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

(11) **EP 4 542 787 A1**

(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
23.04.2025 Bulletin 2025/17

(21) Application number: **23204727.4**

(22) Date of filing: **19.10.2023**

(51) International Patent Classification (IPC):
H01R 13/6591 *(2011.01)* ***H01R 24/58*** *(2011.01)*
H05K 9/00 *(2006.01)* *H01R 13/6598* *(2011.01)*

(52) Cooperative Patent Classification (CPC):
H01R 24/58; H01R 13/65915; H01R 13/6598; H01R 2201/26

(84) Designated Contracting States:
AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC ME MK MT NL NO PL PT RO RS SE SI SK SM TR
Designated Extension States:
BA
Designated Validation States:
KH MA MD TN

(71) Applicant: **Yamaichi Electronics Deutschland GmbH**
85609 Aschheim-Dornach (DE)

(72) Inventors:
- **RAMONAT, Alexander**
  81377 München (DE)
- **FERNANDEZ SERRANO, Jaime**
  28830 Madrid (ES)

(74) Representative: **Müller-Boré & Partner Patentanwälte PartG mbB**
Friedenheimer Brücke 21
80639 München (DE)

(54) CONNECTOR, SUPERCONNECTOR, AND METHOD OF ASSEMBLING A CONNECTOR FOR ESTABLISHING AN ETHERNET CONNECTION

(57) A Connector (10; 10a; 10b) for establishing an ethernet connection comprises a connector housing (40). An ethernet cable end portion (20) enters the connector housing (40) at a cable end (13) of the connector (10) and comprises at least one twisted pair (22a; 22b; 22c; 22d) with two ending contacts (24a; 24b) and a pair shielding (26a; 26b) shielding the twisted pair (22a; 22b; 22c; 22d) and comprising conductive and/or magnetic material. At least one connector shielding (30a; 30b) is arranged in the connector housing (40), comprises conductive and/or magnetic material, contacts the pair shielding (26a; 26b) of the twisted pair (22a; 22b; 22c; 22d), and at least partially encloses the ending contacts (24a; 24b) of the twisted pair (22a; 22b; 22c; 22d). An inner isolator (60a; 60b) is at least partially arranged in the connector shielding (30a; 30b) and isolates and/or holds the ending contacts (24a; 24b) of the twisted pair (22a; 22b; 22c; 22d). A contact portion (27a; 27b) of the pair shielding (26a; 26b) is supported by a support portion (63a; 63b) of the inner isolator (60a; 60b) and held between the support portion (63a; 63b) and the connector shielding (30a; 30b).

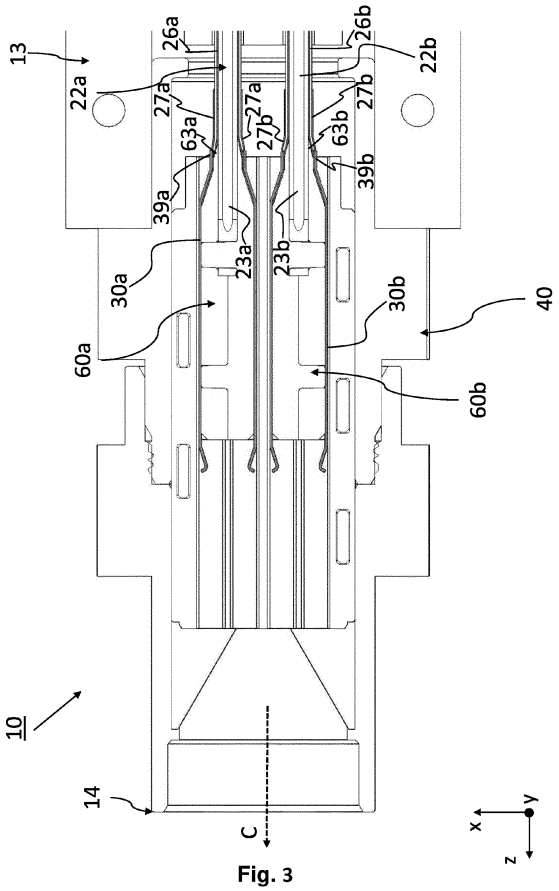

Fig. 3

EP 4 542 787 A1

Description

[0001] The invention relates to a connector for establishing an ethernet connection, a superconnector, and a method of assembling a connector.

[0002] Ethernet connection cables and connectors may be used in various environments and/or networks for establishing ethernet connections. Examples of such environments may be facilities such as factories and/or offices. However, ethernet connections may also be established within transport vehicles such as cars and/or trucks. Ethernet connection cables used in such environments may comprise eight wires which can be arranged in four twisted pairs, wherein each twisted pair comprises two wires of said eight wires arranged in a twisted form.

[0003] For reducing and/or preventing electromagnetic interference which may decrease the functionality, in particular the data transfer rate of the ethernet connection, ethernet connectors and ethernet connection cables may be provided with a shielding. One type of cable which may be used in this context is the so-called S/STP cable (screened shielded twisted pair cable). This type of cable comprises an outer shielding as well as individual pair shieldings for each twisted pair. The outer shielding and the individual pair shieldings contact each other. Thereby, each twisted pair is shielded by its associated pair shielding, and the four twisted pairs are commonly shielded by the outer shielding, while the pair shieldings and the outer shielding share a common electrical potential.

[0004] Along an ethernet connection, portions that are particularly affected by electromagnetic interference can be the connection portions where two corresponding connectors, for example plug and socket, are connected to each other. Some connectors are provided with shielded cases, wherein these cases can be connected to the outer shielding of the ethernet connection cable.

[0005] Particularly in vehicles such as trucks or cars, there may exist regions featuring a high electromagnetic interference. For vehicles comprising a combustion engine, these regions can be located proximate to the engine and/or the alternator. For hybrid or electric vehicles, the number of regions with high electromagnetic interference can be even higher than in vehicles with combustion engine, because they can comprise an increased number of electronic systems and/or devices. For example, proximate to the battery and/or the electric motor and/or the charging devices of the vehicle, high electromagnetic interference can be present. In addition, inductive charging techniques become more common for vehicles, in particular trucks and buses. The inductive charging can use strong electromagnetic fields and, therefore, cause high electromagnetic interference. Simultaneously, modern vehicles may comprise an increasing number of computational systems comprising ethernet connections for data transfer. For instances where a connector of an ethernet connection is arranged close to or within a region with high electromagnetic interference, the functionality of the ethernet connection, in particular the data transfer, may be reduced.

[0006] Another problem in ethernet connectors for vehicles may be caused by physical strain on the connector and/or the ethernet cable caused by, e.g., driving movements and/or extreme weather. Said strain may impact on both the electrical and/or the shielding contact between the connector and the ethernet cable.

[0007] Accordingly, it is an object of the claimed invention to provide an improved connector for establishing an ethernet connection which is less susceptible to electromagnetic interference. In particular, it can be an object to provide a connector for establishing an ethernet connection within vehicles which is less susceptible to electromagnetic interference. It may also be an object to provide a connector with a reliable contact between the shielding along the ethernet cable and the within the connector.

[0008] This object is solved by the subject-matter of the independent claims. Preferred embodiments are subject of the dependent claims.

[0009] An aspect relates to a connector for establishing an ethernet connection comprising a connector housing. An ethernet cable end portion is entering the connector housing at a cable end of the connector and comprises at least one twisted pair with two ending contacts and a pair shielding shielding the twisted pair and comprising conductive and/or magnetic material. At least one connector shielding is arranged in the connector housing. It comprises conductive and/or magnetic material, contacts the pair shielding of the twisted pair, and at least partially encloses the ending contacts of the twisted pair. An inner isolator is at least partially arranged in the connector shielding. It isolates and/or holds the ending contacts of the twisted pair. A contact portion of the pair shielding is supported by a support portion of the inner isolator and held between the support portion and the connector shielding.

[0010] The connector can be formed as a circular connector and is configured to establish at least part of a full ethernet connection. The connector may be configured to establish additional electric contacts not associated to an ethernet connection, e.g., contacts for communicating vehicle signals.

[0011] The connector may be formed as a plug connector and/or a socket connector. The connector may also be formed as a transformable connector, wherein the transformable connector comprises at least one receptacle element configured to releasably engage with at least one plug element and/or at least one socket element. Thus, the transformable connector may be at least partially transformed into a plug and/or socket connector. Then, each ending contact of the connector may contact either a one plug element or a socket element. The connector may comprise male and/or female contacts. In particular, the connector may be provided as a truck connector for establishing a connection within a truck and/or vehicle.

[0012] The connector housing may comprise a con-

nection opening and/or a cable opening. The connection opening may be formed at a side of the connector, where the connector is configured to directly or indirectly engage with a mating connector for establishing an ethernet connection. This side and/or end of the connector may be provided as a connecting end of the connector. For example, the connector can be formed as a socket connector comprising the connection opening in which a corresponding plug connector may be inserted such that said two connectors engage and establish electric contact.

[0013] The cable opening may be formed at a side of the connector wherein the ethernet cable end portion can be at least partially arranged, in particular held, within the cable opening such that the ending contacts are arranged inside of the connector housing. This side and/or end of the connector may be provided as the cable end of the connector. In embodiments wherein the connector is provided as a straight connector, it may be arranged at an end opposite the connecting end. Each ending contact and/or the connector may be configured and/or held within the connector such that the ending contacts contact mating ending contacts of a mating connector.

[0014] The ethernet cable end portion may be provided as an end section of an ethernet cable. The ethernet cable may be provided as a cable configured to establish at least part of an ethernet connection. The ethernet cable end portion may comprise, e.g., one, two, three, or four twisted pairs. For ethernet cable end portion comprising only one, two, or three twisted pairs, the twisted pairs of the ethernet cable end portion may not suffice to establish a full ethernet connection. However, e.g., two ethernet cables, each comprising, e.g., two twisted pairs, may be combined to provide an ethernet connection cable comprising the usual four twisted pairs. For example, the connector may comprise two such ethernet cable end portions. Alternatively, two connectors may be used to establish a full ethernet connection, each of which comprising one of the two ethernet cable end portions.

[0015] The twisted pair may comprise two conducting wires at least partially twisted around each other, each of the wires being encased in an isolator, respectively. The ethernet cable end portion comprises at least one such twisted pair, shielded by its associated pair shielding. The pair shielding may be provided as a sleeve around its associated twisted pair. The pair shielding may be provided as integral component of the ethernet cable which's end is comprised in the connector.

[0016] In embodiments wherein the ethernet cable end portion comprises a plurality of twisted pairs, each twisted pair may be shielded by an associated pair shielding, respectively.

[0017] The ending contacts of the twisted pair may be provided as ending portions of the wires of the twisted pair. Each ending contact may be arranged inside of the connector, and it may be at least partially stripped from its isolator.

[0018] The term "contacting" and variants thereof may describe a state in which at least two objects are in physical and/or electronical contact. In particular, they may be in direct physical contact. Thus, there may be a direct contact between the at least two, in particular conductive and/or magnetic, objects enabling a conductive connection between the at least two objects.

[0019] The connector shielding is arranged at least partially and/or substantially fully within the connector housing. It houses its associated inner isolator and the ending contacts of the associated twisted pair. The connector shielding is configured to provide a shielding function to the ending contacts and their optional extensions (like extension contacts and/or extension pins) within the connector.

[0020] The connector shielding (including its components) may be provided as stamping component.

[0021] The associated ending contacts of at least one of the twisted pairs are arranged so that the connector shielding at least partially encloses the ending contacts arranged therein.

[0022] The inner isolator is arranged within the connector shielding and between the connector shielding and the ending contacts. The inner isolator prevents the ending contacts form contacting the connector shielding. The inner isolator may be snuggly fit into the connector shielding. It may be provided from an isolating material, e.g., from a suitable plastic and/or ceramic.

[0023] For example, the inner isolator may be provided from a material with a relative permeability of about 3 to 5, preferably of about 3.5 to 4.0, in particular of about 3.8.

[0024] Suitable materials for the inner isolator are, e.g., PA, i.e., polyamide, and/or a mixture of PPE, i.e., polyphenylene, and PS, i.e., polystyrene.

[0025] The inner isolator may be provided as an injection molded part.

[0026] The inner isolator may provide one or more of the functions: It may isolate the ending contacts from the connector shielding, e.g., by providing a structural barrier between them. It may also hold the ending contacts in a predetermined position wherein they may be contacted by further elements of the connector (like extension contacts and/or by components of a mating connector). It may also prevent the pair shielding from pressing onto the wires of the twisted pair.

[0027] The pair shielding comprises the contact portion. The contact portion may be provided at the end of the pair shielding. The contact portion may be provided as a regular and/or integral section of the pair shielding of the ethernet cable end portion. The contact portion may be provided at the end of the pair shielding facing the connector.

[0028] The pair shielding and the contact portion may be provided from a conductive and/or magnetic material. At least the contact portion of the pair shielding is supported by the support portion. The support portion may be provided as a protrusion of the inner isolator. The contact portion may be arranged in direct contact, in particular in

direct physical contact, with the support portion of the inner isolator.

[0029] The contact portion is held between the support portion and the connector shielding. In this position, the contact portion may be held so that it is statically fixed in its predetermined position. The support of the contact portion provided by the support portion may improve the connection between the pair shielding and the connector shielding. In regular connectors, a connector shielding may simply be pressed up on the pair shielding. However, in many ethernet cables, the pair shielding is flexible and, e.g., made from wires or a foil. Thus, when the connector shielding is pushed onto the pair shielding, it may bend away. This may negatively impact on the connection between these two shielding's.

[0030] Especially in connectors provided in a strained environment, the connection between the pair shielding and the connector shielding may suffer over time. In regular ethernet cables, the pair shielding is laid around the flexible wires of the twisted pair. Said wires may not be able to provide a sufficiently stable support from the inside to the pair shielding. Thus, the pair shielding may bend away together with the bendy wires from the connector shielding. This may also negatively impact the connection between the connector shielding and the pair shielding.

[0031] This disadvantage may be overcome by the connector according to the invention. The support portion of the inner isolator may provide sufficient support for the contact portion of the pair shielding so that it may be reliably contacted by the connector shielding.

[0032] The connector shielding may contact the contact portion on its side opposite of the support portion. In other words, the support portion may be arranged on a side opposite of the side of the contact portion on which the pair shielding contacts the contact portion. This may enable the contact portion being safely and reliably held in a predetermined mounting position. It may, thus, render the shielding more reliable.

[0033] The connector may further comprise an outer connector shielding, and the ethernet cable end portion may further comprise an outer cable shielding. The outer connector shielding can at least partially enclose the connector shielding. It can be arranged within the connector housing and out of contact, in particular out of physical and/or electrical contact, from the connector shielding.

[0034] The outer cable shielding can at least partially enclose the pair shielding of the ethernet cable end portion and/or it can be arranged within the ethernet cable end portion and out of contact, in particular out of physical and/or electrical contact, from the pair shielding of the at least two twisted pairs. Thereby, the twisted pair and the ending contacts can be additionally shielded from electromagnetic interference. This configuration may enable a reliable and/or effective shielding of the twisted pair and the ending contacts within the connector.

[0035] The outer connector shielding and the outer cable shielding may contact each other to enable sharing a common electrical potential. This may enable a continuous shielding of the twisted pair within the ethernet cable end portion and the ending contacts within the connector housing. Thereby, both the twisted pairs and the ending contacts may be reliably and/or effectively shielded from electromagnetic interference.

[0036] The connector may be provided as and/or comprised in a vehicle connector, wherein the vehicle connector is a connector for establishing at least an ethernet connection between at least two modules or components of a vehicle. For example, the vehicle can be any one of a car, a bus, and a truck. For example, the vehicle connector can be used for establishing at least part of an ethernet connection between a computer inside of an operator cabin of the vehicle and a system of an attached trailer of the truck. The use of a vehicle connector which is formed as and/or comprises the connector can enable that an ethernet connection between the at least two modules or components of the vehicle can be shielded reliably and/or efficiently from electromagnetic interference. Accordingly, the connector may enable avoiding and/or reducing functionality loss of the ethernet connection and, in particular, the data transfer between the at least two modules or components of the vehicle.

[0037] The connector may be configured to only contribute to establishing an ethernet connection, e.g., in embodiments wherein the connector comprises only one, two, or three twisted pairs in the ethernet cable end portion. In embodiments wherein the connector comprises two twisted pairs in the ethernet cable end portion, the connector may establish half of an ethernet connection. Two such connectors used in combination may establish a full ethernet connection comprising the usual four twisted pairs.

[0038] The connector comprising two twisted pairs may be configured to connect with a corresponding connector comprising also two twisted pairs and/or a corresponding portion of a connector comprising four twisted pairs. The use of connectors comprising less than four twisted pairs may allow a greater distance between the different connectors for a full ethernet connection, thereby providing improved design options. This may reduce interference between the shieldings of the two or more connectors providing only parts of the full ethernet connection.

[0039] The connector may be provided for signalling according to the Cat 8a and/or Cat9a Standard. The signalling at this high data transfer rates may be enabled and/or improved by the support provided by the support portion.

[0040] The inner isolator may be provided with more than one support. Thus, it may support the pair shielding at more than only one position, which may improve the overall support provided.

[0041] According to an embodiment, the contact portion of the pair shielding is arranged in a press fit between the support portion and the connector shielding. Within

said press fit, the contact portion of the pair shielding is held in a statically fixed position. Thus, the chance of it being moved out of its contact position is reduced. To establish the press fit, the connector shielding may be pressed onto the contact portion which is held at the opposite side by the support portion.

[0042] According to an embodiment, the support portion of the inner isolator supporting the contact portion of the pair shielding from an inner radial position and/or wherein the support portion of the inner isolator is arranged between isolations of the twisted pair and the contact portion of the pair shielding. In said inner radial position, the support portion may be arranged between the wires of the twisted pair and the pair shielding of the cable and portion. The support portion may be inserted between the contact portion of the pair shielding and the twisted pair. In said inserted position, it supports the contact portion from the inside. The connector shielding may be set in contact with the contact portion from an outer radial position, e.g., by pressing it onto the contact portion from the outside and/or from an outer radial position. The support portion may rest upon isolations of the twisted pair and/or on the bare wires. Because the support portion of the inner isolator may be configured to be more stable than the twisted pair itself, it may provide an improved and or more stable support for the contact portion. This may improve the electrical and/or physical contact between the connector shielding and the pair shielding. It may, thus, render the shielding more reliable.

[0043] According to an embodiment, the support portion of the inner isolator is tapered towards the cable end of the connector. In other words, the support portion may become thinner the more it protrudes from a main body of the inner isolator. Said tapered end and/or tapered tip of the support portion may be provided with a pointed tip. Here, the main body of the inner isolator may be the portion of the inner isolator holding the ending contacts of the associated twisted pair. The tapered end may be arranged at and end facing away from said main body of the inner isolator. This may improve inserting the support portion between the twisted pair and its associated pair shielding.

[0044] According to an embodiment, the support portion of the inner isolator is provided as a thin protrusion protruding from a main body of the inner isolator towards the cable end of the connector. Even if the support portion is not tapered, it may still be provided as the thin protrusion. Optionally, it may be thin and tapered. Herein, the thin extension may refer to the thickness of the protrusion in a radial direction, meaning a direction radial to a connection direction of the connector. The thin protrusion may have a thickness being substantially at most as thick as the thickness of the isolator of the wires of the twisted pair. Also this configuration may improve inserting the support portion between the twisted pair and its associated pair shielding.

[0045] Generally, the support portion may be provided as an extension of the inner isolator extending towards the cable and of the connector. The support portion may be arranged in close proximity of the twisted pair. Support portion may be provided as a sleeve surrounding the twisted pair. Therein, the support portion does not have to be formed as a full sleeve. It may also be formed as only a section of the sleeve, in particular a section at a position at which the connector shielding is configured to contact the contact portion of the pair shielding.

[0046] According to an embodiment, at least the contact portion of the pair shielding is provided from a flexible material, e.g., from a foil and/or mylar and/or a wire mesh. The flexible pair shielding may be configured to not impede a bending of the ethernet cable. Additionally, the mentioned flexible materials are thin and, thus, do not require much installation space. However, when made from the appropriate material, in particular a metallic material, they provide sufficient and ample shielding of the twisted pair.

[0047] In a development of the embodiment, the contact portion of the pair shielding is turned up onto itself. Similar to a sleeve, the end of the pair shielding forming the contact portion may be turned up onto itself, so that its very end is turned inside out. Thus, the contact portion may be slightly thicker than the rest of the pair shielding, because it comprises, e.g., two layers instead of one. This may render the contact portion slightly more stable. Furthermore, it may improve the electric and/or physical contact between the pair shielding and the connector shielding. Finally, turning the pair shielding onto itself may provide a defined edge of the pair shielding.

[0048] In a development of the embodiment, the contact portion of the pair shielding, in particular the turned-up contact portion, is superimposed over the support portion of the inner isolator. Here, either the contact portion may be slid over the support portion, or the support portion may be slid under the flexible contact portion. The support portion may further thicken the turned-up contact portion. This may improve the connection between the pair shielding and the connector shielding.

[0049] According to an embodiment, the connector shielding comprises a shielding contact element contacting the contact portion of the pair shielding. The shielding contact element may be provided from the same material as the connector shielding. It may be provided from magnetic and/or electrically conductive material. The shielding contact element may be arranged in physical and electrical contact with the contact portion. In the assembled state of the connector, the shielding contact element may be pressed and/or pressing onto the contact portion supported at the opposite side by the support portion of the inner isolator. Providing the connector shielding with the shielding contact element may improve the design options of the main body of the connector shielding. The main body of the connector shielding may be the portion of it encasing the associated ending contacts. The main body of the connector shielding itself may have any suitable form for shielding the ending contacts without minding the contact to the contact portion, be-

cause this contact is established via the shielding contact element.

[0050] In a development of this embodiment, the shielding contact element is protruding from the connector shielding towards the cable end of the connector. Herein, the shielding contact element may be provided as a protrusion protruding from the main body of the connector shielding. It may be design similar to an arm and/or hook protruding from the main body of the connector shielding. As such, the shielding contact element may provide a reliable shielding contact between the respective shielding is.

[0051] In a further development of this embodiment, the shielding contact element is springily pressed onto the contact portion of the pair shielding. Herein, the shielding contact element may be at least partially elastic so that it may press on to the contact portion with a pressing force and/or spring force. Said spring/pressing force may hold the shielding contact element in a reliable contact with the contact portion of pair shielding.

[0052] In a further development, the support portion of the inner isolator holds the contact portion of the pair shielding in place against the spring force and/or pressing force of the shielding contact element. The spring force and/or the pressing force may improve the connection between the pair shielding the connector shielding. It may also hold the contact portion in a designated and or predetermined mounting position.

[0053] According to an embodiment, the ethernet cable end portion comprises a plurality of twisted pairs with two ending contacts, respectively, and a pair shielding for each twisted pair. A plurality of connector shieldings is arranged in the connector housing, each of which at least partially encloses ending contacts of one associated of the twisted pairs, respectively, and contacts the pair shielding of the associated twisted pair. The connector further comprises a plurality of inner isolators, each being at least partially arranged in one of the connector shieldings and isolating and/or holding the associated ending contacts of the twisted pair, respectively. Therein, each pair shielding comprises a contact portion supported by an associated support portion of the associated inner isolator and is held between the associated support portion and the associated connector shielding. In this embodiment, the ethernet cable end portion comprises more than just one twisted pair. For example, it may comprise two, three, or four twisted pairs. Herein, each twisted pair is shielded by an associated pair shielding. Each of those pair shieldings is connected to the associated connector shielding. Furthermore, each pair shielding comprises its contact portion, and each contact portion is supported by the associated support portion of the associated inner isolator. Herein, the connector shieldings may be held out of contact of each other. Thus, each connector shielding may be connected and/or arranged at its own, individual electrical potential. This may improve the overall shielding of the twisted pairs, because it may reduce interference and/or noise caused by induced currents within the respective connector shieldings.

[0054] In other words, in this embodiment, each contact portion is individually supported, exactly as the first mentioned contact portion. Indeed, the contact portions of the different pair shieldings may be supported and/or designed as the first mentioned contact portion. They may enable a reliable and/or stable shielding for all of the twisted pairs.

[0055] In an embodiment, the connector further comprises a conductive extension contact for at least one, a plurality of the, or each ending contact, wherein each extension contact contacts, in particular physically and/or electrically contacts, the respective ending contact associated with it. The extension contacts can be configured to extend the ending contacts and/or the wires at the ending contacts, in particular in pointing direction of the ending contacts, e.g., from the cable end towards the connecting end of the connector. The extension contacts may be provided as pin contacts within the connector. The extension contacts may be arranged within the connector shielding associated with the ending contacts they extend.

[0056] The extension contacts may be arranged within the associated inner isolator. Each extension contact may comprise at least one attaching means, e.g., a crimping end, for attachment to the associated ending contact. The extension contacts may enable a reliable signalling along the connector. Herein, a contact end of the extension contacts (arranged at or facing the contacting end of the connector) may approximately coincide with a contact end of the connector shielding (arranged at or facing the contacting end of the connector).

[0057] An aspect relates to a superconnector for establishing an ethernet connection comprising a superhousing in which two connectors according to the previous aspect are arranged. An ethernet connection cable end portion comprises four twisted pairs apportioned to the two ethernet cable end portions of the two connectors.

[0058] The ethernet connection cable end portion may be provided as an end of an ethernet connection cable comprising eight wires. The four twisted pairs of the ethernet connection cable end portion are split up into two ethernet cable end portions, each of which comprising two twisted pairs, respectively. Thus, each of the two connectors comprises its respective ethernet cable end portion with two twisted pairs each.

[0059] Each of the four twisted pairs is shielded by its associated pair shielding. Each of said pair shieldings comprises a contact portion, respectively, supported by an associated support portion by an associated inner isolator arranged within an associated connector shielding, respectively. Each of the support portions may be designed as described in the above aspect. Therefore, the above description also relates to this aspect and vice versa.

[0060] Therein, the four connector shieldings may be

arranged out of contact of each other, so that each twisted pair is individually shielded within each of the two connectors, respectively.

[0061] The superconnector may comprise additional connection wires. For example, the superconnector may be provided as a truck connector comprising the regular truck connection wires arranged at the regular truck connector positions and, additionally, the two additional connectors for providing the ethernet connection. Herein, the two connectors may be integrated within a standard connector like the truck connector, thereby forming the superconnector.

[0062] The superconnector can further comprise an outer superconnector shielding, and the ethernet connection cable end portion can further comprise an outer connection cable shielding. The outer superconnector shielding can at least partially enclose the four connector shieldings of the two connectors. It can be arranged within the superhousing out of contact, in particular out of physical and/or electrical contact, from the four connector shieldings. The outer connection cable shielding can at least partially enclose the twisted pair shieldings and/or can be arranged within the ethernet connection cable end portion out of contact, in particular out of physical and/or electrical contact, from the pair shieldings of the four twisted pairs. Thereby, the twisted pairs and the ending contacts can be additionally shielded from electromagnetic interference. This configuration may improve the overall shielding of the twisted pairs of the superconnector. The outer superconnector shielding and the outer connection cable shielding can contact each other. Thereby, the outer superconnector shielding and the outer connection cable shielding can share a common electrical potential. This may further enable a continuous shielding of the twisted pairs within the ethernet connection cable end portion and the ending contacts within the superhousing. Thereby, both the twisted pairs and the ending contacts can be reliably and/or effectively shielded from electromagnetic interference.

[0063] A further aspect relates to a connector system comprising two connectors, e.g., a plug- and-socket-system, comprising a first connector according to the above aspect and a second connector according to the above aspect configured to engage each other. The connectors can be formed according to any one of the embodiments of the above aspects.

[0064] An aspect relates to a method for assembling a connector for establishing an ethernet connection comprising the steps:

- providing a connector housing;
- arranging an ethernet cable end portion so that it enters the connector housing at a cable end of the connector, wherein the ethernet cable end portion comprises:
    - at least one twisted pair with two ending contacts, and
    - a pair shielding shielding the twisted pair and comprising conductive and/or magnetic material;
- arranging at least one connector shielding in the connector housing so that it contacts the pair shielding of the twisted pair and at least partially encloses the ending contacts of the twisted pair;
- arranging an inner isolator at least partially in the connector shielding so that it isolates and/or holds the ending contacts of the twisted pair; and
- arranging a contact portion of the pair shielding so that it is supported by a support portion of the inner isolator and held between the support portion and the connector shielding.

[0065] The method may be used for assembling the connector according to the above aspect. Therefore, the description of the above aspect also relates to the method and vice versa.

[0066] Herein, the terms upper, lower, below, above, etc. refer to the reference system of the Earth in a mounting position of the subject-matter.

[0067] The numbers and/or angles given in the claims and the description are not limited to the exact numbers and/or angles, but may include measurement inaccuracies within limits that still enable solving the underlying problem.

[0068] The invention is further illustrated in reference to embodiments shown in the figures.

[0069] Embodiments of the invention are described with reference to the figures. Features of the embodiments shown in the figures may be combined with other embodiments. Identical reference numbers may identify identical or similar features of the embodiments.

Figure 1 shows a drawing of a cross-sectional view of an embodiment of an assembled connector.

Figure 2 shows an exploded view of some parts of the connector of Figure 1.

Figure 3 shows another cross-sectional view of the connector of Figure 1 in an assembled form.

Figure 4 shows a front view of the connector of Figure 1 in an assembled form.

Figure 5 shows a spatial view of the connector of Figure 1 in an assembled form.

Figure 6 shows a schematic drawing of a cross-sectional view of an embodiment of two superconnectors, each comprising two connectors.

Figure 7 shows a perspective view of another embodiment of an assembled connector.

Figure 8 shows a cross-sectional view of the connector of Figure 7.

Figure 9A shows a perspective view of an embodiment of an assembled extension adapter

when looking at an adapter connecting end of it.

Figure 9B shows a perspective view of the extension adapter of Figure 9A when looking at a connector end of it.

Figure 10 shows a cross-sectional view of the extension adapter of Figures 9A and 9B.

[0070] **Figure** 1 shows a cross-sectional view of an embodiment of a connector 10, formed as a circular connector, in particular provided as (at least part of) a vehicle and/or truck connector. A dashed line in Figure 4 (showing the same connector 10 from another direction) indicates the location of the cross-section shown in Figure 1. The cross-section is arranged parallel to a connection direction C of the connector 10.

[0071] The connector 10 substantially extends from a cable end 13 to a connecting end 14 in the connection direction C (corresponding to the z-direction in the figures and indicated by the arrow C in Figures 1, 2, 3, and 5).

[0072] The connection direction C is a direction in which an electric plug-connection may be established between the connector 10 and a corresponding connector.

[0073] The connector 10 comprises an ethernet cable end portion 20 which can be an end portion of an ethernet cable 20'. In the shown embodiment, at least the ethernet cable end portion 20 extends in connection direction C. Ethernet data signals may be communicated along the ethernet cable end portion 20. A connector housing 40 comprises a substantially cylindrical form and may be provided as an outer hull of the connector 10. Inside of the connector housing 40, an outer isolator 50 is arranged physically contacting the connector housing 40 from inside. Inside of the outer isolator 50, a first connector shielding 30a is arranged (together with a second connector shielding 30b not shown in Fig. 1 but, e.g., in Fig. 4). Inside of the first connector shielding 30a, a first inner isolator 60a is arranged holding first extension contacts 70a. Similarly, a second inner isolator 60b holding second extension contacts 70b is arranged within the second connector shielding 30b (not shown in Fig. 1).

[0074] Similar as the inner isolator 60a/60b also the outer isolator 50 may be provided from a material comprising a relative permeability of about 3 to 5, preferably of about 3.5 to 4.0, in particular of about 3.8.

[0075] Suitable materials for the inner and/or outer isolators 60a/60b, 50 are, e.g., PA, i.e., polyamide, and/or a mixture of PPE, i.e., polyphenylene, and PS, i.e., polystyrene. These materials may provide sufficient isolation capabilities, simple handling during manufacture, and/or sufficient material strength to enable the formation of delicate functional structures like the support portions 63a, 63b (see description below).

[0076] The ethernet cable end portion 20 comprises a first twisted pair 22a with two first wires 23a, wherein each first wire 23a comprises one first ending contact 24a. Although the first wires 23a are depicted in a non-twisted form in Fig. 1, the first wires 23a can be at least partially twisted around each other. The first wires 23a may be isolated, respectively, except at the first ending contacts 24a. The first wires 23a are partially enclosed by a first pair shielding 26a. The first pair shielding 26a may be provided from a foil, a mylar, and/or a mesh. The first ending contacts 24a and an adjacent portion of the first wires 23a are not enclosed by the first pair shielding 26a. The first pair shielding 26a may be stripped from this section of the first wires 23a.

[0077] At least the first ending contacts 24a and the stripped section of the first wires 23a (not enclosed by the first pair shielding 26a) are arranged inside the connector housing 40 of the connector 10. Additionally, also a section of the first wires 23a which is enclosed by the first pair shielding 26a may be arranged within the connector 10.

[0078] The connector housing 40 may have a substantially cylindrical form. It comprises and/or may consist of a (e.g., substantially cylindrical) first connector housing component 41 and a (e.g., substantially cylindrical) second connector housing component 42. The first connector housing component 41 comprises a connection opening 12 at the connecting end 14 of the connector housing 40. The second connector housing component 42 comprises a cable opening 11 at the cable end 13 of the connector housing 40.

[0079] The first and second connector housing components 41,42 are statically fixed to each other, thereby forming the connector housing 40 of the connector 10. They may, e.g., be screwed and/or clipsed to each other.

[0080] The first connector housing component 41 is configured to receive and/or hold a corresponding connector (not shown) for establishing an ethernet connection through and/or at the connection opening 12.

[0081] The ethernet cable end portion 20 enters the connector 10 through the cable opening 11, such that the first ending contacts 24a are arranged inside of the connector housing 40 between the cable opening 11 and the connection opening 12. The first ending contacts 24a as well as the ethernet cable end portion 20 are arranged so that they point towards the connection opening 12, which is the connection direction C of the connector 10. Accordingly, a direction from the cable opening 11 towards the connection opening 12 is the connection direction C of the connector 10.

[0082] One first extension contact 70a is attached to each of the two first ending contacts 24a, respectively, further extending into the pointing direction of the first ending contacts 24a towards the connecting end 14. The first ending contacts 24a and the first extension contacts 70a are arranged in recesses of and held by the first inner isolator 60a. The first inner isolator 60a comprises and/or consists of a first inner isolator component 61a and a second inner isolator component 62a. Each of which partially comprises the recesses, such that the first ending contacts 24a and the first extension contacts 70a are arranged between and/or held by the first inner isolator

component 61a and the second inner isolator component 62a. At an end of the first extension contacts 70a facing the connecting end 14a, the first inner isolator 60a comprises an opening for each first extension contact 70a, such that the first extension contacts 70a may establish an electrical connection in the connection direction C.

[0083] The first inner isolator 60a is enclosed by the first connector shielding 30a. Thereby, the first connector shielding 30a may fully enclose the first ending contacts 24a and/or the first extension contacts 70a in a direction radial to the connection direction C of the connector 10.

[0084] The first connector shielding 30a is electrically isolated by the first inner isolator 60a from the inside and by the outer isolator 50 from the outside. It may be held between those two isolators 50, 60a, e.g., in a tight fit.

[0085] The first connector shielding 30a comprises and/or may consist of a first connector shielding member 31a and a (e.g., substantially identical) second connector shielding member 32a (not shown in Fig. 1) contacting each other. At a connection end 36a of the first connector shielding 30a, which is provided as an end facing the connecting end 14, i.e., in connection direction C of the connector 10, the first connector shielding 30a comprises one or more connector shielding protrusions 38a. One of the connector shielding protrusions 38a may protrude from the first connector shielding member 31a in connection direction C. Another one of the connector shielding protrusions 38a (not shown in Fig. 1) may protrude from the second connector shielding member 32a (not shown in Fig. 1) in connection direction C. The first connector shielding member 31a and the second connector shielding member 32a are formed substantially symmetrical to each other with respect to an axis extending in connection direction C of the connector 10.

[0086] The first and second connector shielding members 31a, 32a of the first connector shielding 30a may be statically fixed to each other, thereby forming the first connector shielding 30a. They may, e.g., be clipsed to each other. Each connector shielding members 31a, 32a may be substantially shaped like a half an oval cylinder.

[0087] The first connector shielding 30a enclosing the first inner isolator 60a is arranged within a first holding portion 54a of the outer isolator 50. The first holding portion 54a is formed as a recess (e.g., extending along the connection direction C) within the outer isolator 50. It comprises an opening at a first end of the outer isolator 50 facing the connecting end 14.

[0088] At a second end of the outer isolator 50 facing the cable end 13, a through-hole is formed between the first holding portion 54a and the outside of the outer isolator 50 in opposite connection direction C, through which the ethernet cable end portion 20 enters the outer isolator 50.

[0089] The outer isolator 50 may comprise and/or consist of two substantially identical outer isolator components 51, 52, wherein both outer isolator components 51, 52 partially comprise the first holding portion 54a. The two outer isolator components 51, 52 are substantially symmetrical to each other with respect an axis extending in connection direction C of the connector 10.

[0090] The outer isolator components 51, 52 may be statically fixed to each other, thereby forming the outer isolator 50. They may, e.g., be clipsed to each other. Each outer isolator component 51, 52 may be substantially shaped like a half an oval cylinder.

[0091] The two outer isolator components 51, 52 may hold the other components of the connector together and hold them statically fixed, in particular the connector shieldings 30a, 30b and, therewith, the components arranged therein. The two outer isolator components 51, 52 may be held and/or pressed together by the housing 40. During assembly of the connector 10 (and also afterwards), the shieldings are not strained anymore, in particular the connector shieldings 30a, 30b and/or the pair shieldings 26a, 26b.

[0092] The outer isolator 50 is arranged in a substantially cylindrical recess of the connector housing 40, wherein an outer lateral surface, extending in connection direction C of the connector 10, of the outer isolator 50, may contact an inner surface of the connector housing 40, in particular an inner surface of both the first connector housing component 41 and second connector housing component 42. The substantially cylindrical recess of the connector housing 40 is a portion of a through-hole of the connector housing 40 extending between the cable end 13 and the connecting end 14.

[0093] In particular, the outer isolator components 51, 52 may held by the connector housing 40, e.g., in a tight fit.

[0094] A portion of the ethernet cable end portion 20 arranged outside the connector housing 40 may be at least partially enclosed by a twisted pair isolator 28. The twisted pair isolator 28 may comprise a first twisted pair isolator component 28a and a (e.g., substantially identical) second twisted pair isolator component 28b. The twisted pair isolator 28 may separate the twisted pairs 22a, 22b, in particular the pair shieldings 26a, 26b of the twisted pairs 22a, 22b.

[0095] The first twisted pair isolator component 28a and the second twisted pair isolator component 28b may be statically fixed to each other, thereby forming the twisted pair isolator 28. They may, e.g., be clipsed to each other.

[0096] The twisted pair isolator 28 as well es a portion of the second connector housing 42 may be enclosed by a cable casing 29, comprising a first cable casing component 29a and a (e.g., substantially identical) second cable casing component 29b. The first cable casing component 29a and the second cable casing component 29b may be statically fixed to each other, thereby forming the cable casing 29.

[0097] **Fig. 2** shows an exploded view of some parts of the connector 10 of Fig. 1, while **Fig. 5** shows a spatial view of the connector 10 in an assembled form. In Fig. 2, in connection direction C of the connector 10, the orientation of each part corresponds to its orientation in the

assembled connector. In other words, the parts may be shown in Fig. 2 spaced apart and/or separated from each other, wherein particularly in connection direction C of the connector 10 their spatial orientation corresponds to their orientation when being arranged within the assembled connector 10 (cf. Fig. 5).

[0098] Fig. 2 shows that the ethernet cable end portion 20 does not only comprise the first twisted pair 22a shown in Fig. 1, but also a second twisted pair 22b.

[0099] A mid-portion of each of the first twisted pair 22a and a, e.g., substantially identically formed, second twisted pair 22b with two second wires 23b of the ethernet cable end portion 20 are arranged within the second connector housing component 42. They may be spaced apart from each other. Both the first twisted pair 22a and the second twisted pair 22b are respectively shielded by a first pair shielding 26a and a second pair shielding 26b. The second twisted pair 22b comprises second ending contacts 24b. The first twisted pair 22a and the second twisted pair 22b may be arranged next to each other, such that the first ending contacts 24a and second ending contacts 24b are arranged at the approximately same height in connection direction C of the connector 10. The second ending contacts 24b and an adjacent portion of the second wires 23b are not enclosed by the second pair shielding 26b. The second pair shielding 26b may be stripped from this section of the second wires 23b.

[0100] Both the first inner isolator 60a and a second inner isolator 60b comprise (and/or consist of) a first inner isolator component 61a, 61b and a second inner isolator component 62a, 62b, respectively. All inner isolator components 61a, 61b, 62a, 62b of all the inner isolators 60a, 60b may be designed substantially identically. The first and second inner isolator 60b are arranged spaced (e.g., perpendicular to the connection direction C) to and out of contact from each other and of the first ending contacts 24a and of second ending contacts 24b, respectively. The first and/or second inner isolator components 61a, 61b, 62a, 62b of the first inner isolator 60a and the second inner isolator 60b may hold the extension contacts 70a, 70b of the associated first/second extension contacts 70a, 70b, respectively (wherein only the second extension contacts 70b are shown in Figure 2).

[0101] Generally, components being designed substantially identically as, e.g., all the inner isolator components 61a, 61b, 62a, 62b, may enable an easier production, because they may be produced identically. E.g., they may be produced in the same or an identical molding and/or by the exact same production method.

[0102] The first connector shielding 30a and a (e.g., substantially identically formed) second connector shielding 30b are arranged spaced (e.g., perpendicular to the connection direction C) to and out of contact from each other. The second connector shielding 30b comprises and/or consists of a first connector shielding member 31b and a second connector shielding member 32b which can be substantially identically formed. For assembling the connector 10, the first connector shielding member 31a, 31b and the second connector shielding member 32a, 32b of each of the first connector shielding 30a and the second connector shielding 30b may be put together and brought into contact, e.g., by a clipping them together. In Figure 1, only the first connector shielding member 31a of the first connector shielding 30a is shown.

[0103] The second connector shielding 30b may be electrically isolated by the second inner isolator 60b from the inside and by the outer isolator 50 from the outside. It may be held between those two isolators 50, 60b, e.g., in a tight fit.

[0104] The first and second connector shielding members 31b, 32b of the second connector shielding 30b may be statically fixed to each other, thereby forming the second connector shielding 30b. They may, e.g., be clipsed to each other. Each connector shielding members 31b, 32b may be substantially shaped like a half an oval cylinder.

[0105] Each of the first connector shielding members 31a, 31b and second connector shielding members 32a, 32b may comprise the connector shielding protrusion 38a, 38b at the connection end 36a, 36b.

[0106] At an end opposite to the connection direction C of the connector 10, which is a shielding end 34a, 34b, each of the first connector shielding members 31a, 31b and/or the second connector shielding members 32a, 32b may comprise a shielding contact element 39a, 39b. Each first shielding contact element 39a of the first connector shielding 30a can be arranged in contact with the first pair shielding 26a and each second shielding contact element 39b of the second connector shielding 30b can be arranged in contact with the second pair shielding 26b, in particular when the connector 10 is assembled. In other words, when the connector 10 is assembled, each pair shielding 26a, 26b can be contacted by (e.g., at least) two shielding contact elements 39a, 39b from (e.g., at least) two sides of each twisted pair 22a, 22b, in particular from (e.g., at least) two opposite sides of each twisted pair 22a, 22b. This may enable a reliable contact between the pair shieldings 26a, 26b and the connector shieldings 30a, 30b contacting the respective pair shieldings 26a, 26b. Thereby, a reliable and secure shielding of the twisted pairs 22a, 22b and the contact elements 24a, 24b from electromagnetic interference can be enabled.

[0107] In other embodiments, each connector shielding 30a, 30b may only comprise one shielding contact element 39a, 39b, respectively, or more than two shielding contact elements 39a, 39b.

[0108] The contact between the shielding contact element 39a, 39b and the pair shieldings 26a, 26b is shown in more detail in Fig. 4 (cf. below).

[0109] From the inside to the outside, the connector 10 may comprise the contact elements 24a, 24b held by the inner isolators 60a, 60b arranged inside the connector shieldings 30a, 30b arranged inside the outer isolator 50. In Fig. 2, the outer isolator 50 is shown in a disassembled form, wherein the two, e.g., substantially identically formed, outer isolator components 51, 52 are separated.

Each outer isolator component 51, 52 comprises corresponding engagement elements 55, which may be formed as recesses and protrusions. The engagement elements 55 may be formed on a connection surface of each outer isolator component 51, 52, wherein the connection surfaces can contact each other when the connector 10, in particular the outer isolator 50, is assembled. The engagement elements 55 may be formed such that, when the connector 10, in particular the outer isolator 50, is assembled, each recess of one of the outer isolator components 51, 52 may be engaged with a corresponding protrusion of the other one of the outer isolator components 51, 52.

[0110] Each of the outer isolator components 51, 52 comprises a portion of the first holding portion 54a and a portion of a second holding portion 54b of the outer isolator 50, wherein in the first holding portion 54a the first connector shielding 30a and in the second holding portion 54b the second connector shielding 30b can be arranged, in particular snuggly fit, when the connector 10 is assembled.

[0111] Each of the outer isolator components 51, 52 comprises at least partially a separator 53, e.g., formed as a bar, arranged between the portion of the first holding portion 54a and the portion of the second holding portion 54b. When the connector 10 is assembled, the two separators 53 may be brought into contact with each other, such that the first holding portion 54a and the second holding portion 54b are separated by the two separators 53.

[0112] On a side of the outer isolator 50 in connection direction C of the connector 10 from, the first connector housing component 41 is arranged.

[0113] In assembled form, the connector shieldings 30a, 30b, enclose the respective inner isolators 60a, 60b and the respective ending contacts 24a, 24b with their respective extension contacts 70a, 70b are arranged in their respective holding portion 54a, 54b of the outer isolator component 52. The separator 53 separates the first connector shielding 30a from the second connector shielding 30b.

[0114] **Figure 3** shows another cross-sectional view of the connector 10. A dotted line in Figure 4 (showing the same connector 10 from another direction) indicates the location of the cross-section shown in Figure 3. The cross-section is arranged parallel to a connection direction C of the connector 10. The planes of the cross-sections of Figs. 1 and 3 are arranged substantially perpendicular to each other. In Fig. 3, only some of the reference signs are identified, while most are omitted.

[0115] As shown in Fig. 3, the ends of the pair shieldings 26a, 26b facing the connector 10 are turned inside out, so that the end of the first pair shielding 26a is provided by a first contact portion 27a and the end of the second pair shielding 26b is provided by a second contact portion 27b. These contact portions 27a, 27b may be slightly thicker and/or stiffer than the rest of the pair shieldings 26a, 26b, because here, the pair shieldings 26a, 26b are turned back onto itself. The contact portions 27a, 27b may correspond to this turned up section of the pair shieldings 26a, 26b. The respective contact portion 27a, 27b may be provided as integral part of the associated pair shielding 26a, 26b.

[0116] As described before, each pair shielding 26a, 26b (and, thus, also each contact portion 27a, 27b) may be provided as a foil and/or mylar and/or mesh made from a conductive and/or magnetic material. Each pair shielding 26a, 26b is configured to shield the associated twisted pair 22a, 22b it is shielding.

[0117] At the very end of the first pair shielding 26a, a first support portion 63a of the first inner isolator 60a is inserted under the first contact portion 27a. It may be slipped between the first wires 23a and the first pair shielding 26a. The first support portion 63a is provided as a protrusion of the first inner isolator 60a protruding from the first inner isolator 60a towards the cable end 13 of the connector 13. The first support portion 63a may be tapered, so that is easily slid under the first pair shielding 26a. The first support portion 63a may support the first connection portion 27a from a radial inner position.

[0118] Similarly, at the very end of the second pair shielding 26b, a second support portion 63b of the second inner isolator 60b may be inserted under the second contact portion 27b. It may be slipped between the second wires 23b and the second pair shielding 26b. The second support portion 63b may be provided as a protrusion of the second inner isolator 60b protruding from the second inner isolator 60b towards the cable end 13 of the connector 13. The second support portion 63b may be tapered, so that is easily slid under the second pair shielding 26b. The second support portion 63b may support the second connection portion 27b from a radial inner position.

[0119] This (at least slight) improvement in stiffness by the turned up designed of the contact portion 27a, 27b enables a reliable insertion of the associated support portion 63a, 63b.

[0120] Each support portion 63a, 63b may be provided as an integral component of the respective inner isolator 60a, 60b. It may prevent the respectively supported contact portion 27a, 27b from bending away from the respective shielding contact element 39a, 39b when a shielding contact is established between the connector shielding 30a, 30b and the associated pair shielding 26a, 26b.

[0121] Because the cross-section plane of Fig. 3 splits the forking wires 23a, 23b, these wires 23a, 23b appear to be cut short (which they are not). However, as seen, e.g., in Fig. 1 and 2, this is only because these wires 23a, 23b branch out towards their associated extension contacts 70a, 70b (not shown in Fig. 3). In an area not shown in Fig. 3, these the wires 23a, 23b branch out and extend further along the connecting direction C towards their respective extension contacts 70a, 70b, exactly as shown in Figs. 1 and 2.

[0122] In the assembled state shown in Fig. 3, the first

contact portion 27a is pinned between the first support portion 63a and the first shielding contact element 39a of the first connector shielding 30a. While the first support portion 63a may support the first contact portion 27a from an inner position, the first shielding contact element 39a may press onto the first contact portion 27a from a radial outer position inwards and onto the first support portion 63a.

[0123] Similarly, the second contact portion 27b may be pinned between the second support portion 63b and the second shielding contact element 39b of the second connector shielding 30b. While the second support portion 63b may support the second contact portion 27b from an inner position, the second shielding contact element 39b may press onto the second contact portion 27b from a radial outer position inwards and onto the second support portion 63b.

[0124] The pair shieldings 26a, 26b substantially keep their shape even after being contacted by the associated connector shielding 30a, 30b, because they are supported by the associated support portion 63a, 63b. Because the pair shieldings 26a, 26b do not alter their regular shielding shape, this does not negatively impact on the signaling quality. Indeed, the support provided by the support portion 63a, 63b may, thus, enable an increased signaling quality.

[0125] At the very end of respective shielding contact element 39a, 39b, a hook and/or other enlargement (not shown in the figures) may be provided, e.g., pointing inwards and/or towards the associated contact portion 27a, 27b. Said hook and/or enlargement may further increase the contact between the contact portion 27a, 27b and the respective shielding contact element 39a, 39b.

[0126] The shielding contact element 39a, 39b may be elastic. As such it may press onto the associated contact portion 27a, 27b with a controlled spring force and/or pressing force.

[0127] Herein each inner isolator component 61a, 61b, 62a, 62b (cf. Fig. 2) may comprise at least one of the support portions 63a, 63b. This may improve the support provided for the pair shielding 26a, 26b, thereby enabling the pair shielding 26a, 26b to keep its shape even after being contacted by the associated connector shielding 30a, 30b. This may enable a positive impact on the overall signalling quality.

[0128] This connection between the connector shielding 30a, 30b and the associated pair shielding 26a, 26b enables a reliable and/or durable shielding connection, especially for truck connectors.

[0129] **Figure 4** shows a front view of the connector of Figure 1 in an assembled form. The dashed line indicates the location of the cross-section of Figure 1. The dotted line indicates the location of the cross-section of Figure 3. The first extension contacts 70a and the second extension contacts 70b, the first inner isolator 60a and the second inner isolator 60b, the first connector shielding 30a and the second connector shielding 30b, as well as the outer isolator components 51, 52 may be arranged within and/or held by the connector housing 40 symmetrically to each other with respect to a central axis of the connector 10 extending in connection direction C of the connector 10, respectively. The two separators 53 separate the first connector shielding 30a and the second connector shielding 30b.

[0130] **Figure 6** shows a schematic drawing of a cross-sectional view of two superconnectors 100a, 100b, each comprising two connectors, namely a first connector 10a and a second connector 10b. Each of these connectors 10a, 10b may be designed as (or at least similar to) the connector 10 shown in Figs. 1-5 or as the connector 10 shown in Figs. 7 and 8 below.

[0131] In Fig. 6, each of the connectors 10a, 10b is provided as a half connector, i.e., it may be configured to establish a connection for two twisted pairs, i.e., half of the four twisted pairs usually comprised in an ethernet connection.

[0132] The two superconnectors 100a, 100b may be designed as a mating superconnectors. Thus, they may be designed similarly to each other and/or so that they may be plugged into each other.

[0133] Each superconnector 100a, 100b of the two superconnectors comprises a first extension adapter 90a for the first connector 10a and a second extension adapter 90b for the second connector 10b. Each extension adapter 90a, 90b is arranged at the respective connecting end 14 and/or at an respective adapter receptacle 80 (cf. Fig. 7 below) of the respective connector 10a, 10b. In Fig. 6, the extension adapters 90a, 90b are shown highly schematically. Each of these extension adapters 90a, 90b may be configured like and/or similar to the extension adapter 90 shown in Figs. 9-10.

[0134] Each extension adapters 90a, 90b may be provided as an extension of its respective connector 10a, 10b. For example, the two extension adapters 90a, 90b of the first superconnector 100a may extend the first superconnector 100a in a first connection direction C1. The two extension adapters 90a, 90b of the second superconnector 100b may extend the second superconnector 100b in a second connection direction C2 which may be directed opposite to the first connection direction C1 so that the two superconnectors 100a, 100b may be connected towards and/or into each other.

[0135] Each connector 10a, 10b may be formed as a transformable connector. It may comprise male and/or female adapter contacts 95a-d (cf. Figs. 9-10) extending the extension contacts 70a, 70b (cf. Figs. 1 and 2), e.g., depending on the nature of the chosen extension adapter 90a, 90b.

[0136] The first extension adapter 90a may be configured as a single component comprising both the two first and the two second adapter contacts 95a-d for the first connector 10a. Similarly, also the second extension adapter 90b may be configured as a single component comprising two third and two fourth adapter contacts for the second connector 10b.

[0137] Alternatively, the first extension adapter 90a may be configured as a two-piece component, wherein a first piece of the first extension adapter 90a comprises the two first adapter contacts 95a-b for the first connector 10a and a second piece of the first extension adapter 90a comprises the two second adapter contacts 95c-d for the first connector 10a. The first piece of the first extension adapter 90a may be removably inserted into a first section of the adapter receptacle 80 and the second piece of the first extension adapter 90a may be removably inserted into a second section of the adapter receptacle 80 (cf. Fig. 4).

[0138] Similarly, also the second extension adapter 90b may be configured as a two-piece component, wherein a first piece of the second extension adapter 90b comprises the two third adapter contacts for the second connector 10b and a second piece of the second extension adapter 90b comprises the two fourth adapter contacts for the second connector 10b. Each of these two pieces of the second extension adapter 90b may be removably inserted into an associated section of the adapter receptacle 80 of the second connector 10b, similar to the first and second section of the adapter receptacle 80 shown in Fig. 4.

[0139] The first and the second superconnector 100a, 100b further comprises a superhousing 400, respectively, in which all (or most of) the components of the respective superconnector 100a, 100b may be arranged.

[0140] An ethernet connection cable end portion 200, which may be provided as an end portion of an ethernet connection cable 200', enters the superhousing 400 at connection cable end 113. Said connection cable end 113 is provided as an end of the respective superconnector 100a, 100b against the respective connection direction C1, C2.

[0141] The ethernet connection cable end portion 200 comprises four twisted pairs, namely a first twisted pair 22a, a second twisted pair 22b, a third twisted pair 22c, and a fourth twisted pair 22d. The twisted pairs 22a-d are apportioned to two ethernet cable end portions for the two connectors 10a, 10b.

[0142] Herein, the first and second twisted pair 22a, 22b are guided towards and connected at the cable end 13 of the first connector 10a. The third and fourth twisted pair 22c, 22d are guided towards and connected at the cable end 13 of the second connector 10b.

[0143] The first connector 10a, optionally together with the first extension adapter 90a, is configured to establish an electrical connection for the first and second twisted pair 22a, 22b, i.e., for half of the full ethernet connection. Similarly, the second connector 10b, optionally together with the second extension adapter 90b, is configured to establish an electrical connection for the third and fourth twisted pair 22c, 22d, i.e., for the other half of the full ethernet connection.

[0144] The first connection direction C1 of the first superconnector 100a (indicated by the arrow C1 in Fig. 6) may be a direction in which an electric plug-connection may be established between the first superconnector 100a and, e.g., the mating second superconnector 100b. It may coincide with a connection direction C (cf., e.g., Fig. 1 and 2) of the first and/or second connectors 10a, 10b of the first superconnector 100a.

[0145] The second connection direction C2 of the second superconnector 100b (indicated by the arrow C2) may be a direction in which an electric plug-connection may be established between the second superconnector 100b and, e.g., the mating first superconnector 100a. It may coincide with a connection direction C (cf., e.g., Fig. 1 and 2) of the first and/or second connectors 10a, 10b of the second superconnector 100b.

[0146] The first superconnector 100a and the second superconnector 100b may be provided as mating superconnectors and configured to engage with each other for establishing an ethernet connection, in particular a full ethernet connection. Herein, the first extension adapters 90a of the first and second superconnectors 100a, 100b may be configured to engage with each other, similar as the second extension adapters 90b of the first and second superconnectors 100a, 100b for establishing the ethernet connection.

[0147] In each first connector 10a, the first and second pair shieldings 26a and 26b of the first and second twisted pair 22a and 22b, in particular their respective connection portion 27a, 27b, may be supported by a respective support portion 63a, 63b of the associated inner isolator 60a, 60b. It may be contacted by an associated shielding contact element 39a, 39b of the associated connector shielding 30a, 30b as described above.

[0148] Additionally, in each first connector 10a, the first and second ending contacts 24a, 24b may be electrically connected to removably attached first and second adapter contacts 95a-d provided in the first extension adapter 90a, e.g., indirectly via the first and second extension contacts 70a, 70b.

[0149] Similarly, in each second connector 10b, third and fourth pair shieldings of the third and fourth twisted pair 22c and 22d, in particular their respective connection portion, may be supported by a respective support portion of the associated inner isolator. It may be contacted by an associated shielding contact element of an associated connector shielding as described above.

[0150] And, in each second connector 10b, third and fourth ending contacts of the third and fourth twisted pair 22c, 22d may be electrically connected to removably attached third and fourth adapter contacts provided in the second extension adapter 90b, e.g. indirectly via the third and fourth extension contacts.

[0151] The first superconnector 100a and/or the second superconnector 100b may be provided as truck connectors. Thus, each superconnector 100a, 100b may comprise further electrical contacts arranged within the respective superhousing 400.

[0152] **Figure 7** shows a perspective view of another embodiment of a connector 10. The connector 10 shown in Fig. 7 may comprise similar and/or the same compo-

nents as the connector 10 described with respect to Figs. 1-4. Therefore, the same or similar reference signs are used when describing this embodiment of the connector 10.

[0153] Because most and/or all of the description provided above with respect to the embodiment described with respect to Figs. 1-4 equally applies to the embodiment of the connector 10 shown in Fig. 7, reference is made to the above description.

[0154] In particular, also the connector 10 shown in Fig. 7 may be formed as a circular connector, in particular provided as (at least part of) a vehicle and/or truck connector. The connector 10 substantially extends from a cable end 13 to a connecting end 14 in the connection direction C. The connection direction C is a direction in which an electric plug-connection may be established between the connector 10 and a corresponding connector and/or the extension adapter shown in Figs. 9-10.

[0155] **Figure 8** shows a cross-sectional view of the connector 10 shown in Fig. 7. In contrast to the embodiment shown in Fig. 1, the ethernet cable 20' with its ethernet cable end portion 20 is omitted in Figs. 7 and 8. However, in assembled form, also the connector 10 shown in Figs. 7 and 8 is connected to an ethernet cable 20'. This applies in particular to its extension contacts 70a, 70b and its connector shieldings 30a, 30b.

[0156] Similar as in the embodiment of the connector 10 described above, also the connector 10 shown in Figs. 7 and 8 may comprise the connector housing 40 with the first connector housing component 41 and the second connector housing component 42. It may comprise the outer isolator 50 with the first holding portion 54a and the second holding portion 54ab and the outer isolator components 51, 52 (cf. also Fig. 7). It may also comprise the first inner isolator 60a (comprising, e.g., the first inner isolator component 61a and the second inner isolator component 62a) holding the first extension contacts 70a. It may comprise the second inner isolator 60b (comprising, e.g., the first inner isolator component 61b and the second inner isolator component 62b) holding the second extension contacts 70b. It may comprise the first connector shielding 30a holding the first inner isolator 60a which is holding the first extension contacts 70a. And it may comprise the second connector shielding 30b holding the second inner isolator 60b which is holding the second extension contacts 70b.

[0157] At the first and second shielding end 34a, 34b of the first and second connector shielding 30a, 30b, the ethernet cable end portion 20 is omitted in Fig. 7. Similarly, also its pair shielding 26a; 26b is omitted in Fig. 7. In the assembled state of the connector 10, the first pair shielding 26a, in particular a first contact portion 27a of it (cf. Fig. 3), may be held within a first clamping space 64a arranged between the first support portion 63a of the first inner isolator 60a and the first shielding end 34a of the first connector shielding 30a. The first clamping space 64a may extend around the first support portion 63a and within the first shielding end 34a. It may extend in radial direction, i.e., perpendicular to the connection direction C, from the (radially) outer side of the first support portion 63a to the (radially) inner side of the first shielding end 34a.

[0158] Similarly, in the assembled state of the connector 10, the second pair shielding 26b, in particular a first contact portion 27a of it (cf. Fig. 3), may be held within a second clamping space 64b arranged between the second support portion 63b of the second inner isolator 60b and the second shielding end 34b of the second connector shielding 30b. The second clamping space 64b may extend around the second support portion 63b within the second shielding end 34b. It may extend in radial direction, i.e., perpendicular to the connection direction C, from the (radially) outer side of the second support portion 63b to the (radially) inner side of the second shielding end 34b.

[0159] The width of the clamping space 64a, 64b in radial direction may be dimensioned so that the pair shielding 26a; 26b, in particular the respective contact portion 27a; 27b, is pressed together inside of the clamping space 64a, 64b, respectively. This may ensure the establishment of a stable physical and electrical connection between the respective pair shielding 26a; 26b and the respective connector shielding 30a; 30b in the assembled state of the connector 10.

[0160] The first connector housing component 41 may comprise the connection opening 12 at the connecting end 14 of the connector housing 40. The second connector housing component 42 may comprise the cable opening 11 at the cable end 13 of the connector housing 40.

[0161] The first and second connector housing components 41,42 are statically fixed to each other, thereby forming the connector housing 40 of the connector 10. They may, e.g., be screwed and/or clipsed to each other.

[0162] The first connector housing component 41 is configured to receive and/or hold a mating connector (not shown) for establishing an ethernet connection through and/or at the connection opening 12.

[0163] In particular, the connector housing 40 and/or the first connector housing element 41 may be configured to indirectly receive and/or hold the (not shown) mating connector. In this regard, indirectly may mean that it does not directly contact the mating connector, but that at least one other component is plugged in between. This other component may be provided as the extension adapter 90 shown in Figs. 9-10. Thus, the connector 10 is first extended by the extension adapter 90, and then plugged into the mating connector. It may be plugged directly and/or indirectly into said mating connector. For example, also the mating connector may first be extended by a similar extension adapter, so that the two extension adapters 90 are connected to each other, e.g., by a plug connection.

[0164] At a connection end 36a of the first connector shielding 30a, which is provided as an end facing the connecting end 14, i.e., in connection direction C of the

connector 10, the first connector shielding 30a comprises a plurality of connector shielding protrusions 38a. One or more of the connector shielding protrusions 38a may protrude from the first connector shielding member 31a in connection direction C. One or more of the connector shielding protrusions 38a may protrude from the second connector shielding member 32a in connection direction C.

[0165] Similarly, also at a connection end 36b of the second connector shielding 30b, which is provided as an end facing the connecting end 14, i.e., in connection direction C of the connector 10, the second connector shielding 30b comprises a plurality of connector shielding protrusions 38b. One or more of the connector shielding protrusions 38b may protrude from the first connector shielding member 31b in connection direction C. One or more of the connector shielding protrusions 38b may protrude from the second connector shielding member 32b in connection direction C.

[0166] The at least one separator 53 of the outer isolator 50 separates the first connector shielding 30a and the second connector shielding 30b.

[0167] At the connecting end 14 and/or at the adapter receptacle 80, the connector housing 40 comprises at least one protrusion 82. In the shown embodiment, the connector housing 40 comprises two protrusions 82 extending from the connecting end 14 in connection direction C.

[0168] A shape of the protrusion 82 may follow the outer shape of the (here: circular) housing 40. For example, in inner section of the protrusion 82. may be shaped concave, and/or an outer section of the protrusion 82 may be formed convex. The protrusion 82 may span over from about 3% to about 20%, in particular from about 5% to about 15%, of the outer shape of the connector housing 40, e.g., over from about 10° to about 75° of the circular outer shape of the connector housing 40. Thus, each protrusion 82 may provide a substantial stabilisation function between the connector 10 and the extension adapter 90.

[0169] Two protrusions 82 may be provided at opposite sides of the connection opening 12. This may provide an improved stabilization and/or fixation between the connector 10 and the extension adapter 90.

[0170] Additionally or alternatively to the protrusion 82, the connector 10 may comprise a connection thread 84, e.g., at the connection end 14 of the connector 10. The connection thread 84 may be provided as an outer thread at an outer section of the connector housing 40. The connection thread 84 may be used to establish a secure and/or releasable screwing connection between the connector 10 and the extension adapter 90.

[0171] **Figure 9A** shows a perspective view of an embodiment of an assembled extension adapter 90 when looking at an adapter connecting end 99b of the extension adapter 90. **Figure 9B** shows a perspective view of the extension adapter 90 when looking at a connector end 99a of the extension adapter 90.

[0172] The extension adapter 90 comprises an adapter housing 91 extending substantially from the connector end 99a to the adapter connecting end 99b.

[0173] The extension adapter 90 is configured and designed to be connected to and/or extend the connector 10 shown in Figs. 7 and 8 or the one shown in Figs. 1-5. The connection direction C is consistently indicated in all figures showing the connector 10 and the extension adapter 90.

[0174] The extension adapter 90 is configured as an extension of the connector 10. As such, it may comprise similar components as the connector 10 that extend the components of the connector 10. For these components of the extension adapter 90 being similar to the components of the connector 10, the above description applies equally.

[0175] For example, the extension adapter 90 comprises the adapter housing 91 being configured similar to the housing 40 of the connector 10. The adapter housing 91 comprises and/or holds and/or surrounds a plurality of components of the extension adapter 90.

[0176] From the outside to the inside, the extension adapter 90 may comprise at least some or all of the following components:

- the adapter housing 91,
- an outer adapter isolator 92 arranged within the adapter housing 91,
- a first adapter shielding 96a and/or a second adapter shielding 96b arranged within the outer adapter isolator 92,
- a first inner adapter isolator 94a arranged within the first adapter shielding 96a,
- a second inner adapter isolator 94b arranged within the second adapter shielding 96b,
- two first adapter contacts 95a, 95b arranged within the first inner adapter isolator 94a, and
- two second adapter contacts 95c, 95d arranged within the second inner adapter isolator 94b.

[0177] Therein, the adapter housing 91 of the extension adapter 90 extends and may have similar functions as the housing 40 of the connector 10. The outer adapter isolator 92 of the extension adapter 90 extends and may have similar functions as the outer isolator 50 of the connector 10. The first adapter shielding 96a of the extension adapter 90 extends and may have similar functions as the first connector shielding 30a of the connector 10. Indeed, the first adapter shielding 96a may be electrically coupled to the first connector shielding 30a so that they share the electrical potential. The second adapter shielding 96b of the extension adapter 90 extends and may have similar functions as the second connector shielding 30b of the connector 10. Also here, the second adapter shielding 96b may be electrically coupled to the second connector shielding 30b so that they share the electrical potential. The first inner adapter isolator 94a of the extension adapter 90 extends and may have similar

functions as the first inner isolator 60a of the connector 10. The second inner adapter isolator 94b of the extension adapter 90 extends and may have similar functions as the first inner isolator 60b of the connector 10.

[0178] The two first adapter contacts 95a, 95b may be electrically coupled to the two first extension contacts 70a, respectively, so that they may conduct signals from the two first ending contacts 24a of the first twisted pair 22a (cf. Fig. 2). The two second adapter contacts 95c, 95d may be electrically coupled to the two second extension contacts 70b, respectively, so that they may conduct signals from the two second ending contacts 24b of the second twisted pair 22b (cf. Fig. 2).

[0179] In an assembled operating state, the extension adapter 90 is fixed to the connector 10 so that it may be considered as a component of the connector 10. Then, the connector end 99a of the extension adapter 90 is facing the connecting end 14 of the connector 10 and the adapter connecting end 99b provides an end opposite the ethernet cable 20 for being connected by a mating connector.

[0180] In the shown embodiment, all adapter contacts 95a-d are configured as male adapter contacts. Thus, whenever the extension adapter 90 is extending the connector 10 in its assembled operating state, the connector 10 (including the extension adapter 90) is configured as connector comprising only male contacts. However, in different embodiments with similar extension adapters, the adapter contacts may all be configured as female contacts, or any mix of male and female contacts.

[0181] Similar as in the connector 10, also the outer adapter isolator 92 and/or the inner adapter isolators 94a, 94b may comprise and/or consist of two or more inner/-outer isolator components.

[0182] Similar as in the connector 10, also the two adapter shielings 96a, 96b of the extension adapter 90 may comprise and/or consists of two or more adapter shielding components.

[0183] **Figure 10** shows a cross-sectional view of the extension adapter 90 of Figures 9A and 9B. Therein, it is shown that the adapter housing 91 may comprise a first adapter housing component 91a at the adapter connecting end 99b and a second adapter housing component 91b at the connector end 99a.

[0184] The two adapter housing components 91a, 91b may be connected via connecting means, e.g., an adapter ring 98d configured as a clamping ring. A second adapter seal 98b may seal a connection between the two adapter housing components 91a, 91b from fluids and/or dirt.

[0185] The adapter contacts 95a-d, of which only the two first adapter contacts 95a-b are shown in Fig. 10, may extend throughout the whole extension adapter 90. At the adapter connecting end 99b, they protrude from their respective inner adapter isolator (in Fig. 10: the first inner adapter isolator 94a) as either male or female contacts. In the shown embodiment, they extend as male contacts. At the connector end 99a of the extension adapter 90, they are configured to electrically couple to the extension contacts 70a, 70b of the connector 10 (cf. Fig. 8).

[0186] As shown in Fig. 9B and 10, the extension adapter 90 may comprise an inner adapter thread 97a and/or at least one adapter recess 97 at its connector end 99a. In an assembled operating state, the protrusion(s) 82 of the connector 10 (cf. Figs. 7-8) may be inserted into the adapter recess(es) 97 of the extension adapter 90. In an assembled operating state, the adapter thread 97a may be screwed to the connection thread 84 of the connector 10 (cf. Figs. 7-8). In an assembled operating state, the connector shielding protrusion(s) 38a, 38b may be pressed onto the adapter shielding(s) 96a, 96b, respectively, to establish an electrical connection.

[0187] The connection between the connector 10 and the extension adapter 90 may be protected from fluids and/or dirt by a connector seal 85 (cf. Fig. 8). Additionally, it may be statically improved by an adapter collar 98e of the extension adapter 90 into which the housing 40 of the connector 10 is at least partially inserted during assembly. Alternatively, the collar and/or the seal may be provided at the respective other component, so that at least one of the connector 10 and/or the extension adapter 90 may comprise a seal and/or a collar to improve the connection.

[0188] In the assembled operating state, the extension adapter 90 is, thus, mounted to the adapter receptable 80 of the connector 10 so that its contacts are configured as provided by the extension adapter 90 (in the shown embodiment: as male contacts). However, the extension adapter 90 is removably mounted and/or fixed to the connector 10, so that it may be exchanged, e.g., whenever it is damaged. It may also be exchanged in case other types of contacts are desired. Thus, whenever a different extension adapter 90 is mounted to the connector 10, different types of contacts may be mounted to the connector 10. Thus, the connector 10 is highly configurable, so that any customer may choose the kinds of contacts he requires and/or desires.

[0189] At its adapter connecting end 99b, the extension adapter 90 may comprise a first adapter seal 98a held in a groove and/or by an adapter bulge 98c. The first adapter seal may protect the connection between the extension adapter 90 and the mating connector from fluids and/or dirt.

[0190] Each or any of the seals 85, 98a, 98b may be provided as an O-ring.

List of Reference Numerals

[0191]

10	connector
10a	first connector
10b	second connector
11	cable opening
12	connection opening

13	cable end
14	connecting end
20	ethernet cable end portion
20'	ethernet cable
22a	first twisted pair
22b	second twisted pair
22c	third twisted pair
22d	fourth twisted pair
23a	first wire
23b	second wire
24a	first ending contact
24b	second ending contact
26a	first pair shielding
26b	second pair shielding
27a	first contact portion
27b	second contact portion
28	twisted pair isolator
28a	first twisted pair isolator component
28b	second twisted pair isolator component
29	cable casing
29a	first cable casing component
29b	second cable casing component
30a	first connector shielding
30b	second connector shielding
31a, 31b	first connector shielding member
32a, 32b	second connector shielding member
34a, 34b	shielding end
36a, 36b	connection end
38a	first connector shielding protrusion
38b	second connector shielding protrusion
39a	first shielding contact element
39b	second shielding contact element
40	connector housing
41	first connector housing component
42	second connector housing component
50	outer isolator
51, 52	outer isolator component
53	separator
54a	first holding portion
54b	second holding portion
55	engagement element
60a	first inner isolator
60b	second inner isolator
61a, 61b	first inner isolator component
62a, 62b	second inner isolator component
63a	first support portion
63b	second support portion
64a	first clamping space
64b	second clamping space
70a	first extension contact
70b	second extension contact
80	adapter receptacle
82	protrusion
83a	first adapter groove
83b	second adapter groove
84	connection thread
90	extension adapter
90a	first extension adapter
90b	second extension adapter
91	adapter housing
91a	first adapter housing component
91b	second adapter housing component
92	outer adapter isolator
93	adapter separator
94a	first inner adapter isolator
94b	second inner adapter isolator
95a	adapter contact
95b	adapter contact
95c	adapter contact
95d	adapter contact
96a	first adapter shielding
96b	second adapter shielding
97	adapter recess
97a	adapter thread
98	adapter connection opening
98a	first adapter seal
98b	second adapter seal
98c	adapter bulge
98d	adapter ring
98e	adapter collar
99a	connector end
99b	adapter connecting end
100a	first superconnector
100b	second superconnector
113	connection cable end
200	ethernet connection cable
200'	ethernet connection cable end portion
400	superhousing
C	connection direction
C1	first connection direction
C2	second connection direction

Claims

1. Connector (10; 10a; 10b) for establishing an ethernet connection comprising:

- a connector housing (40);
- an ethernet cable end portion (20) entering the connector housing (40) at a cable end (13) of the connector (10) and comprising:

  - at least one twisted pair (22a; 22b; 22c; 22d) with two ending contacts (24a; 24b), and
  - a pair shielding (26a; 26b) shielding the twisted pair (22a; 22b; 22c; 22d) and comprising conductive and/or magnetic material;

- at least one connector shielding (30a; 30b) arranged in the connector housing (40), comprising conductive and/or magnetic material, contacting the pair shielding (26a; 26b) of the twisted pair (22a; 22b; 22c; 22d), and at least partially enclosing the ending contacts (24a;

24b) of the twisted pair (22a; 22b; 22c; 22d); and
- an inner isolator (60a; 60b) at least partially arranged in the connector shielding (30a; 30b) and isolating and/or holding the ending contacts (24a; 24b) of the twisted pair (22a; 22b; 22c; 22d);

wherein:

- a contact portion (27a; 27b) of the pair shielding (26a; 26b) is supported by a support portion (63a; 63b) of the inner isolator (60a; 60b) and held between the support portion (63a; 63b) and the connector shielding (30a; 30b).

2. Connector (10) according to claim 1, wherein the contact portion (27a; 27b) of the pair shielding (27a; 27b) is arranged in a press fit between the support portion (63a; 63b) and the connector shielding (30a; 30b).

3. Connector (10) according to claim 1 or 2, wherein the support potion (63a; 63b) of the inner isolator (60a; 60b) is supporting the contact portion (27a; 27b) of the pair shielding (26a; 26b) from a radial inner position and/or wherein the support potion (63a; 63b) of the inner isolator (60a; 60b) is arranged between isolations of the twisted pair (22a; 22b; 22c; 22d) and the contact portion (27a; 27b) of the pair shielding (26a; 26b).

4. Connector (10) according to any of the preceding claims, wherein the support potion (63a; 63b) of the inner isolator (60a; 60b) is tapered towards the cable end (13) of the connector (10).

5. Connector (10) according to any of the preceding claims, wherein the support potion (63a; 63b) of the inner isolator (60a; 60b) is provided as a thin protrusion protruding from a main body of the inner isolator (60a; 60b) towards the cable end (13) of the connector (10).

6. Connector (10) according to any of the preceding claims, wherein at least the contact portion (27a; 27b) of the pair shielding (26a; 26b) is provided from a flexible material, in particular from a foil and/or a mylar and/or a wire mesh.

7. Connector (10) according to claim 6, wherein the contact portion (27a; 27b) of the pair shielding (26a; 26b) is turned up onto itself.

8. Connector (10) according to claim 6 or 7, wherein the contact portion (27a; 27b) of the pair shielding (26a; 26b), in particular the turned up contact portion (27a; 27b), is superimposed over the support potion (63a; 63b) of the inner isolator (60a; 60b).

9. Connector (10) according to any of the preceding claims, wherein the connector shielding (30a; 30b) comprises a shielding contact element (39a; 39b) contacting the contact portion (27a; 27b) of the pair shielding (26a; 26b).

10. Connector (10) according to claim 9, wherein the shielding contact element (39a; 39b) is protruding from the connector shielding (30a; 30b) towards the cable end (13) of the connector (10).

11. Connector (10) according to claim 9 or 10, wherein the shielding contact element (39a; 39b) is springily pressed onto the contact portion (27a; 27b) of the pair shielding (26a; 26b).

12. Connector (10) according to claim 11, wherein the support portion (63a; 63b) of the inner isolator (60a; 60b) holds the contact portion (27a; 27b) of the pair shielding (26a; 26b) in place against a spring force and/or pressing force of the shielding contact element (39a; 39b).

13. Connector (10) according to any of the preceding claims, wherein:

- the ethernet cable end portion (20) comprises a plurality of twisted pairs (22a; 22b; 22c; 22d) with two ending contacts (24a; 24b), respectively, and a pair shielding (26a; 26b) for each twisted pair (22a; 22b; 22c; 22d);
- a plurality of connector shieldings (30a; 30b) being arranged in the connector housing (40), each of which at least partially enclosing ending contacts (24a; 24b) of one associated of the twisted pairs (22a; 22b; 22c; 22d), respectively, and contacting the pair shielding (26a; 26b) of the associated twisted pair (22a; 22b; 22c; 22d);
- a plurality of inner isolators (60a; 60b), each being at least partially arranged in one of the connector shieldings (30a; 30b) and isolating and/or holding the associated ending contacts (24a; 24b) of the twisted pair (22a; 22b; 22c; 22d), respectively;

wherein:

- each pair shielding (26a; 26b) comprises a contact portion (27a; 27b) supported by an associated support portion (63a; 63b) of the associated inner isolator (60a; 60b) and is held between the associated support portion (63a; 63b) and the associated connector shielding (30a; 30b).

14. Superconnector (100a; 100b) for establishing an ethernet connection comprising:

- a superhousing (400) in which two connectors (10a, 10b) according to any one of the claims 1 to 13 are arranged; and
- an ethernet connection cable end portion comprising four twisted pairs (22a, 22b, 22c, 22d) apportioned to the two ethernet cable end portions (20) of the connectors (10a, 10b).

15. Method for assembling a connector (10; 10a; 10b) for establishing an ethernet connection comprising the steps:

- providing a connector housing (40);
- arranging an ethernet cable end portion (20) so that it enters the connector housing (40) at a cable end (13) of the connector (10), wherein the ethernet cable end portion (20) comprises:

  - at least one twisted pair (22a; 22b; 22c; 22d) with two ending contacts (24a; 24b), and
  - a pair shielding (26a; 26b) shielding the twisted pair (22a; 22b; 22c; 22d) and comprising conductive and/or magnetic material;

- arranging at least one connector shielding (30a; 30b) in the connector housing (40) so that it contacts the pair shielding (26a; 26b) of the twisted pair (22a; 22b; 22c; 22d) and at least partially encloses the ending contacts (24a; 24b) of the twisted pair (22a; 22b; 22c; 22d);
- arranging an inner isolator (60a; 60b) at least partially in the connector shielding (30a; 30b) so that it isolates and/or holds the ending contacts (24a; 24b) of the twisted pair (22a; 22b; 22c; 22d); and
- arranging a contact portion (27a; 27b) of the pair shielding (26a; 26b) so that it is supported by a support portion (63a; 63b) of the inner isolator (60a; 60b) and held between the support portion (63a; 63b) and the connector shielding (30a; 30b).

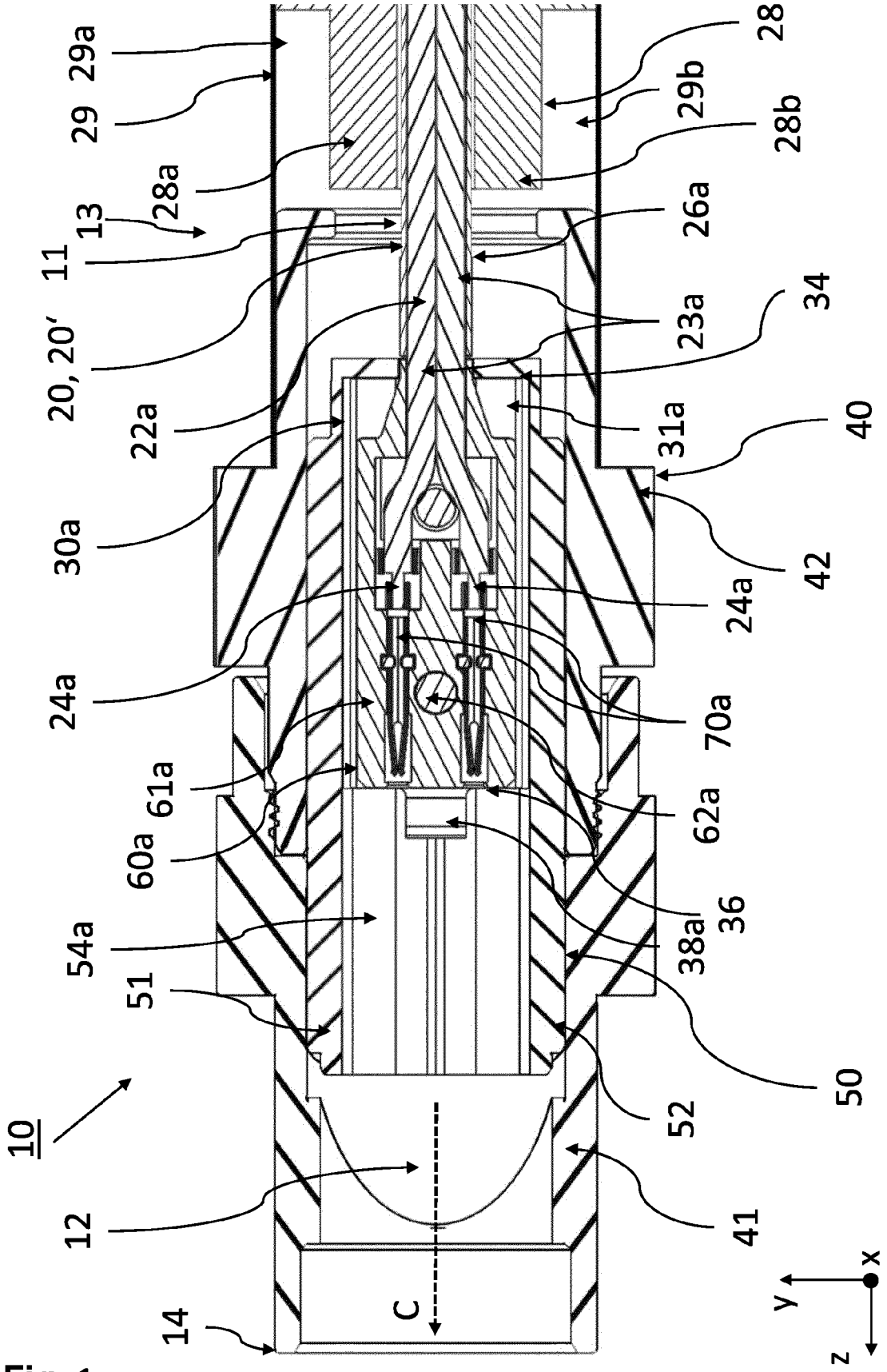
29a
29
28
29b
28b
28a
13
26a
11
20, 20'
23a
34
22a
31a
40
30a
42
24a
24a
70a
61a
62a
60a
36
38a
54a
51
50
10
52
12
41
14
C
x
y
z

Fig. 1

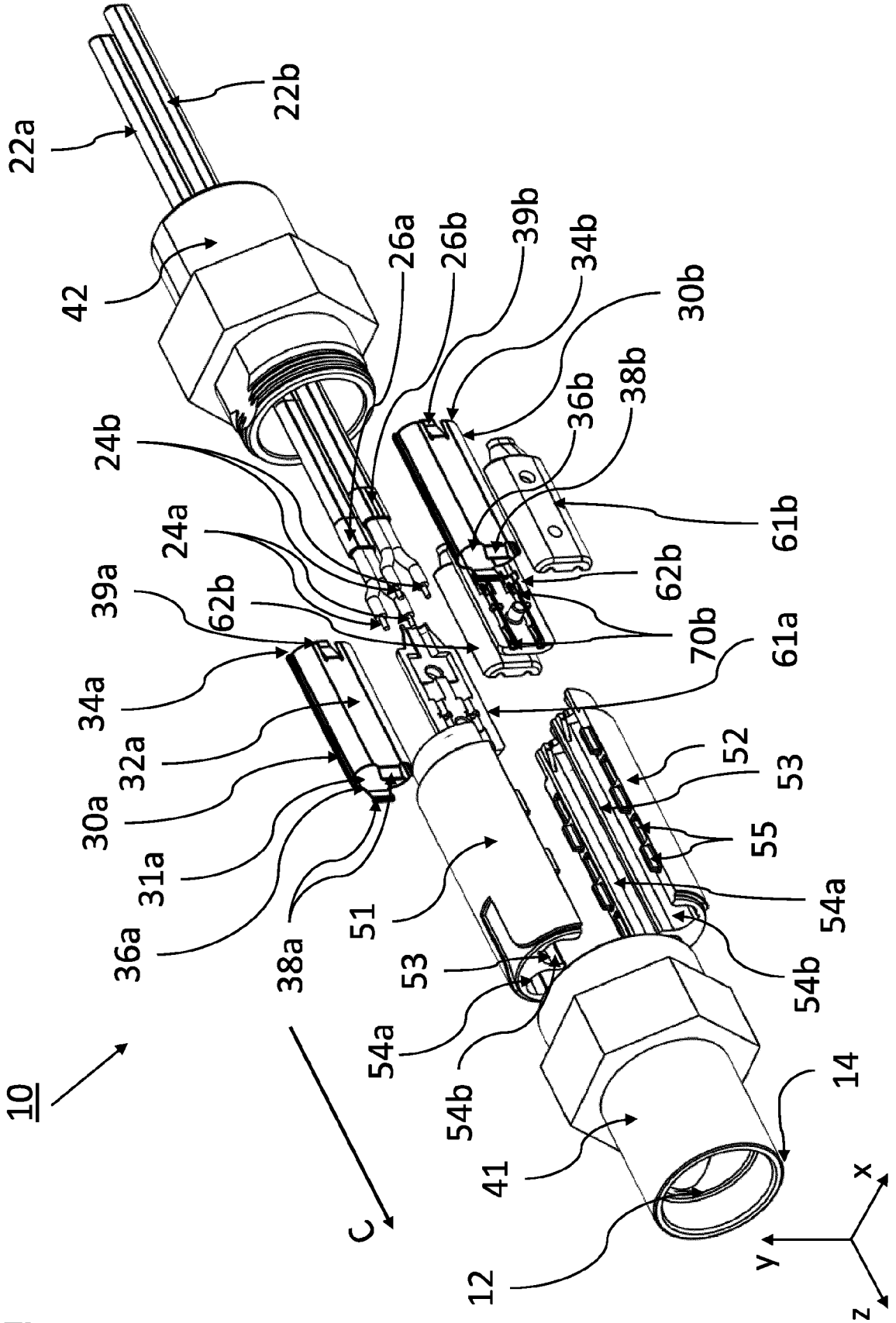
22a
22b
42
26a
26b
39b
34b
30b
36b
38b
24b
24a
61b
62b
39a
62b
70b
61a
34a
32a
30a
31a
36a
38a
51
53
54a
54b
52
53
55
54a
54b
14
41
12
C
10
x
y
z

Fig. 2

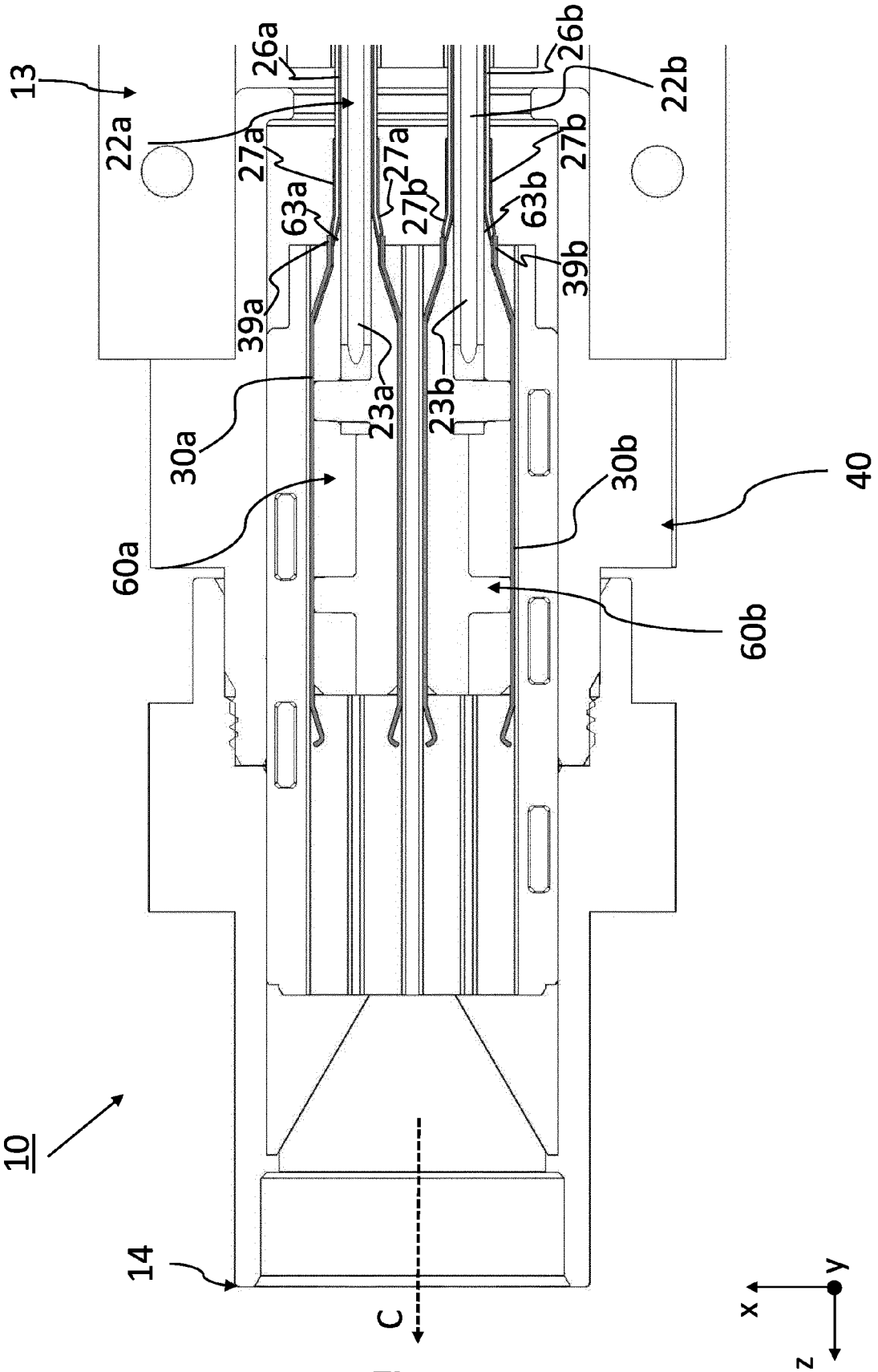
13
22a
26a
26b
22b
27a
27a
27b
27b
63a
63b
39a
39b
23a
23b
30a
30b
40
60a
60b
10
14
C
x
y
z

Fig. 3

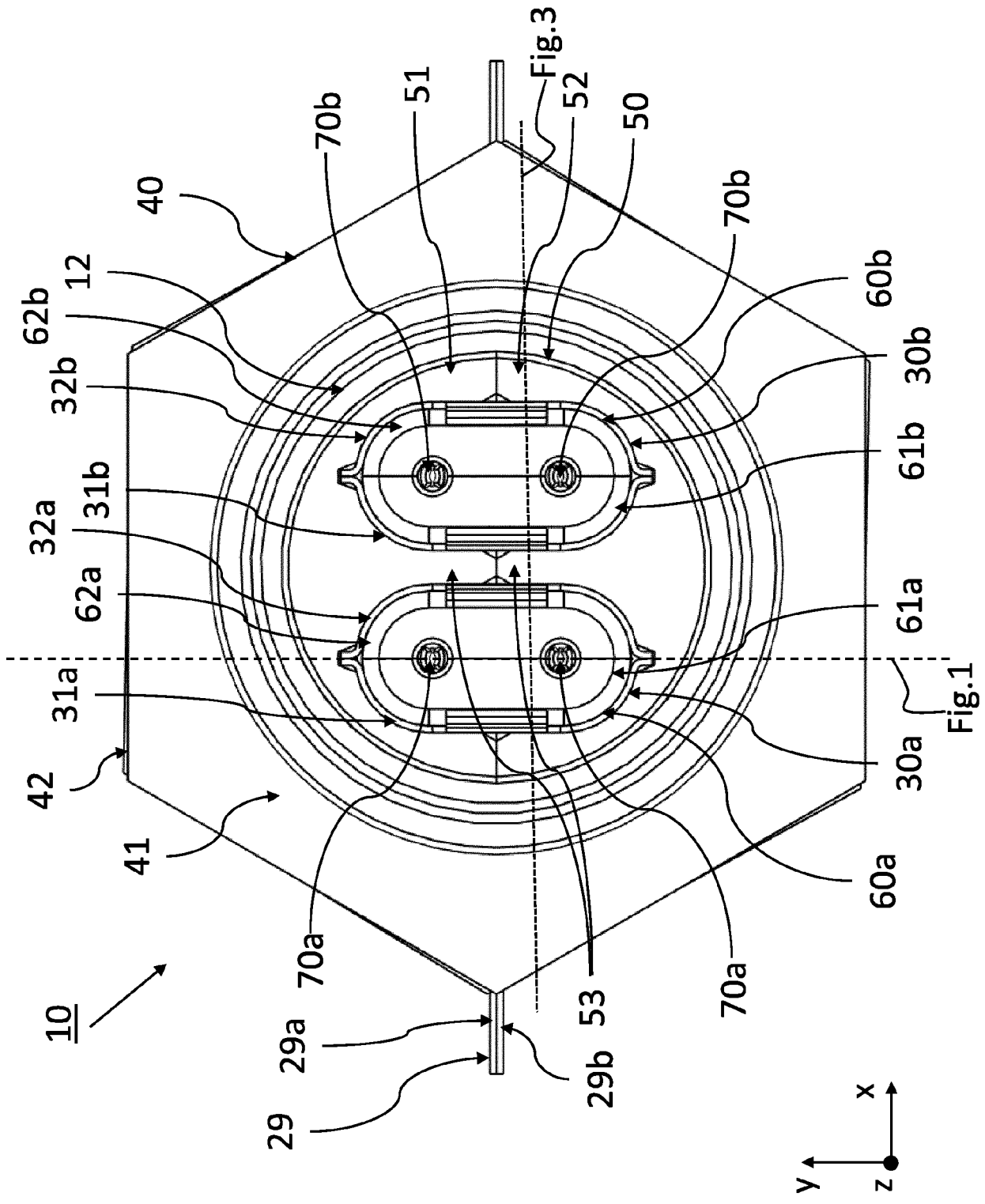
Fig.3
Fig.1
10
12
29
29a
29b
30a
30b
31a
31b
32a
32b
40
41
42
50
51
52
53
60a
60b
61a
61b
62a
62b
70a
70b
x
y
z

Fig. 4

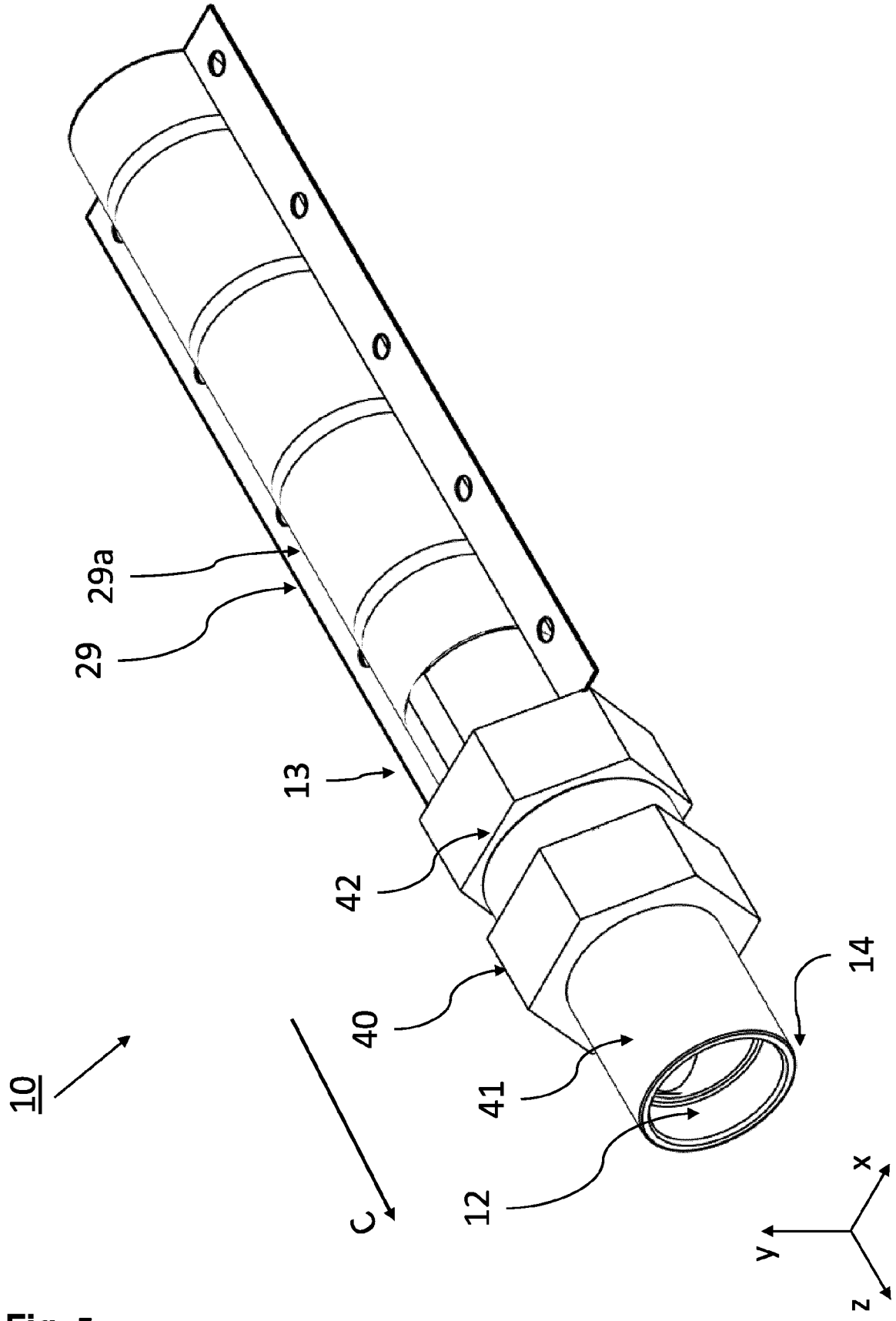

Fig. 5

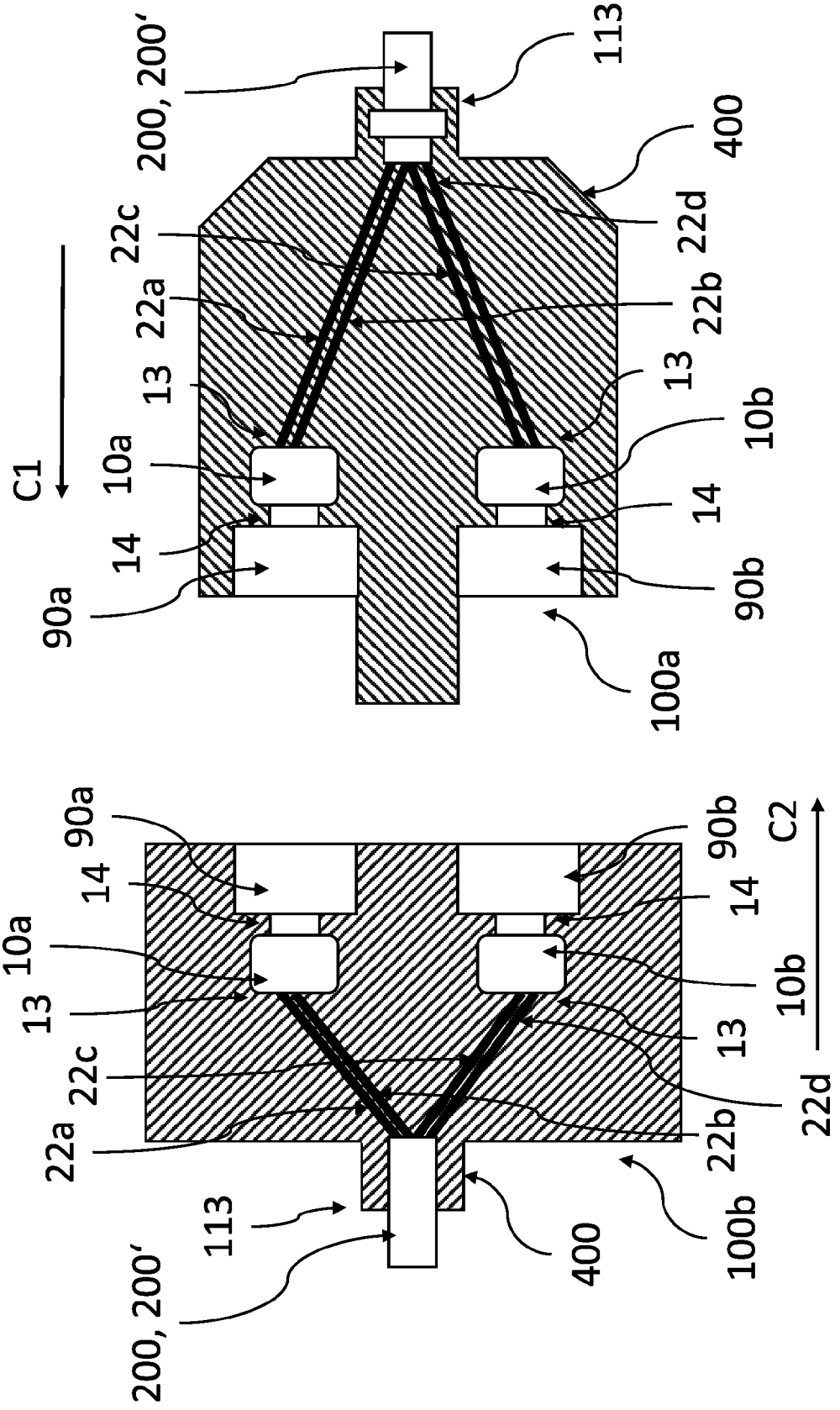
200, 200'
113
400
22c
22d
22a
22b
13
13
10a
10b
C1
14
14
90a
90b
100a
90a
14
90b
C2
10a
14
10b
13
13
22c
22d
22a
22b
113
100b
400
200, 200'

Fig. 6

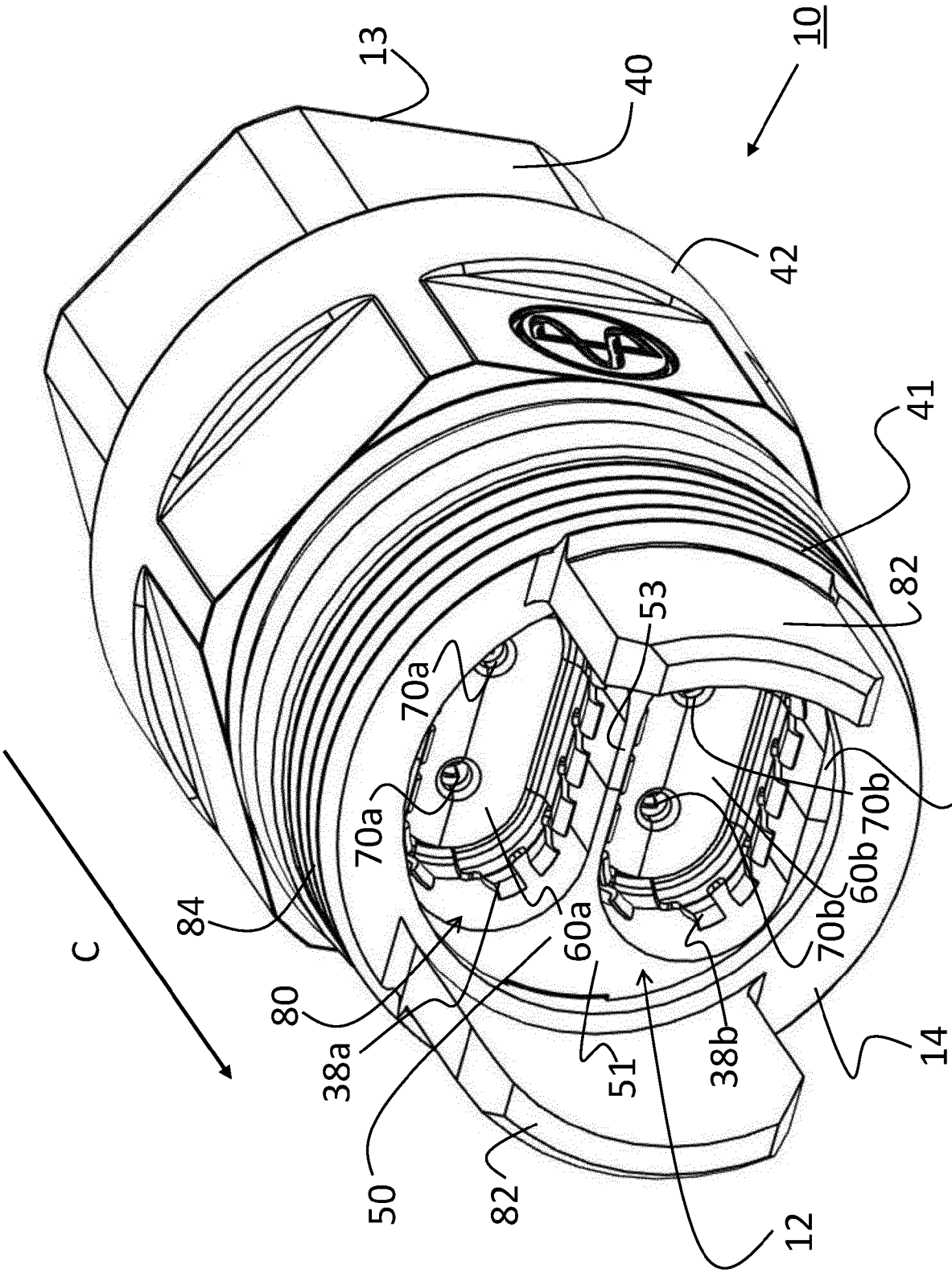
10
13
40
42
41
82
53
52
70a
70a
70b
60b
70b
60a
84
80
38a
51
38b
14
50
82
12
C

Fig. 7

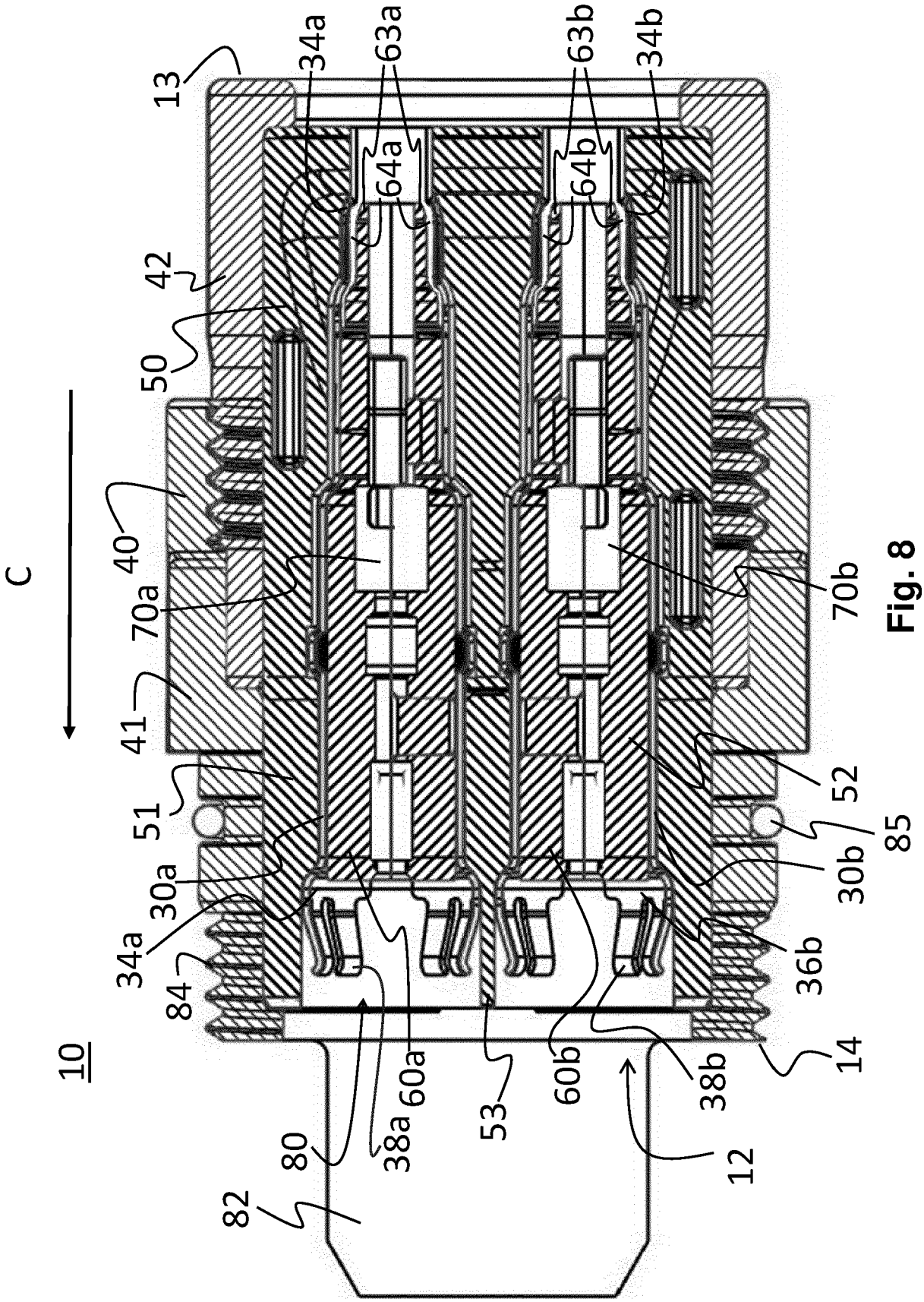
C
10
13
34a
63a
63b
34b
64a
64b
42
50
40
70a
70b
41
51
52
85
30a
30b
34a
84
36b
14
60a
60b
38a
38b
53
80
12
82

Fig. 8

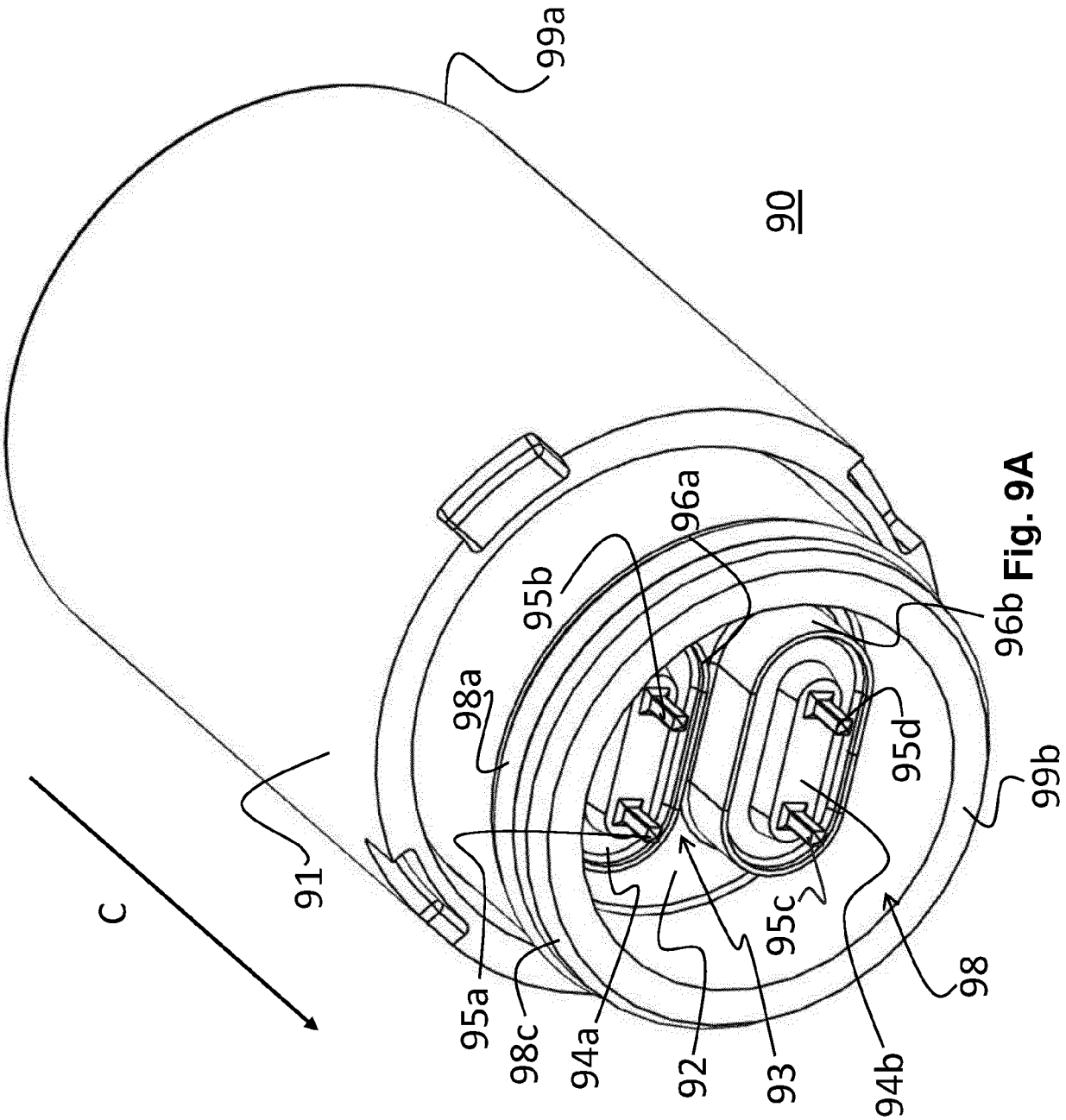

Fig. 9A

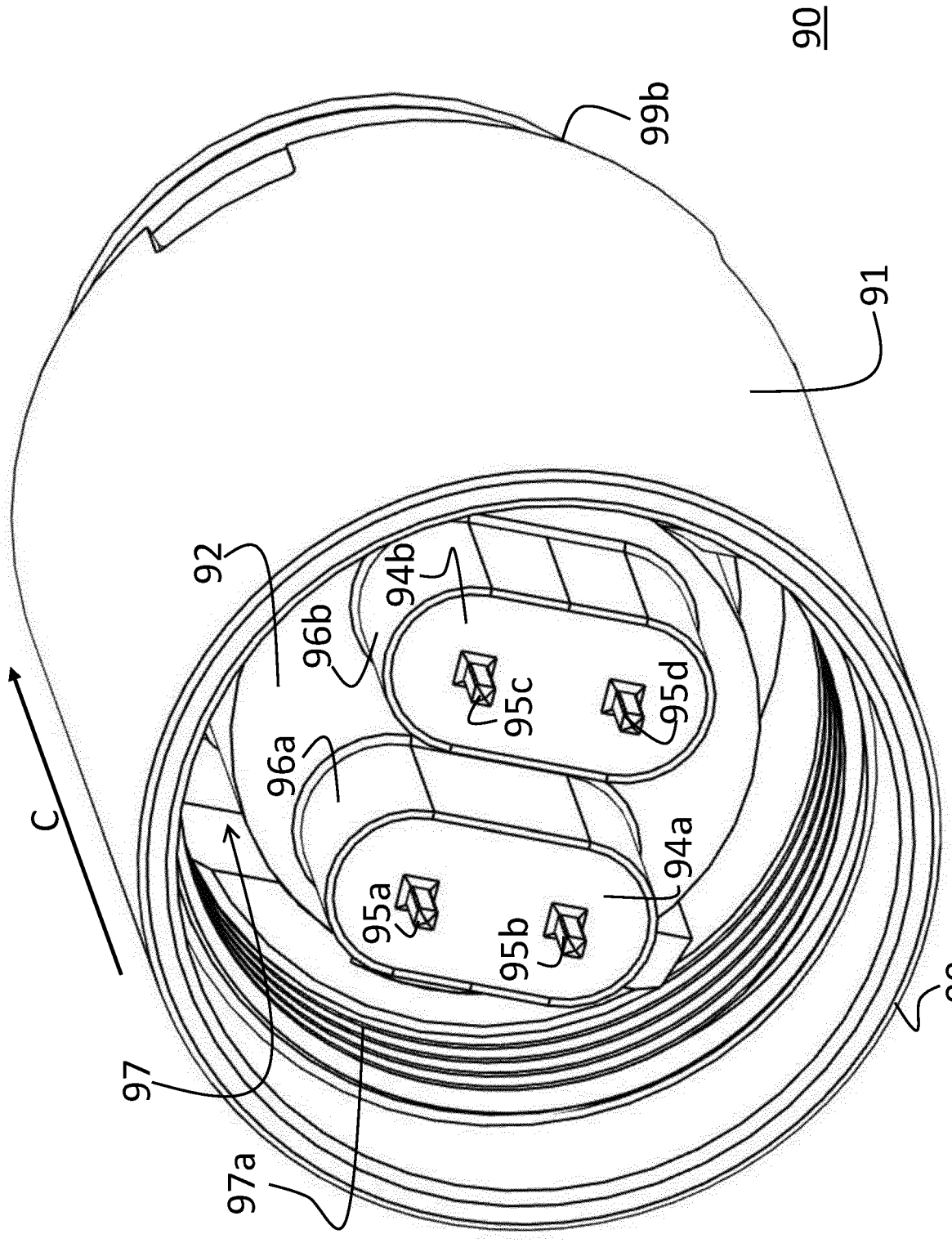

Fig. 9B

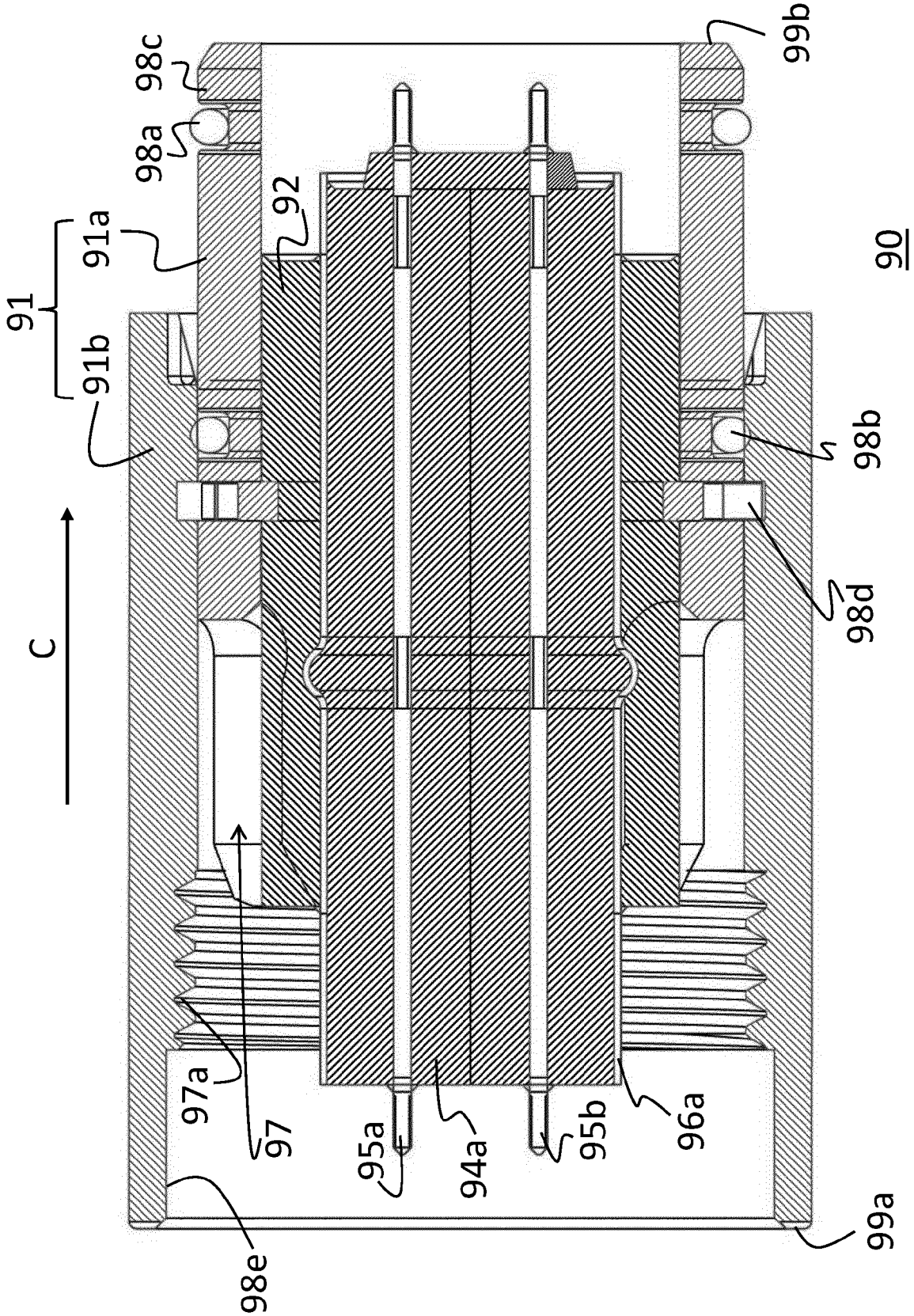
99b
98c
98a
92
91a
91
91b
90
98b
98d
C
97a
97
95a
94a
95b
96a
98e
99a

Fig. 10

Europäisches Patentamt
European Patent Office
Office européen des brevets

EUROPEAN SEARCH REPORT

Application Number
EP 23 20 4727

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	EP 0 350 835 A2 (GORE W L & ASS GMBH [DE]) 17 January 1990 (1990-01-17)	1-6,15	INV. H01R13/6591
Y	* abstract; figures 3,4,5 *	7-14	H01R24/58 H05K9/00
Y	US 2023/261422 A1 (MAESOBA HIROYOSHI [JP] ET AL) 17 August 2023 (2023-08-17)	7,8	ADD.
A	* abstract; figures 1,2,3,4,5 *	1-6,9-15	H01R13/6598
Y	US 8 337 238 B2 (TOBEY SHAWN PHILLIP [US]; BURWELL ROBERT JEFFREY [US] ET AL.) 25 December 2012 (2012-12-25)	13,14	
A	* abstract; figures 3,4 *	1-12,15	
Y	US 4 509 816 A (FREITAG WOLFGANG [DE]) 9 April 1985 (1985-04-09)	9-12	
A	* abstract; figures 1,2,3,4 *	1-8, 13-15	

TECHNICAL FIELDS SEARCHED (IPC)

H01R
H05K

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	15 March 2024	Skaloumpakas, K

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
Y : particularly relevant if combined with another document of the same category
A : technological background
O : non-written disclosure
P : intermediate document

T : theory or principle underlying the invention
E : earlier patent document, but published on, or after the filing date
D : document cited in the application
L : document cited for other reasons

& : member of the same patent family, corresponding document

EPO FORM 1503 03.82 (P04C01)

ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 23 20 4727

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.

15-03-2024

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
EP 0350835 A2	17-01-1990	AU 3786089 A	25-01-1990
		DE 3823617 A1	18-01-1990
		EP 0350835 A2	17-01-1990
		JP H02132781 A	22-05-1990
US 2023261422 A1	17-08-2023	CN 116057789 A	02-05-2023
		JP 2022047631 A	25-03-2022
		US 2023261422 A1	17-08-2023
		WO 2022054455 A1	17-03-2022
US 8337238 B2	25-12-2012	EP 2410620 A1	25-01-2012
		ES 2571353 T3	24-05-2016
		US 2012015551 A1	19-01-2012
US 4509816 A	09-04-1985	NONE	

EPO FORM P0459

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