig 3 the inner

lever members 15 are in a pre-tensioned state 97 and exert an opening torque 99 on the outer lever members 13.

[0095] Fig 4 shows a force-distance characteristic 101 of the inventive lever assembly. The force-distance characteristic 101 plots a force 103 versus a distance 105, wherein the distance 105 is measured along a direction perpendicular to the mating direction 19 and wherein the distance zero corresponds to the pre-coupled state 19 and the distance 1 corresponds to the coupled state 91.

[0096] The force-distance characteristic 101 plots the constant trigger force 79 and the axial force 85, wherein the axial force 85 is non-linearly dependent on the distance 105.

[0097] The initial axial force 85 close to distance 105 near 0 is smaller than a final axial force close to a distance 105 in the region of 1 indicating a state of the inventive connector assembly 1 close to the coupled state 91.

[0098] Figs 5a and 5b show the inventive lever in two different perspective views, wherein the attachment portion 37 is visible in Figs 5a and 5b as it is not received within the receiving contour 43.

[0099] The attachment portion 37 is located next to the extension portion 71 and comprises two stub shafts 107 which extend substantially perpendicularly to an extension direction 109 of the lever 11. The stub shafts 107 are arranged in a T-shape 111 of the attachment portion 37.

[0100] Fig 5b furthermore shows a circle 53 indicating the receiving contour 43 (see Figs. 2 and 3) which receives the attachment portion 37, that is the extension portion 71 as well as the stub shafts 107. The stub shafts 107 extend out of the drawing plane, respectively into the drawing plane.

[0101] The attachment portion 37 is received within the receiving contour 43 along the receiving direction 65.

[0102] In Figures 6a and 6b the inventive lever 11 is shown in two different perspective views, wherein the stub shafts 107 are in a bent state 113. The bent state 113 of the stub shafts 107 is obtained if the extension portion 71 (see circle 53 of Fig 5b) is moved along a bent direction 115 which results in the formation of the bent stub shafts 107.

[0103] In general, a lever 11 with stub shafts 107 in the bent state 113 may not be removed from the receiving contour 43 any longer. The separated levers 11 of Figs 6a and 6b are solely used for a schematic explanation of the bent state 113.

[0104] By bending of the stub shafts 107 within the receiving contour 43, the bent stub shafts 107 form a positive lock (not shown) with the receiving contour 43. The lever 11 is therefore secured within the receiving contour 43 of the connector 3.

REFERENCE NUMERALS

[0105]

1	connector assembly
3	connector
5	mating connector
7	lever assembly
9	mating direction
11	lever
13	outer lever member
15	inner lever member
17	deformation portion
19	pre-coupled state
21	open state
23	weakening zone
25	recess
25a	recess
27	base portion
29	cantilevered portion
31	monolithic piece
33	sheet metal part
35	pivot axis
37	attachment portion
39	end
41	pressing portion
43	receiving contour
45	free end
47	abutment portion
49	embossing
51	concave shape
53	circle
53a	circle
55	unidirectional abutment
57	coupling force
59	curved shape
61	concave side
63	region of increased flexibility
65	receiving direction
67	straight portion
69	end portion
71	extension portion
73	cutout portion
75	thread
77	trigger force
79	force direction
81	pivotal movement
83	counter abutment member
85	axial force
87	axial movement
89	lug
91	coupled state
93	bidirectional engagement
95	abutment line
97	pre-tension state
99	opening torque
101	force-distance characteristic
103	force
105	distance
107	stub shaft
109	extension direction
111	T-shape

113 bent shape
115 bend direction

Claims

1. Connector assembly configured to provide a lever gear ratio allowing a user to couple the connector to a mating connector with a limited manual force applicable by the user comprising a connector (3), a mating connector (5) adapted to be coupled to the connector (3), in a mating direction (9), and a lever assembly (7), the lever assembly (7) comprising at least one lever (11), the lever (11) being arranged on the connector (3) pivotably about a pivot axis (35), the pivot axis (35), being oriented essentially perpendicular to the mating direction (9), the lever (11) at least partly covering the mating connector (5) in a coupled state (91) of the connector assembly (1), the lever (11) comprising an inner lever member (15) and an outer lever member (13), the inner lever member (15) being connected to the outer lever member (13) at a position distal from the pivot axis (35), the inner lever member (15) being arranged between the outer lever member (13) and the mating connector (5) in the coupled state (91) of the connector assembly (1), and the inner lever member (15) engaging the mating connector (5) at least in the mating direction (9).

2. Connector assembly (1) according to claim 1, wherein the lever (11) is a monolithic piece (31).

3. Connector assembly (1) according to claim 1 or 2, wherein the inner lever member (15) extends obliquely away from the outer lever member (13) towards the mating connector (5) in a pre-coupled (19) state of the connector assembly (1).

4. Connector assembly (1) according to any one of claims 1 to 3, wherein the inner lever member (15) is arranged at least partly within a recess (25a) of the outer lever member in the coupled state (91) of the connector assembly (1).

5. Connector assembly (1) according to any one of claims 1 to 4, wherein the outer lever member (13) comprises a curved shape (59), wherein a concave side (67) of the curved outer lever member (13) faces towards the mating connector (5) in a direction essentially perpendicular to the mating direction (9).

6. Connector assembly (1) according to any one of claims 1 to 5, wherein the inner lever member (15) is deformed in the coupled state (91) of the connector assembly (1).

7. Connector assembly (1) according to any one of claims 1 to 6, wherein the inner lever member (15) comprises a deformation portion (17), which is arranged between the outer lever member (13) and the inner lever member (15), the deformation portion (17) being deformed in the coupled state (91) of the connector assembly (1).

8. Connector assembly (1) according to claim 7, wherein the deformation portion (17) comprises a region of increased flexibility (63).

9. Connector assembly (1) according to any one of claims 1 to 8, wherein the inner lever member (15) comprises a free end (45) with an embossing (49) and/or a concave shape (51) of the inner lever member (15) towards the mating connector (5).

10. Connector assembly (1) according to any one of claims 1 to 9, wherein the inner lever member (15) engages the mating connector (5) bidirectionally, that is in and opposite the mating direction (9), at least in the coupled state (91) of the connector assembly (1).

11. Connector assembly (1) according to any one of claims 1 to 10, wherein the outer lever member (13) and/or the inner lever member (15) at least partly receive the mating connector (5) in the coupled state (91) of the connector assembly (1).

12. Connector assembly (1) according to any one of claims 1 to 11, wherein an attachment portion (37) of the lever (11) is received in a receiving contour (43) of the connector (3).

13. Connector assembly (1) according to any one of claims 1 to 12, wherein the connector (3) and the lever (11) are connected to each other by stub shafts (107).

14. Connector assembly (1) according to claim 13, wherein the stub shafts (107) received in the connector (3) are deformed and are engaged in a positive fit with the receiving contour (43) of the connector (3).

15. Connector assembly (1) according to any one of claims 1 to 14, wherein the lever (11) is a stamped and at least one of bent or folded sheet metal part (33).

Patentansprüche

1. Verbinderanordnung konfiguriert ein Hebelübersetzungsverhältnis bereitzustellen, das einem Benutzer ermöglicht, den Verbinder mit einem Gegenverbinder mit einer begrenzten, vom Benutzer anwend-

baren manuellen Kraft zu koppeln, umfassend einen Verbinder (3), einen Gegenverbinder (5), der angepasst ist mit dem Verbinder (3), in einer Eingriffsrichtung (9), gekoppelt zu werden, und eine Hebelbaugruppe (7), wobei die Hebelbaugruppe (7) mindestens einen Hebel (11) umfasst, wobei der Hebel (11) um eine Schwenkachse (35) schwenkbar an dem Verbinder (3) angeordnet ist, wobei die Schwenkachse (35) im Wesentlichen senkrecht zu der Eingriffsrichtung (9) ausgerichtet ist, der Hebel (11) zumindest teilweise den Gegenverbinder (5) in einem gekoppelten Zustand (91) der Verbinderanordnung (1) abdeckt, wobei der Hebel (11) ein inneres Hebelelement (15) und ein äußeres Hebelelement (13) umfasst, wobei das innere Hebelelement (15) mit dem äußeren Hebelelement (13) an einer von der Schwenkachse (35) entfernten Position verbunden ist, das innere Hebelelement (15) in dem gekoppelten Zustand (91) der Verbinderanordnung (1) zwischen dem äußeren Hebelelement (13) und dem Gegenverbinder (5) angeordnet ist, und das innere Hebelelement (15) den Gegenverbinder (5) zumindest in der Eingriffsrichtung (9) in Eingriff nimmt.

2. Verbinderanordnung (1) nach Anspruch 1, wobei der Hebel (11) ein monolithisches Teil (31) ist.

3. Verbinderanordnung (1) nach Anspruch 1 oder 2, wobei sich das innere Hebelelement (15) in einem vorgekoppelten (19) Zustand der Verbinderanordnung (1) schräg von dem äußeren Hebelelement (13) weg in Richtung des Gegenverbinders (5) erstreckt.

4. Verbinderanordnung (1) nach einem der Ansprüche 1 bis 3, wobei das innere Hebelelement (15) im gekoppelten Zustand (91) der Verbinderanordnung (1) zumindest teilweise innerhalb einer Ausnehmung (25a) des äußeren Hebelelements angeordnet ist.

5. Verbinderanordnung (1) nach einem der Ansprüche 1 bis 4, wobei das äußere Hebelelement (13) eine gekrümmte Form (59) aufweist, wobei eine konkave Seite (67) des gekrümmten äußeren Hebelelements (13) dem Gegenverbinder (5) in einer Richtung im Wesentlichen senkrecht zur Eingriffsrichtung (9) zugewandt ist.

6. Verbinderanordnung (1) nach einem der Ansprüche 1 bis 5, wobei das innere Hebelelement (15) im gekoppelten Zustand (91) der Verbinderanordnung (1) verformt ist.

7. Verbinderanordnung (1) nach einem der Ansprüche 1 bis 6, wobei das innere Hebelelement (15) einen Verformungsabschnitt (17) umfasst, der zwischen dem äußeren Hebelelement (13) und dem inneren Hebelelement (15) angeordnet ist, wobei der Verformungsabschnitt (17) in dem gekoppelten Zustand (91) der Verbinderanordnung (1) verformt wird.

8. Verbinderanordnung (1) nach Anspruch 7, wobei der Verformungsabschnitt (17) einen Bereich mit erhöhter Flexibilität (63) umfasst.

9. Verbinderanordnung (1) nach einem der Ansprüche 1 bis 8, wobei das innere Hebelelement (15) ein freies Ende (45) mit einer Prägung (49) und/oder einer konkaven Form (51) des inneren Hebelelements (15) in Richtung des Gegenverbinders (5) aufweist.

10. Verbinderanordnung (1) nach einem der Ansprüche 1 bis 9, wobei das innere Hebelelement (15) mit dem Gegenverbinder (5) bidirektional, d.h. in und entgegen der Eingriffsrichtung (9), in Eingriff steht, zumindest im gekoppelten Zustand (91) der Verbinderanordnung (1).

11. Verbinderanordnung (1) nach einem der Ansprüche 1 bis 10, wobei das äußere Hebelelement (13) und/oder das innere Hebelelement (15) den Gegenverbinder (5) im gekoppelten Zustand (91) der Verbinderanordnung (1) zumindest teilweise aufnehmen.

12. Verbinderanordnung (1) nach einem der Ansprüche 1 bis 11, wobei ein Befestigungsabschnitt (37) des Hebels (11) in einer Aufnahmekontur (43) des Verbinders (3) aufgenommen ist.

13. Verbinderanordnung (1) nach einem der Ansprüche 1 bis 12, wobei der Verbinder (3) und der Hebel (11) durch Achsstummel (107) miteinander verbunden sind.

14. Verbinderanordnung (1) nach Anspruch 13, wobei die in dem Verbinder (3) aufgenommenen Achsstummel (107) verformt sind und formschlüssig in die Aufnahmekontur (43) des Verbinders (3) eingreifen.

15. Verbinderanordnung (1) nach einem der Ansprüche 1 bis 14, wobei der Hebel (11) ein gestanztes und mindestens ein gebogenes oder gefaltetes Blechteil (33) ist.

Revendications

1. Ensemble de connecteur configuré pour fournir un rapport d'engrenage à levier permettant à un utilisateur de coupler le connecteur à un connecteur d'accouplement avec une force manuelle limitée applicable par l'utilisateur, comprenant un connecteur (3), un connecteur d'accouplement (5) conçu pour être couplé au connecteur (3) dans une direction d'ac-

couplement (9), et un ensemble de levier (7), l'ensemble de levier (7) comprenant au moins un levier (11), le levier (11) étant agencé sur le connecteur (3) de manière à pouvoir pivoter autour d'un axe de pivotement (35), l'axe de pivotement (35) étant orienté essentiellement perpendiculairement à la direction d'accouplement (9), le levier (11) recouvrant au moins partiellement le connecteur d'accouplement (5) dans un état couplé (91) de l'ensemble de connecteur (1), le levier (11) comprenant un élément de levier interne (15) et un élément de levier externe (13), l'élément de levier interne (15) étant connecté à l'élément de levier externe (13) à une position distale de l'axe de pivot (35), l'élément de levier intérieur (15) étant disposé entre l'élément de levier extérieur (13) et le connecteur d'accouplement (5) dans l'état couplé (91) de l'ensemble de connecteur (1), et l'élément de levier intérieur (15) engageant le connecteur d'accouplement (5) au moins dans la direction d'accouplement (9).

2. Ensemble connecteur (1) selon la revendication 1, dans lequel le levier (11) est une pièce monolithique (31).

3. Ensemble de connecteur (1) selon les revendications 1 ou 2, dans lequel l'élément de levier interne (15) s'étend obliquement à l'écart de l'élément de levier externe (13) vers le connecteur d'accouplement (5) dans un état pré-couplé (19) de l'ensemble de connecteur (1).

4. Ensemble de connecteur (1) selon l'une quelconque des revendications 1 à 3, dans lequel l'élément de levier interne (15) est disposé au moins partiellement à l'intérieur d'un évidement (25a) de l'élément de levier externe dans l'état couplé (91) de l'ensemble de connecteur (1).

5. Ensemble de connecteur (1) selon l'une quelconque des revendications 1 à 4, dans lequel l'élément de levier externe (13) comprend une forme incurvée (59), dans lequel un côté concave (67) de l'élément de levier externe incurvé (13) est orienté vers le connecteur d'accouplement (5) dans une direction essentiellement perpendiculaire à la direction d'accouplement (9).

6. Ensemble connecteur (1) selon l'une quelconque des revendications 1 à 5, dans lequel l'élément de levier interne (15) est déformé dans l'état couplé (91) de l'ensemble connecteur (1).

7. Ensemble de connecteur (1) selon l'une quelconque des revendications 1 à 6, dans lequel l'élément de levier interne (15) comprend une partie de déformation (17), qui est agencée entre l'élément de levier externe (13) et l'élément de levier interne (15), la partie de déformation (17) étant déformée dans l'état couplé (91) de l'ensemble de connecteur (1).

8. Ensemble connecteur (1) selon la revendication 7, dans lequel la partie de déformation (17) comprend une région de flexibilité accrue (63).

9. Ensemble de connecteur (1) selon l'une quelconque des revendications 1 à 8, dans lequel l'élément de levier interne (15) comprend une extrémité libre (45) avec un gaufrage (49) et/ou une forme concave (51) de l'élément de levier interne (15) vers le connecteur homologue (5).

10. Ensemble de connecteur (1) selon l'une quelconque des revendications 1 à 9, dans lequel l'élément de levier interne (15) engage le connecteur d'accouplement (5) de manière bidirectionnelle, c'est-à-dire dans et à l'opposé de la direction d'accouplement (9), au moins dans l'état couplé (91) de l'ensemble de connecteur (1).

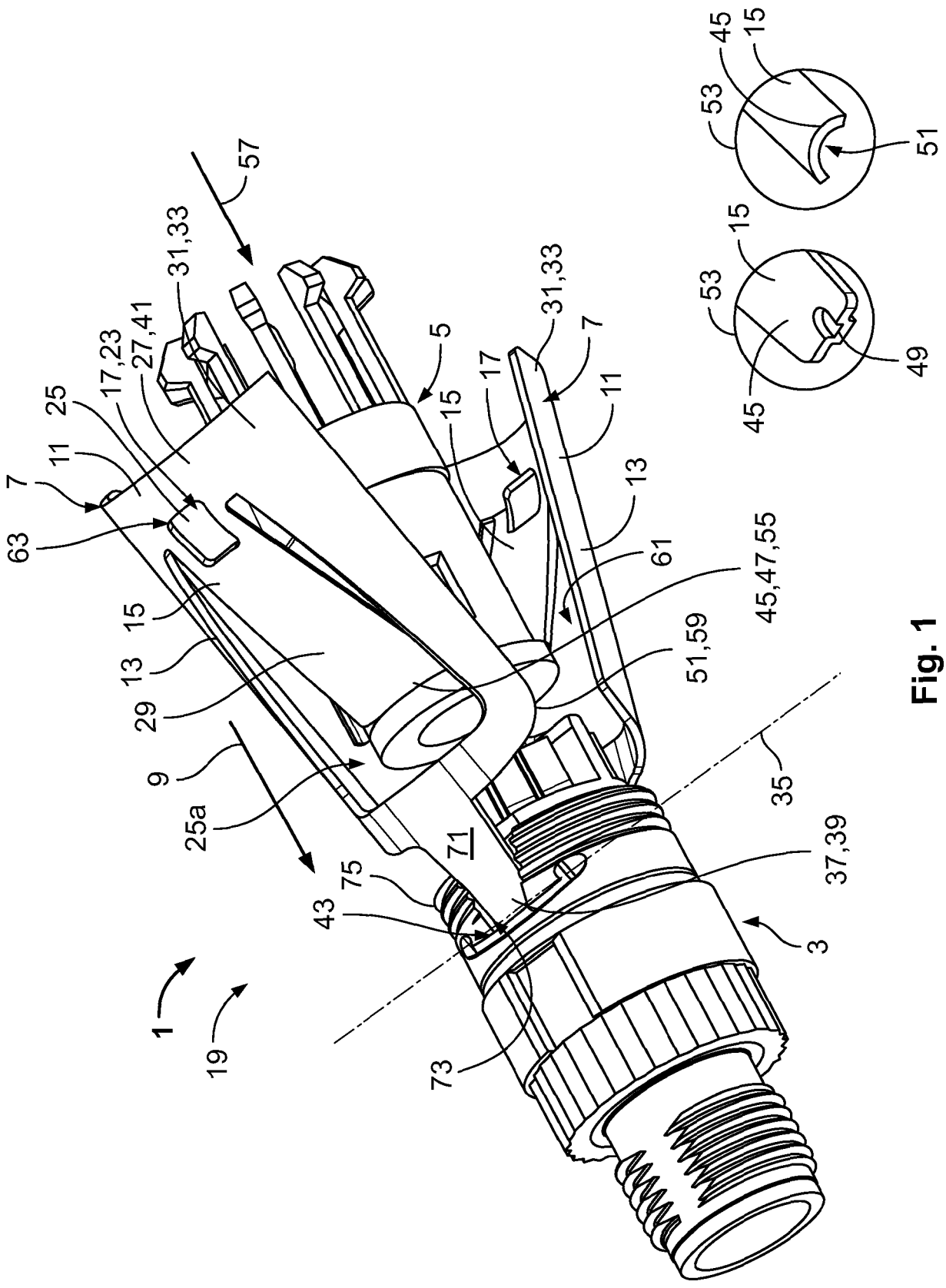
11. Ensemble de connecteur (1) selon l'une quelconque des revendications 1 à 10, dans lequel l'élément de levier extérieur (13) et/ou l'élément de levier intérieur (15) reçoivent au moins partiellement le connecteur complémentaire (5) dans l'état couplé (91) de l'ensemble de connecteur (1).

12. Ensemble connecteur (1) selon l'une quelconque des revendications 1 à 11, dans lequel une partie de fixation (37) du levier (11) est reçue dans un contour de réception (43) du connecteur (3).

13. Ensemble connecteur (1) selon l'une quelconque des revendications 1 à 12, dans lequel le connecteur (3) et le levier (11) sont reliés l'un à l'autre par des bouts d'arbre (107).

14. Ensemble connecteur (1) selon la revendication 13, dans lequel les bouts d'arbre (107) reçus dans le connecteur (3) sont déformés et sont engagés dans un ajustement positif avec le contour de réception (43) du connecteur (3).

15. Ensemble connecteur (1) selon l'une quelconque des revendications 1 à 14, dans lequel le levier (11) est une pièce en tôle emboutie et au moins une pièce en tôle pliée ou recourbée (33).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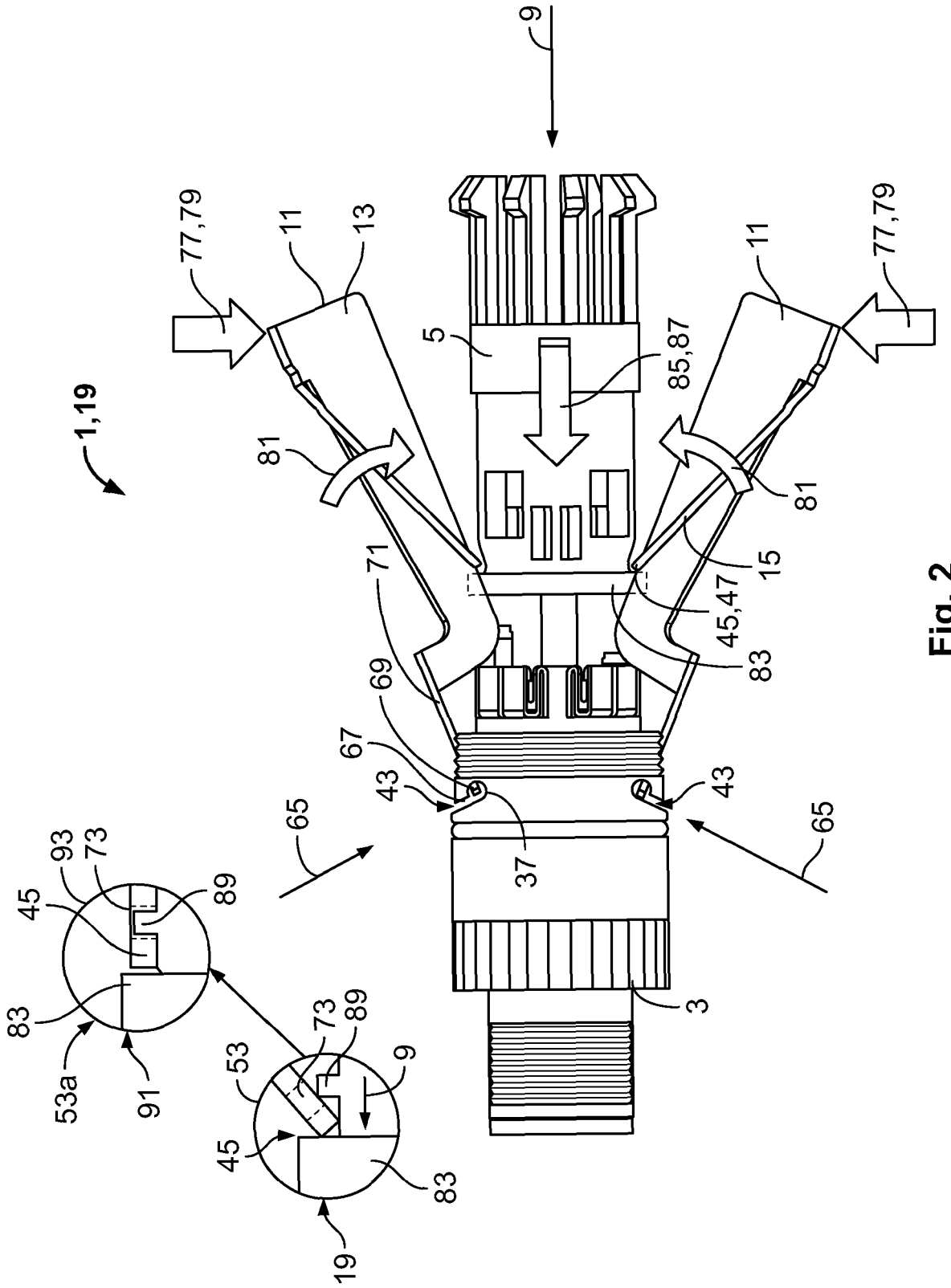
49
45

Fig. 1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91
19

Fig. 2

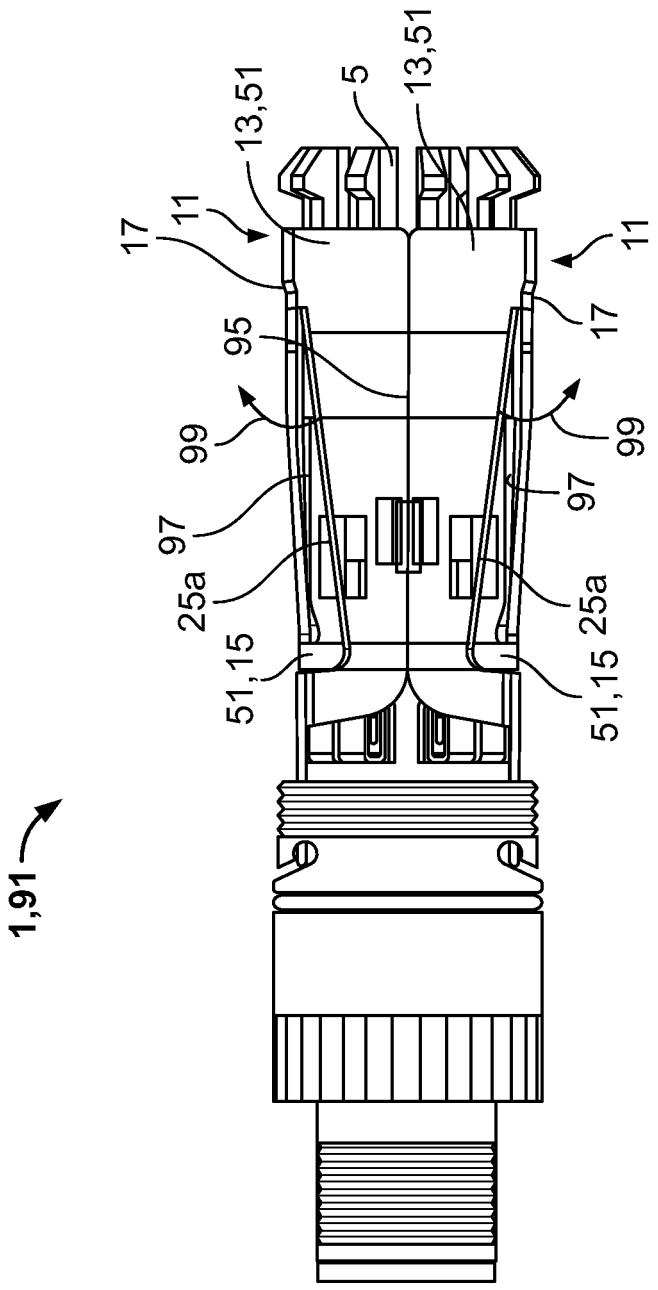


Fig. 3

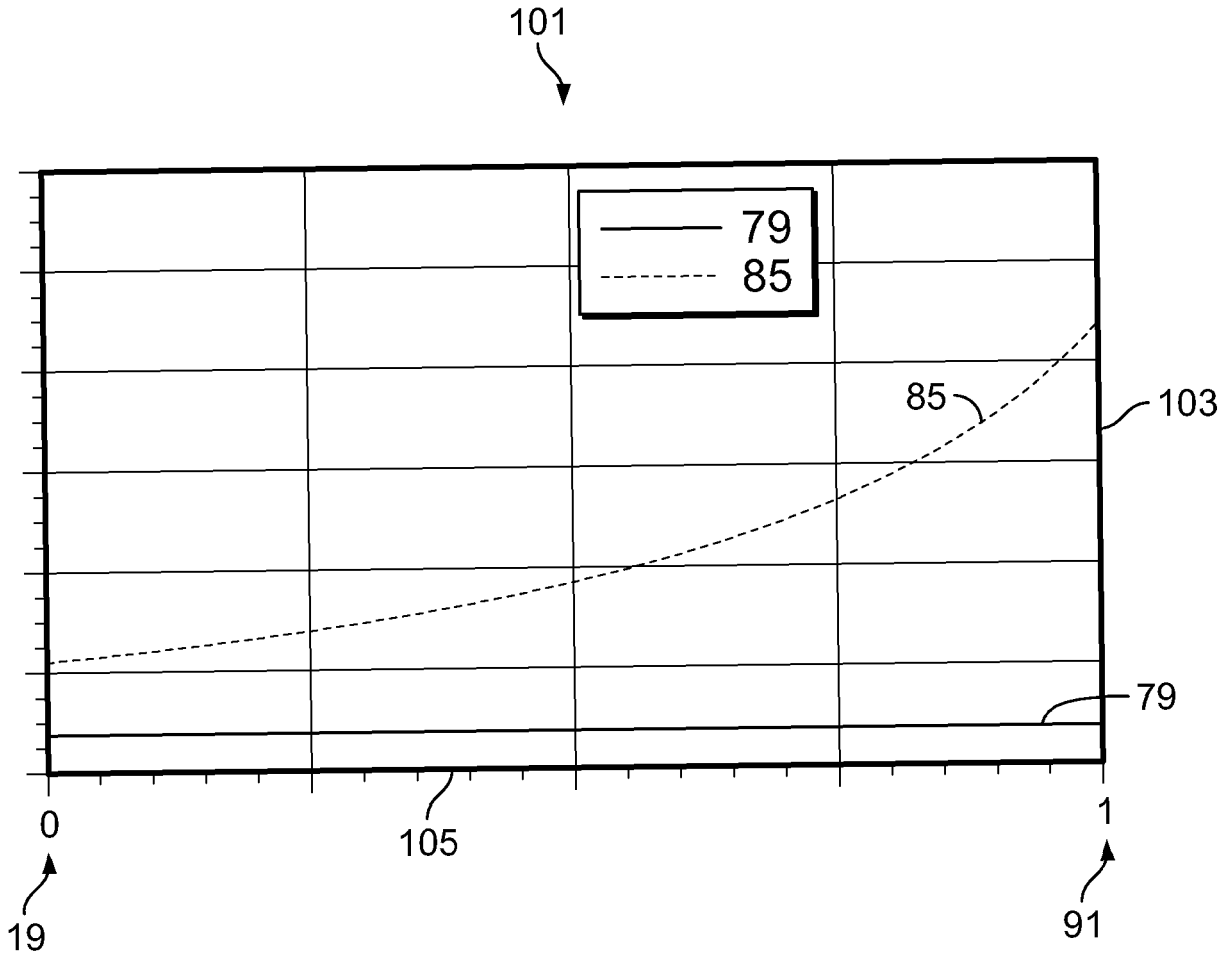
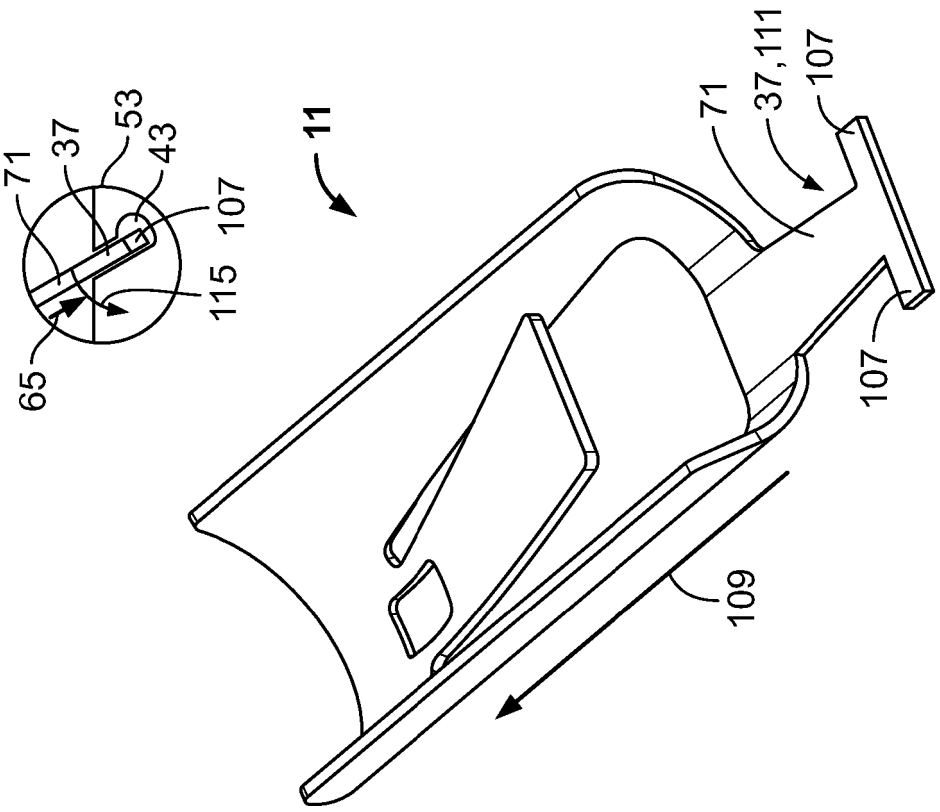


Fig. 4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107
107
109

Fig. 5b

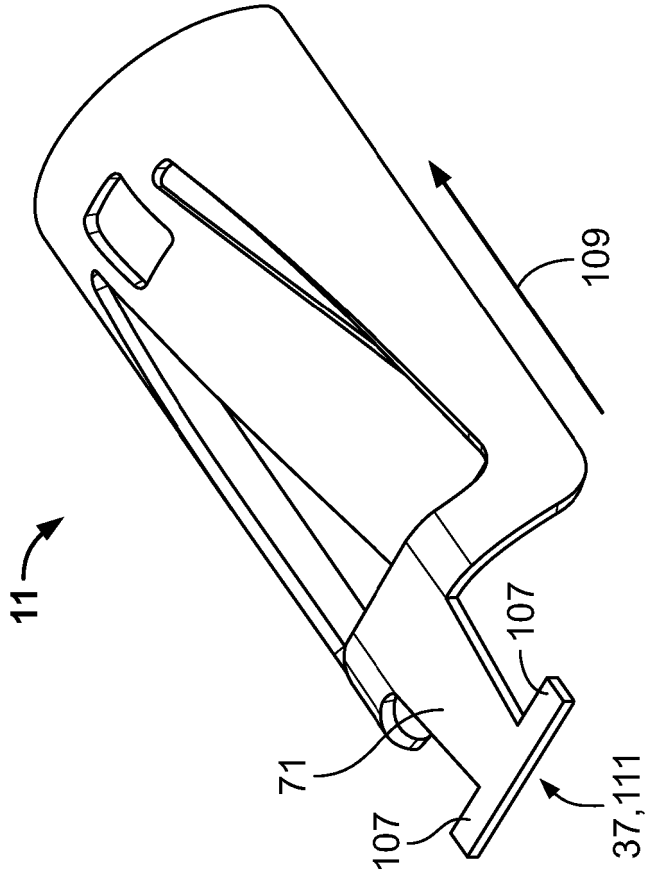
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Fig. 5a

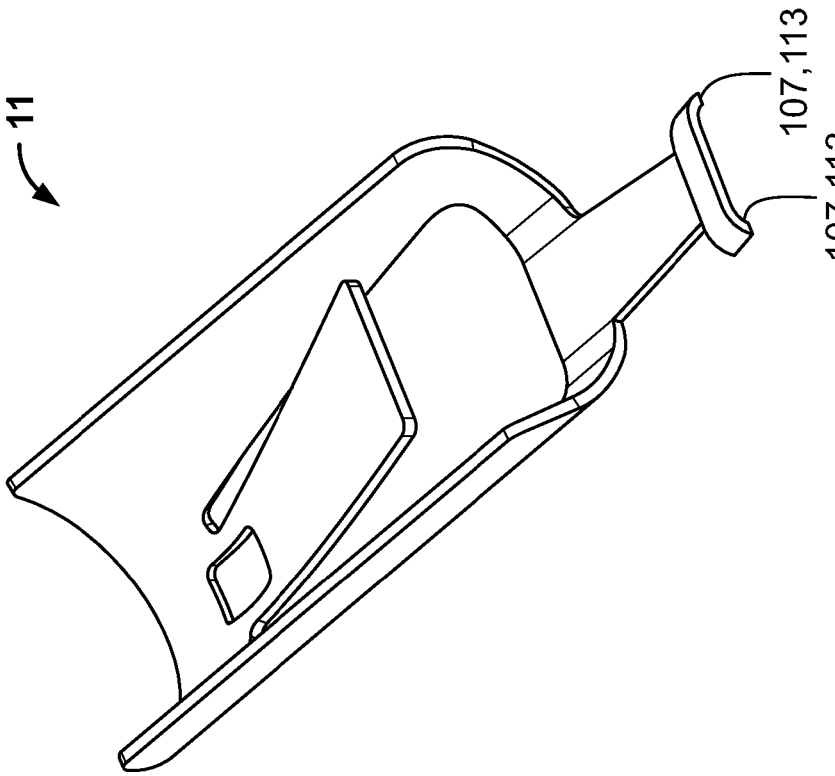

Fig. 6b

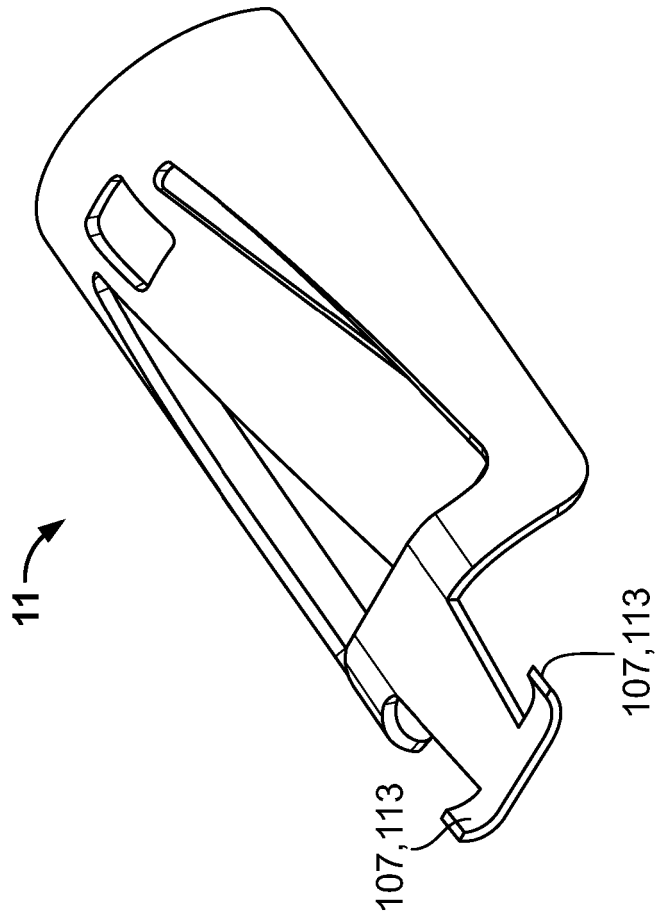

Fig. 6a

REFERENCES CITED IN THE DESCRIPTION

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