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(54) **CONNECTOR FOR ESTABLISHING AN ETHERNET CONNECTION AND ETHERNET CABLE**

(57) Connector (10; 10a; 10b) for establishing an ethernet connection comprising an ethernet cable end portion (20) comprising at least two twisted pairs (22a, 22b). Each twisted pair (22a, 22b) comprises two ending contacts (24a, 24b). The ethernet cable end portion (20) further comprises a pair shielding (26a, 26b) for each twisted pair (22a, 22b) comprising conductive and/or magnetic material. The connector (10) further comprises a connector housing (40) in which the ending contacts (24a, 24b) are arranged and at least two connector shieldings (30a, 30b) arranged in the connector housing (40) and comprising conductive and/or magnetic material. In each connector shielding (30a, 30b), the ending contacts (24a, 24b) of at least one of the twisted pairs (22a, 22b) are arranged so that the connector shielding (30a, 30b) at least partially encloses the ending contacts (24a, 24b) arranged therein. Each connector shielding (30a, 30b) contacts the pair shielding (26a, 26b) of the at least one twisted pair (22a, 22b) comprising the ending contacts (24a, 24b) enclosed by the respective connector shielding (30a, 30b). Further, the connector shieldings (30a, 30b) are arranged separately and out of contact from each other within the connector housing (40).

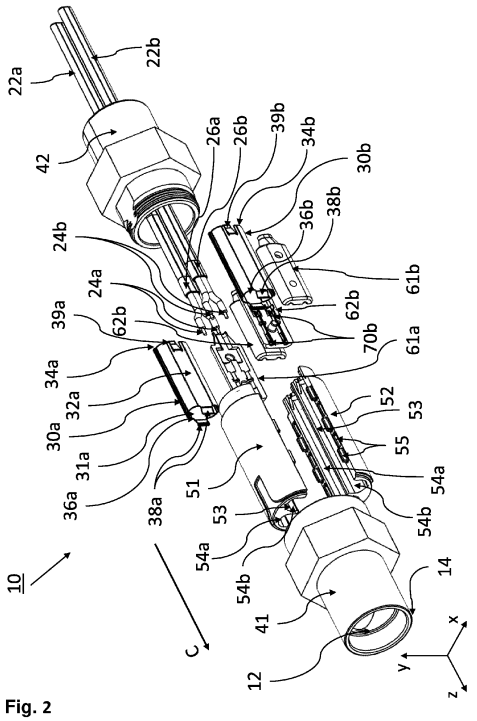


Fig. 2

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## Description

**[0001]** The claimed invention relates to a connector for establishing an ethernet connection and an ethernet cable.

**[0002]** Ethernet connection cables and connectors can be used in various environments and networks for establishing ethernet connection. Examples for such environments can be facilities such as factories or offices. However, ethernet connections may also be established within transport vehicles such as cars 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]** In order to reduce or prevent electromagnetic interference which may lead to a deterioration of the functionality, in particular data transfer, of the ethernet connection, ethernet connectors and ethernet connection cables can be provided with a shielding. One type of cable which can be used 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 the 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 can be regions with 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, new vehicles can comprise an increased 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, can be deteriorated.

**[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 of the invention to provide a connector enabling an increased data throughput and/or an improved and/or reliable shielding.

**[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 with an ethernet cable end portion comprising at least two twisted pairs, wherein each twisted pair comprises two ending contacts, and a pair shielding for each twisted pair comprising conductive and/or magnetic material. The connector further comprises a connector housing in which the ending contacts are arranged and at least two connector shieldings arranged in the connector housing and comprising conductive and/or magnetic material. In each connector shielding, the 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. Each connector shielding contacts the pair shielding of the at least one twisted pair comprising the ending contacts enclosed by the respective connector shielding and the connector shieldings are arranged separately and out of contact, in particular out of physical and/or electrical contact, from each other within the connector housing.

**[0010]** In this context, the term "ethernet cable" may describe a cable that can be used for at least partially establishing an ethernet connection. The ethernet cable end portion can be an end portion of an ethernet cable comprising, e.g., two or four twisted pairs. Two ethernet cables, each comprising two twisted pairs, can be combined to provide an ethernet connection cable comprising the usual four twisted pairs.

**[0011]** The term "twisted pair" may refer to two conducting wires at least partially twisted around each other, each of the wires being encased in an isolator, respectively.

**[0012]** The ending contacts of the twisted pair may be provided as ending portions of the wires of the twisted pair. The ending contact can be arranged inside of the connector, and it can be at least partially stripped from its isolator.

**[0013]** The term "out of contact" may describe a state in

which at least two objects are out of, in particular direct, physical and/or electronical contact. In other words, there may be no direct contact between the at least two, in particular conductive and/or magnetic, objects enabling a conductive connection between the at least two objects. Furthermore, there may also be no indirect, e.g., electrical, contact between the two objects.

**[0014]** The connector may be formed as a circular connector. This may enable a symmetric, in particular axis symmetric (with respect to a common symmetry axis, particularly in connection direction of the connector), arrangement of the connector shieldings, which can enable a more homogenic shielding from electromagnetic interference.

**[0015]** The connector may, e.g., be formed as a plug connector or a socket connector comprising male and/or female contacts.

**[0016]** Alternatively, the connector can be formed as a transformable connector, wherein the transformable connector comprises at least one receptacle element configured to releasably engage with at least one connection element and/or an adapter contact. The connection element may comprise the adapter contact. The connection element may be formed as a plug element or a socket element. The adapter contact may be provided as a male or female adapter contact. Thus, the kind of contacts the connector comprises may be transformed and/or exchanged and/or configured as desired. Each ending contact of the connector formed as a transformable connector may comprise one adapter contact. 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.

**[0017]** The connector housing can comprise a connection opening and/or a cable opening. The connection opening can 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 can be inserted such that said two connectors engage and establish electric contact.

**[0018]** The cable opening can 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 a 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 can be configured such that the ending contacts contact ending contacts of the mating connector.

**[0019]** In each connector shielding, the 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. In other words, the ending contacts of at least two of the twisted pairs are shielded individually. Thereby, the ending contacts of the at least one of the twisted pairs arranged within the respective connector shielding can be reliably and effectively shielded from electromagnetic interference within the connector. The individual shielding of the twisted pair may also increase the data throughput by reducing noise and/or interference. This may also reduce interference caused by currents induced within the individual connector shieldings.

**[0020]** Each connector shielding contacts the pair shielding of the at least one twisted pair comprising the ending contacts enclosed by the respective connector shielding. Thereby, the respective connector shielding and the pair shielding of the at least one twisted pair contacted by the respective connector shielding can share a common electrical potential. This can enable a continuous shielding of the twisted pairs within the ethernet cable end portion and the ending contacts within the connector housing. Thereby, both the twisted pairs and the ending contacts can be more reliably and effectively shielded from electromagnetic interference.

**[0021]** The connector shieldings are arranged separately and out of contact, in particular out of physical and/or electrical contact, from each other within at least the connector housing. In other words, the connector shieldings do not directly physically and/or electronically contact each other. They may be separated by an isolator establishing and/or enabling the separate arrangement. Thereby, the connector shieldings only share the electrical potential of the respectively contacted at least one pair shielding. This can enable a more reliable and effective shielding of the ending contacts and the twisted pairs within the connector, in particular within the connector housing and within the ethernet cable end portion.

**[0022]** In other words, each connector shielding may only be in contact with its associated pair shielding, namely the pair shielding of the associated twisted pair, but not with the with other connector shielding and/or with the other (not associated) pair shielding of the other (not associated) twisted pair.

**[0023]** The connector may further comprise an outer connector shielding, e.g., a die-cast. The ethernet cable end portion can further comprise an outer cable shielding, e.g., a cable braid. The outer connector shielding can at least partially enclose the at least two connector shieldings. It can be arranged within the connector housing and out of contact, in particular out of physical and/or electrical contact, from the at least two connector shieldings. The outer cable shielding can at least partially enclose the pair shieldings 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 shieldings of the at least two twisted pairs. Thereby, the twisted pairs and the

ending contacts can be additionally shielded from electromagnetic interference. This configuration can enable a more reliable and effective shielding of the twisted pairs and the ending contacts within the connector.

**[0024]** The outer connector shielding and the outer cable shielding can contact each other. Within the connector, both outer connector shielding and the and at least two connector shieldings may be isolated from other, e.g. by an outer isolator. This enables an outer isolated general GND to each twisted couple GND, using the proper cable configuration. Therein, the ethernet cable end may comprise a separate pair shielding (e.g., a mylar) for each twisted pair, surrounded by an inner cable isolation, surrounded by a conductive outer cable shielding (e.g., a cable braid), surrounded by an outer cable isolator. Therein, the outer connector shielding and the outer cable shielding can share a common electrical potential. This can further enable a continuous shielding of the twisted pairs within the ethernet cable end portion and the ending contacts within the connector housing. Thereby, both the twisted pairs and the ending contacts can be more reliably and effectively shielded from electromagnetic interference.

**[0025]** The connector can be formed as and/or comprised in a vehicle connector, wherein the vehicle connector is a connector for establishing 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 ethernet connection between the at least two modules or components of the vehicle can be shielded more reliable and efficient from electromagnetic interference. Accordingly, the connector may enable avoiding and/or reducing deterioration of the functionality of the ethernet connection and, in particular, the data transfer between the at least two modules or components of the vehicle.

**[0026]** The connector may be configured to only contribute to establishing an ethernet connection, e.g., in embodiments wherein the connector comprises only two or three twisted pairs in the ethernet cable end portion. In embodiments wherein the connector only comprises two twisted pairs in the ethernet cable end portion, the connector may be referred to as a half connector, i.e., a connector for establishing half of an ethernet connection. Two such half connectors may be configured and/or used to establishing a full ethernet connection, wherein together they provide the usual four twisted pairs for establishing a full ethernet connection.

**[0027]** The half connector can be configured to connect with a mating half connector and/or a mating portion of a connector comprising four twisted pairs. The use of half connectors can enable a greater distance between the half connectors, and thereby, the two twisted pairs of the two half connectors, respectively, when establishing an ethernet connection with four twisted pairs. This may also reduce interference between the shieldings of the two half connectors caused by currents induced within the connector shieldings and/or pair shieldings of one of the two half connectors.

**[0028]** 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 individual shielding for the twisted pairs.

**[0029]** In an embodiment, the pair shieldings for the at least two twisted pairs of the ethernet cable end portion are arranged separately and out of contact, in particular out of physical and/or electrical contact, from each other. This may prevent the connector shieldings from indirectly contacting each other via the pair shieldings. This can enable a more reliable and effective shielding of the ending contacts and the twisted pairs within the connector, in particular within the connector housing and within the ethernet cable end portion.

**[0030]** In an embodiment, the connector further comprises at least one separator arranged between the at least two connector shieldings. In particular, the at least one separator can be formed from non-conductive and/or non-magnetic material, in particular from an isolating material. The at least one separator can be formed, e.g., as a wall, a bar, a strip, or a crosspiece. The separator can be an element of an isolator arranged at least between the at least two connector shieldings. Thereby, the separator as a structural element can separate the at least two connector shieldings out of contact, in particular out of physical and/or electrical contact, from each other. This can enable a reliable separation of the at least two connector shieldings and, thereby, a reliable and effective shielding of the ending contacts from electromagnetic interference.

**[0031]** In an embodiment, the at least two connector shieldings are held spaced apart from each other within an outer isolator of the connector. The outer isolator may comprise the at least one separator. Further, the outer connector shielding can at least partially enclose the outer isolator. The configuration in which the at least two connector shieldings are held spaced apart from each other within the outer isolator may enable a reliable and/or fixed separation of the at least two connector shieldings and reliably prevent contact of the at least two connector shieldings.

**[0032]** In an embodiment, the at least two connector shieldings are held spaced apart from each other by at least 1 mm, preferably at least 1.5mm. Such a spacing may effectively decrease the influence between the at least two connector shieldings, in particular due to electromagnetic interference, thereby enabling more reliable and effective shielding of the ending contacts from electromagnetic interference. At the same time, still a compact and/or size-reduced connector can be provided. Within said spacing, an isolator may be arranged, e.g.,

a separator of an outer isolator of the connector.

**[0033]** In an embodiment, the connector further comprises an outer isolator, wherein the outer isolator comprises a holding portion formed as a recess for each connector shielding and at least one separator. The connector shieldings are arranged, in particular held, inside the respective holding portions and separated by the at least one separator. The holding portions may be shaped so that the respective connector shieldings snuggly fit into them. In particular, the outer isolator may at least partially enclose the connector shieldings. The outer connector shielding can at least partially enclose the outer isolator. This configuration can enable a reliable and fixed separation of the at least two connector shieldings and reliably prevent contact of the at least two connector shieldings. Thereby, a reliable and effective shielding of the ending contacts from electromagnetic interference can be enabled.

**[0034]** In an embodiment, the outer isolator comprises at least two outer isolator components, wherein each outer isolator component at least partially comprises at least one of the holding portions. This configuration may provide an improved assembly of the connector. In particular, this may enable an easy introduction of the connector shieldings into the holding portions.

**[0035]** Optionally, the at least two outer isolator components can be formed identically and/or can have the same shape. This configuration allows the outer isolator components to be produced more efficiently, e.g., by the same shaping procedure.

**[0036]** Each outer isolator component may comprise at least one engagement element engaged with one engagement element of the other outer isolator component. The engagement elements can be corresponding engagement elements, for example: a recess and a protrusion, guide bars, and/or clips. This can enable the connector being assembled in a more stable way such that within the outer isolator the connector shieldings can be secured easily. Accordingly, this can prevent a misplacement and/or movement of the connector shieldings within the outer isolator. Thereby, the ending contacts can be shielded reliably and efficiently from electromagnetic interference.

**[0037]** In an embodiment, the connector further comprises an inner isolator for each connector shielding arranged at least partially within the respective connector shielding. Each inner isolator holds the ending contacts enclosed by the respective connector shielding within and out of contact, in particular out of physical and/or electrical contact, from the respective connector shielding. The inner isolator provides an isolation between the connector shielding and the ending contacts. This configuration can enable a reliable and stable arrangement of the ending contacts within the respective connector shielding. It may reliably prevent contact between the ending contacts and the respective connector shielding.

**[0038]** Herein, each inner isolator can comprise a first inner isolator component and a second inner isolator component. These two inner isolator components put together form the inner isolator. This configuration can enable the connector being easily assembled. In particular, this may enable an easy introduction of the ending contacts into the inner isolator.

**[0039]** Optionally, the first inner isolator component and the second inner isolator component can be formed identically and/or can have the same shape. This configuration allows first inner isolator components and the second inner isolator components to be produced more efficiently, e.g., by the same shaping procedure.

**[0040]** In addition or alternatively, each of the first inner isolator component and the second inner isolator component can comprise at least one inner engagement element engaged with each other. The inner engagement elements can be corresponding engagement elements, for example: a recess and a protrusion, guide bars, and/or clips. This can enable the connector being assembled in a more stable way such that within the inner isolator the ending contacts can be secured easily. Accordingly, this can prevent a misplacement and/or movement of the ending contacts within the inner isolator. Thereby, the ending contacts can be shielded reliably and efficiently from electromagnetic interference.

**[0041]** In an embodiment, each connector shielding comprises a first connector shielding member and a second connector shielding member. In particular, the first connector shielding member and the second connector shielding member can be formed as separate members contacting each other and/or being connected to each other. Herein, each connector shielding may substantially be provided from these two connector shielding members. Each connector shielding member may be shaped like a half shell. This configuration can enable that the connector can be easily assembled wherein the inner isolator and/or the ending contacts can be arranged within the connector shieldings more easily such that a misplacement of the inner isolator becomes less probable.

**[0042]** Optionally, the first connector shielding member and the second connector shielding member of each connector shielding can be formed identically and/or can have the same shape. This configuration can enable that the connector can be easily assembled and/or an efficient production of the connector shieldings.

**[0043]** In an embodiment, each connector shielding comprises a shielding end at which the connector shielding contacts the pair shielding of the at least one twisted pair comprising the ending contacts enclosed by the respective connector shielding. Each connector shielding further comprises an extension end, in particular opposite to the shielding end. Each connector shielding further comprises at least one connector shielding protrusion arranged at the extension end. In particular, the at least one connector shielding protrusion and the connector shielding can be formed integrally. Each connector shielding may substantially extend from the shielding end to the extension end along the connector. The ex-

tension end may be arranged at a connecting end of the connector, wherein the shielding end may be arranged at the cable end of the connector. The at least one connector shielding protrusion can be configured to contact, in particular engage with, a shielding element, in particular a connector shielding, of a corresponding connector. In embodiments in which the connector is provided as a transformable connector, the at least one connector shielding protrusion can be configured to contact, in particular engage with a shielding element of the at least one adapter contact.

**[0044]** For engaging with shielding elements, the connector shielding protrusion may be provided with a connection device like a hook, protrusion, recess, or the like. This configuration may enable that the shielding of the ending contacts continuously extends over a connection of two corresponding connectors and/or the connector and the connection element. In particular, in embodiments in which the connector is formed as a transformable connector, the at least one connector shielding protrusion may be provided as and/or may comprise the receptacle element. Thereby, a reliable and/or effective shielding at the connecting end of the connector may be provided, respectively.

**[0045]** In an embodiment, each twisted pair is associated to exactly one of the at least two connector shieldings. Further, in each connector shielding, only the ending contacts of the associated twisted pair are arranged so that each connector shielding at least partially encloses only the ending contacts of the associated twisted pair arranged therein. Further, each connector shielding contacts the pair shielding of the associated twisted pair. Herein, each connector shielding may enclose other elements like an inner isolator, but it does not enclose any ending contacts of another twisted pair but the one associated to the respective connector shielding.

**[0046]** In other words, the connector can comprise a plurality of N connector shieldings and a plurality of N twisted pairs, wherein N is a natural number equal or greater than two. Each twisted pair can be associated to exactly one of the N connector shieldings and cannot be associated with any of the other connector shieldings, such that N shielding-pairs are formed, each shielding-pair comprising one connector shielding and the pair shielding of the associated twisted pair. The connector shieldings can contact the pair shieldings of the twisted pairs shielding-pair-wise, without contacting pair shieldings of other shielding-pairs.

**[0047]** Generally, the connector may comprise a dedicated connector shielding for each twisted pair of the ethernet cable end portion.

**[0048]** This configuration can enable that the ending contacts of each twisted pair are individually shielded from electromagnetic interference. The connector shieldings and the pair shieldings can share a common electrical potential shielding-pair-wise. Thereby, a reliable and/or effective shielding of the ending contacts from electromagnetic interference can be enabled.

**[0049]** In an embodiment, the connector comprises a first connector shielding and a second connector shielding. The ethernet cable end portion comprises a first twisted pair comprising first ending contacts and a second twisted pair comprising second ending contacts. The first ending contacts are arranged in and at least partially enclosed by the first connector shielding. The second ending contacts are arranged in and at least partially enclosed by the second connector shielding. The first connector shielding contacts a first pair shielding of the first twisted pair. The second connector shielding contacts a second pair shielding of the second twisted pair.

**[0050]** This configuration can enable that at least the first ending contacts and the second ending contacts are individually shielded from electromagnetic interference. The first connector shielding and the first pair shielding can share a common first electrical potential. Simultaneously, the second connector shielding and the second pair shielding can share a common second electrical potential. Thereby, the first electrical potential and the second electrical potential can be different, such that the first ending contacts and the second ending contacts are shielded individually. This can enable a reliable and/or effective shielding of the first ending contacts and the second ending contacts from electromagnetic interference.

**[0051]** Similarly, the connector may comprise a third connector shielding for third ending contacts of a third twisted pair of the ethernet cable end portion and a fourth connector shielding for fourth ending contacts of a fourth twisted pair of the ethernet cable end portion.

**[0052]** In an embodiment, the connector further comprises a conductive extension contact for at least one 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.

**[0053]** 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).

**[0054]** Each extension contact can be configured to contact and/or engage with an ending contact and/or an extension contact of a mating connector. In addition or alternatively, each extension contact can be configured

to contact and/or engage with a contact of the at least one connection element and/or the adapter contact. Each extension contact can be formed as male and/or female extension contact.

**[0055]** As used herein, the "pointing direction" of the ending contacts may describe a direction towards a physical end of the ending contact facing away from the ethernet cable. It may relate to a direction along which signals can be communicated along the ending contact. In this sense, the pointing direction can vary for each ending contact with respect to a fixed external reference system depending on how the ending contact is arranged within the connector.

**[0056]** Generally, the pointing direction of most and/or all ending contacts may coincide with the connection direction of the connector from its cable end to its connecting end (in embodiments wherein the connector is straight).

**[0057]** Each inner isolator can hold the ending contacts and the extension contacts enclosed by the respective connector shielding within and out of contact from the respective connector shielding. The extension contacts can contact the respective ending contacts. This configuration can enable a secure and/or stable arrangement of the extension contacts within the respective connector shielding. It may reliably prevent contact between the extension contacts and the respective connector shielding.

**[0058]** A further aspect relates to an ethernet cable comprising at least two twisted pairs and a pair shielding for each twisted pair, the pair shieldings comprising conductive and/or magnetic material. The pair shieldings are arranged separately and out of contact, in particular out of physical and/or electrical contact, from each other along a signalling direction of the ethernet cable. Thereby, it can be enabled that the pair shieldings do not share a common electrical potential. This configuration can enable a more reliable and effective shielding of each twisted pair. It may also reduce noise caused by induction within the shielding.

**[0059]** As used herein, the "signalling direction of the ethernet cable" may describe a direction along which the ethernet cable extends, in particular a direction in which the twisted pairs extend within the ethernet cable from one end of the ethernet cable to another end of the ethernet cable. In other words, the signalling direction of the ethernet cable may be the direction in which data transfer takes place along the ethernet cable. In this sense, the signalling direction can vary with respect to a fixed external reference system and/or along the extension of the ethernet cable depending on whether the ethernet cable is arranged in a straight or bended form.

**[0060]** The ethernet cable can further comprise an outer cable shielding. The outer cable shielding can at least partially enclose the twisted pair shieldings. It can be arranged within the ethernet cable out of contact, in particular out of physical and/or electrical contact, from the pair shieldings of the at least two twisted pairs. Thereby, the twisted pairs can be additionally shielded from electromagnetic interference. This configuration can enable a reliable and/or effective shielding of the twisted pairs from electromagnetic interference.

**[0061]** The ethernet cable comprises at least two twisted pairs and, thus, provides at least half of the wires necessary for establishing a full ethernet connection (requiring eight wires and, thus, four twisted pairs). The ethernet cable may also comprise four twisted pairs, each shielded by a dedicated pair shielding. Such an ethernet cable with four twisted pairs may provide all wires required for establishing a full ethernet connection. Therefore, the ethernet cable comprising four twisted pairs is also referred to as "ethernet connection cable".

**[0062]** A further aspect relates to a connector for establishing an ethernet connection according to the aspect described above, wherein the ethernet cable end portion of the connector is an end portion of an ethernet cable according to the preceding aspect. The connector can be formed according to any one of the embodiments of the first aspect. This configuration enables a dedicated shielding for each twisted pair both within the ethernet cable and within the connector. It may also prevent indirect electrical contact of the connector shieldings of the connector and/or of the pair shieldings within the ethernet cable. Thus, it may enable an efficient and/or reliable shielding of the connector and/or the ethernet cable from electromagnetic interference.

**[0063]** An aspect relates to a superconnector comprising a superhousing in which two connectors according to the above aspect are arranged. The superconnector further comprises an ethernet connection cable end portion with four twisted pairs apportioned to the two ethernet cable end portions of the connectors. The connectors can be formed according to any one of the embodiments of the above aspect.

**[0064]** 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.

**[0065]** Two of the four twisted pairs are individually shielded within each of the two connectors, respectively. Thereby, all ending contacts of the four twisted pairs can be individually shielded from electromagnetic interference. This may enable the improved shielding referred to above. This configuration further allows the superconnector to establish a full ethernet connection. Furthermore, this allows splitting a "full" ethernet connector up into two smaller connectors, in particular half connectors, which may be integrated in the larger superconnector at predetermined positions.

**[0066]** 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, in particular half 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.

**[0067]** 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 can 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.

**[0068]** 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.

**[0069]** Herein, the connector system may comprise two connectors according to the above aspect formed as a transformable connector.

**[0070]** A configuration of a connector system comprising two connectors according to this aspect may enable that the ending contacts of both connectors are reliably and/or efficiently shielded from electromagnetic interference, even over the connection established by the plug-and-socket-system.

**[0071]** A further aspect relates to a method of assembling a connector, in particular a connector according to the above aspect, comprising a connector shielding arrangement step of arranging at least two connector shieldings within a connector housing of the connector separately and out of contact from each other. The method further comprises an ending contact arrangement step of arranging ending contacts of at least one twisted pair of at least two twisted pairs of an ethernet cable end portion within each connector shielding, so that the connector shielding at least partially encloses the ending contacts arranged therein. The method further comprises a shielding contacting step of bringing each connector shielding in contact with the pair shielding of the at least one twisted pair comprising the ending contacts enclosed by the respective connector shielding.

**[0072]** The connector can be a connector according to any one of the embodiments of the above aspect. Because the method may be used to assemble a connector of the above aspect, the remarks to the above aspects also apply to the method and *vice versa.*

**[0073]** Herein, the terms upper, lower, below, above, etc. refer to the reference system of the Earth in a mounting position of the subject-matter.

**[0074]** 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.

**[0075]** In the following, embodiments of the invention are described with reference to the appended drawings. It is to be understood that the invention is not limited to the embodiments described, and that features of the embodiments may be combined with other embodiments of the invention.

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 some parts 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.

**[0076]** **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.

**[0077]** 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).

**[0078]** The connection direction C is a direction in which an electric plug-connection may be established between the connector 10 and a corresponding connector.

**[0079]** 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).

**[0080]** The inner isolator 60a/60b and/or 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.

**[0081]** 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).

**[0082]** 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 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.

**[0083]** 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.

**[0084]** 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.

**[0085]** 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.

**[0086]** 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.

**[0087]** 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.

**[0088]** 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.

**[0089]** 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.

**[0090]** 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.

**[0091]** 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.

**[0092]** 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.

**[0093]** 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.

**[0094]** 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.

**[0095]** 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.

**[0096]** 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.

**[0097]** 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.

**[0098]** In particular, the outer isolator components 51, 52 may held by the connector housing 40, e.g., in a tight fit.

**[0099]** 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.

**[0100]** 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.

**[0101]** 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.

**[0102]** **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).

**[0103]** 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.

**[0104]** 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 are 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.

**[0105]** 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).

**[0106]** 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.

**[0107]** 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.

**[0108]** 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.

**[0109]** 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. 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 second connector shielding members 32a, 32b may comprise a shielding contact element 39a, 39b. Each shielding contact element 39a of the first connector shielding 30a can be in contact with the first pair shielding 26a and each shielding contact element 39b of the second connector shielding 30b can be in contact with the second pair shielding 26b, 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.

**[0110]** 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.

**[0111]** 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.

**[0112]** 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.

**[0113]** 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.

**[0114]** **Figure 3** shows some parts of the connector of Figure 1, in particular the arrangement of the connector shieldings 30a, 30b, in an assembled form. In Figure 3, the two twisted pairs 22a, 22b are partially arranged in only the second twisted pair isolator component 28b. The first twisted pair isolator component 28a is omitted.

**[0115]** The first inner isolator 60a is enclosed by the first connector shielding 30a. In Fig. 3, the first inner isolator component 61b of the second inner isolator 60b and the second connector shielding member 32b of the second connector shielding 30b are omitted. Thus, the second extension contacts 70b are only held by the second isolator component 62b of the second connector shielding 30b.

**[0116]** In Fig. 3, only one (here: the lower) of the outer isolator components 52 is shown, the other one is omitted. The connector shieldings 30a, 30b, enclosing 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.

**[0117]** **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 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.

**[0118]** **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.

**[0119]** 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.

**[0120]** The two superconnectors 100a, 100b may be designed as a mating superconnectors.

**[0121]** Thus, they may be designed similarly to each other and/or so that they may be plugged into each other.

**[0122]** 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.

**[0123]** 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.

**[0124]** 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.

**[0125]** 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.

**[0126]** 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).

**[0127]** 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.

**[0128]** 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.

**[0129]** 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.

**[0130]** 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.

**[0131]** 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.

**[0132]** 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.

**[0133]** 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.

**[0134]** 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.

**[0135]** 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.

**[0136]** In each first connector 10a, the first and second pair shieldings 26a and 26b of the first and second twisted pair 22a and 22b may be supported by a respective support portion 63a, 63b of the associated inner isolator 60a, 60b (cf. Fig. 9 below). It may be contacted by the associated connector shielding 30a, 30b as described above.

**[0137]** 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.

**[0138]** 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.

**[0139]** 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.

**[0140]** 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.

**[0141]** **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 components 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.

**[0142]** 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.

**[0143]** 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.

**[0144]** The extension contacts 70a, 70b may be arranged spaced from their respective connector shielding 30a, 30b by the respective inner isolator 60a, 60b. The space between the middle axis of the first extension contact 70a and the inner surface of the first connector shielding 30a may be about 2mm. Similarly, also the space between the middle axis of the second extension

contact 70b and the inner side of the second connector shielding 30b may be about 2mm.

**[0145]** A pitch between the two first extension contacts 70a, in particular between their middle axes, may be from about 3mm to about 4.5mm, in particular about 3.8mm. Similarly, also a pitch between the two second extension contacts 70b, in particular between their middle axes, may be from about 3mm to about 4.5mm, in particular about 3.8mm.

**[0146]** A pitch between the two pairs of extension contacts 70a, 70b, e.g., the pitch between on first extension contact 70a and the closest second extension contact 70b, measured substantially perpendicular to the connection direction C, may be from about 4mm to about 8mm, in particular about 6mm. Thus, the separator 53 between the two connector shieldings 30a, 30b may be at least 1mm thick, preferably at least 1.5mm.

**[0147]** The above dimensions, in particular the spacing between the two connector shieldings 30a, 30b in which the separator 53 is arranged, may enable a sufficient electrical isolation between the two connector shieldings 30a, 30b so that the twisted pairs may be isolated individually, thereby increasing the possible data throughput through the connector 10 as described above.

**[0148]** **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.

**[0149]** 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.

**[0150]** 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 (cf. Fig. 2), 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.

**[0151]** Similarly, in the assembled state of the connector 10, the second pair shielding 26b (cf. Fig. 2), 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.

**[0152]** The width of the clamping space 64a, 64b in radial direction may be dimensioned so that the pair shielding 26a; 26b may be 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.

**[0153]** 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.

**[0154]** 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.

**[0155]** 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.

**[0156]** 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.

**[0157]** 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.

**[0158]** 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.

**[0159]** The at least one separator 53 of the outer isolator 50 separates the first connector shielding 30a and the second connector shielding 30b.

**[0160]** 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.

**[0161]** 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.

**[0162]** 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.

**[0163]** 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.

**[0164]** **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.

**[0165]** The extension adapter 90 comprises an adapter housing 91 extending substantially from the connector end 99a to the adapter connecting end 99b.

**[0166]** 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. 1-4. The connection direction C is consistently indicated in all figures showing the connector 10 and the extension adapter 90.

**[0167]** 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.

**[0168]** 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.

**[0169]** 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.

**[0170]** 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.

**[0171]** 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).

**[0172]** 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.

**[0173]** 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.

**[0174]** 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.

**[0175]** 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.

**[0176]** The first adapter shielding 96a may be isolated from the second adapter shielding 96b so that the two first adapter contacts 95a, 95b of the first twisted pair 22a (cf. Fig. 2) are effectively isolated from the two second adapter contacts 95c, 95d of the second twisted pair 22b shielded by the second adapter shielding 96b. Thus, the separate shielding of the twisted pairs may be implemented throughout the whole connector 10 including the extension adapter 90.

**[0177]** **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.

**[0178]** 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.

**[0179]** 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).

**[0180]** 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.

**[0181]** 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.

**[0182]** 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.

**[0183]** 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.

**[0184]** Each or any of the seals 85, 98a, 98b may be provided as an O-ring.

**List of Reference Numerals**

**[0185]**

| | |
|---|---|
| 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 |
| 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, 38b | connector shielding protrusion |
| 39a, 39b | 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:

- an ethernet cable end portion (20) comprising
  - at least two twisted pairs (22a, 22b), wherein each twisted pair (22a, 22b) comprises two ending contacts (24a, 24b), and
  - a pair shielding (26a, 26b) for each twisted pair (22a, 22b) comprising conductive and/or magnetic material;
- a connector housing (40) in which the ending contacts (24a, 24b) are arranged; and

- at least two connector shieldings (30a, 30b) arranged in the connector housing (40) and comprising conductive and/or magnetic material;
wherein:

in each connector shielding (30a, 30b), the ending contacts (24a, 24b) of at least one of the twisted pairs (22a, 22b) are arranged so that the connector shielding (30a, 30b) at least partially encloses the ending contacts (24a, 24b) arranged therein;
each connector shielding (30a, 30b) contacts the pair shielding (26a, 26b) of the at least one twisted pair (22a, 22b) comprising the ending contacts (24a, 24b) enclosed by the respective connector shielding (30a, 30b); and
the connector shieldings (30a, 30b) are arranged separately and out of contact from each other within the connector housing (40).

**2.** Connector (10) according to claim 1, wherein the pair shieldings (26a, 26b) for the at least two twisted pairs (22a, 22b) of the ethernet cable end portion (20) are arranged separately and out of contact from each other.

**3.** Connector (10) according to claim 1 or 2, further comprising at least one separator (53) arranged between the at least two connector shieldings (30a, 30b).

**4.** Connector (10) according to any of the preceding claims, wherein the at least two connector shieldings (30a, 30b) are held spaced apart from each other within an outer isolator (50) of the connector (10).

**5.** Connector (10) according to any claim 4, wherein the at least two connector shieldings (30a, 30b) are held spaced apart from each other by at least 1 mm.

**6.** Connector (10) according to any one of the preceding claims, further comprising an outer isolator (50), wherein the outer isolator comprises (50):

- a holding portion (54a, 54b) formed as a recess for each connector shielding (30a, 30b); and
- at least one separator (53); wherein
the connector shieldings (30a, 30b) are arranged, in particular held, inside the respective holding portions (54a, 54b) and separated by the at least one separator (53).

**7.** Connector (10) according to claim 6, wherein the outer isolator (50) comprises at least two outer isolator components (51, 52),
wherein each outer isolator component (51, 52) at least partially comprises at least one of the holding portions (54a, 54b), and
wherein optionally the at least two outer isolator components (51, 52) are formed identically.

**8.** Connector (10) according to any one of the preceding claims, further comprising an inner isolator (60a, 60b) for each connector shielding (30a, 30b) arranged at least partially within the respective connector shielding (30a, 30b),
wherein each inner isolator (60a, 60b) holds the ending contacts (24a, 24b) enclosed by the respective connector shielding (30a, 30b) within and out of contact from the respective connector shielding (30a, 30b).

**9.** Connector (10) according to any one of the preceding claims, wherein each connector shielding (30a, 30b) comprises a first connector shielding member (31a, 31b) and a second connector shielding member (32a, 32b), and
wherein optionally the first connector shielding member (31a, 31b) and the second connector shielding member (32a, 32b) of each connector shielding (30a, 30b) are formed identically.

**10.** Connector (10) according to any one of the preceding claims, wherein each connector shielding (30a, 30b) comprises:

- a shielding end (34a, 34b) at which the connector shielding (30a, 30b) contacts the pair shielding (26a, 26b) of the at least one twisted pair (22a, 22b) comprising ending contacts (24a, 24b) enclosed by the respective connector shielding (30a, 30b);
- an extension end (36a, 36b), in particular opposite to the shielding end (34a, 34b); and
- at least one connector shielding protrusion (38a, 38b) arranged at the extension end (36a, 36b).

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

each twisted pair (22a, 22b) is associated to exactly one of the at least two connector shieldings (30a, 30b);
in each connector shielding (30a, 30b), only the ending contacts (24a, 24b) of the associated twisted pair (22a, 22b) are arranged so that each connector shielding (30a, 30b) at least partially encloses only the ending contacts (24a, 24b) of the associated twisted pair (22a, 22b) arranged therein; and
each connector shielding (30a, 30b) contacts the pair shielding (26a, 26b) of the associated

twisted pair (22a, 22b).

**12.** Connector (10) according to any of the preceding claims, comprising a first connector shielding (30a) and a second connector shielding (30b), wherein:

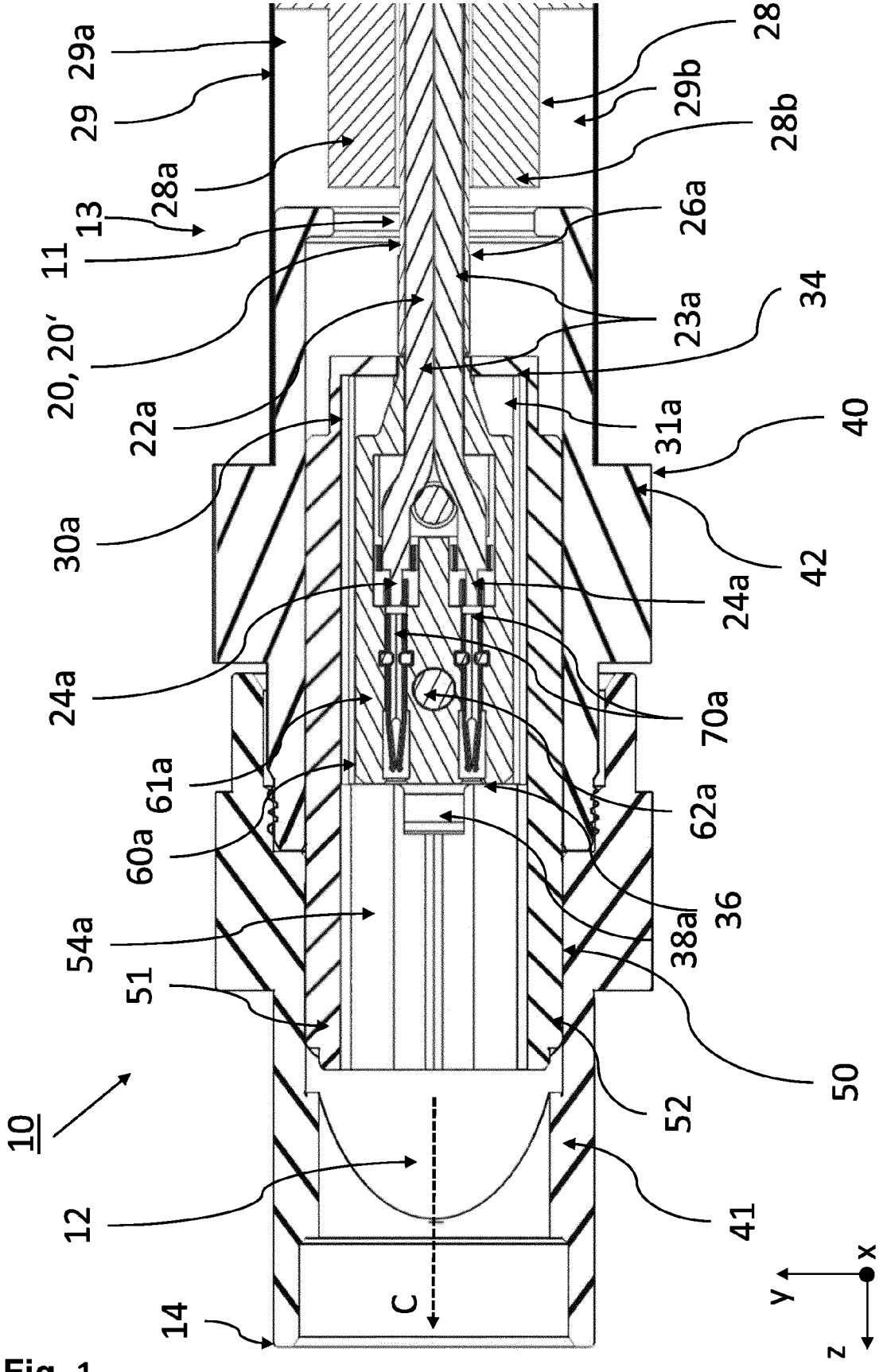
the ethernet cable end portion (20) comprises a first twisted pair (22a) comprising first ending contacts (24b) and a second twisted pair (22b) comprising second ending contacts (24b);
the first ending contacts (24a) are arranged in and at least partially enclosed by the first connector shielding (30a);
the second ending contacts (24b) are arranged in and at least partially enclosed by the second connector shielding (30b);
the first connector shielding (30a) contacts a first pair shielding (26a) of the first twisted pair (22a); and
the second connector shielding (30b) contacts a second pair shielding (26b) of the second twisted pair (22b).

**13.** Ethernet cable (20') comprising at least two twisted pairs (22a, 22b) and a pair shielding (26a, 26b) for each twisted pair (22a, 22b), the pair shieldings (26a, 26b) comprising conductive and/or magnetic material, wherein
the pair shieldings (26a, 26b) are arranged separately and out of contact from each other along a signalling direction of the ethernet cable (20').

**14.** Connector (10) for establishing an ethernet connection according to any one of the claims 1 to 12, wherein the ethernet cable end portion (20) of the connector (10) is an end portion of an ethernet cable (20') according to claim 13.

**15.** Superconnector (100a; 100b) comprising:

- a superhousing (400) in which two connectors (10a, 10b) according to any one of the claims 1 to 12 are arranged; and
- an ethernet connection cable end portion (200) comprising four twisted pairs (22a, 22b, 22c, 22d) apportioned to the two ethernet cable end portions (20) of the connectors (10a, 10b).


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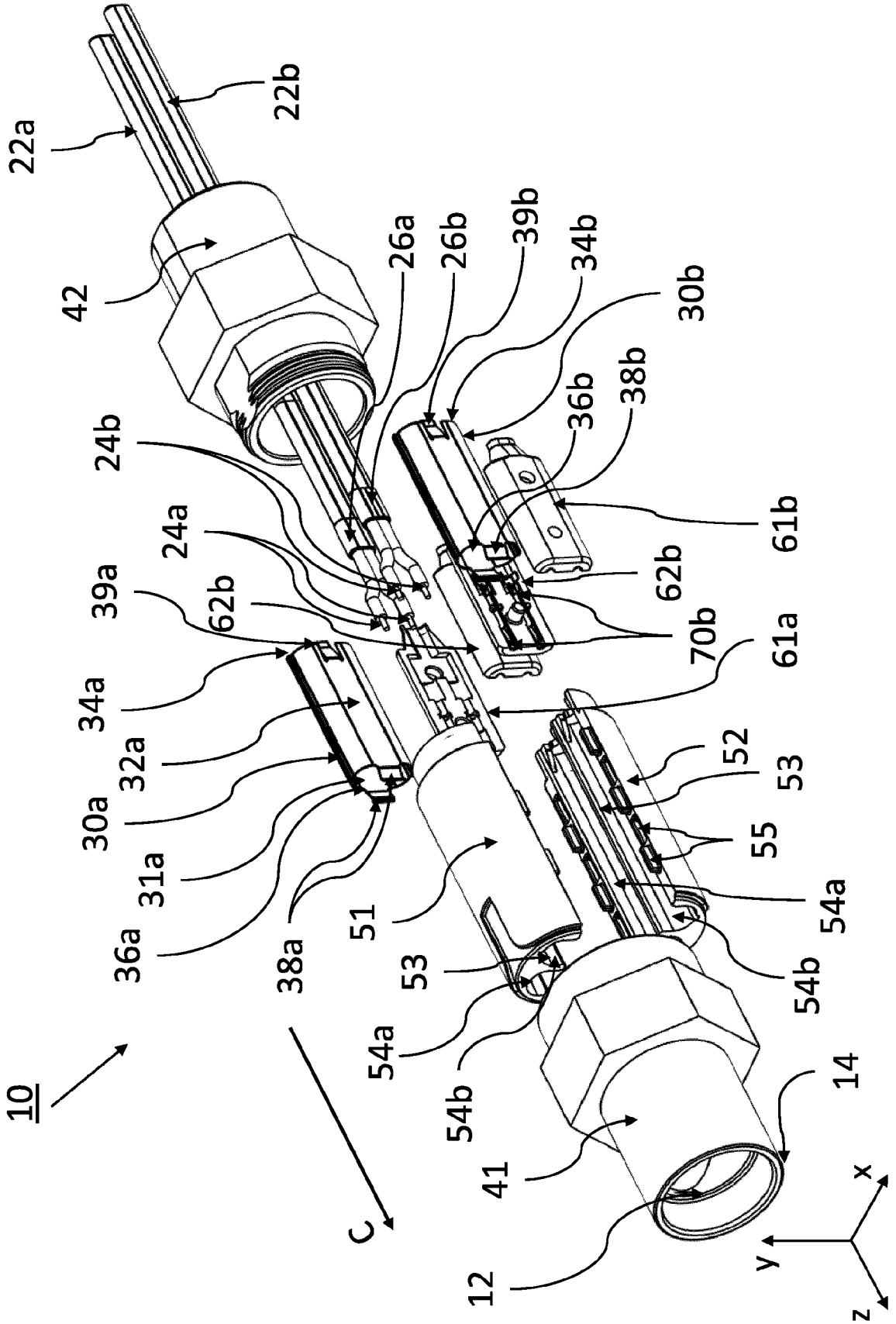
10
12
41
14
C
x
y
z

Fig. 1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39b
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30b
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70b
61a
34a
32a
30a
31a
36a
38a
51
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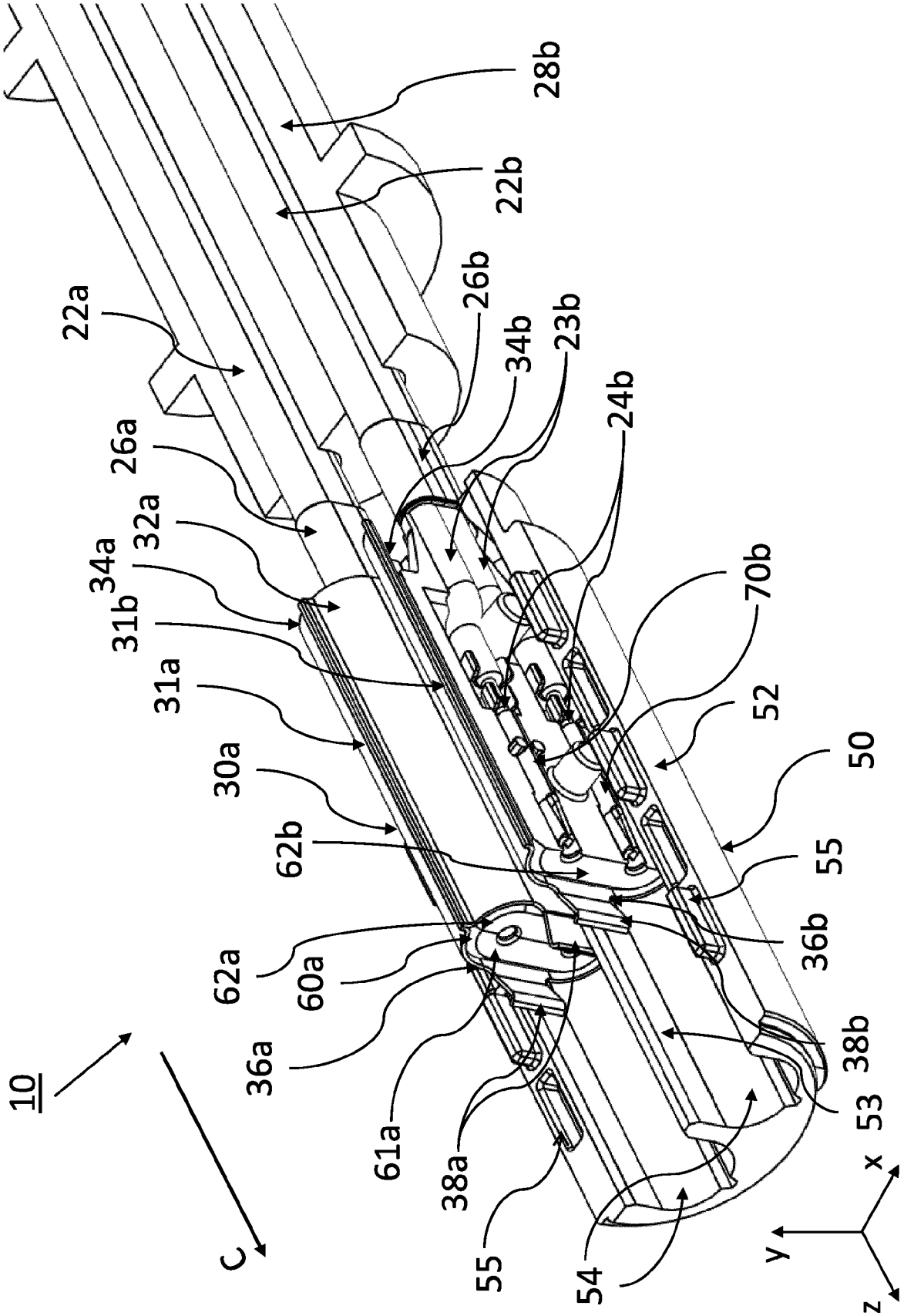
53
55
54a
54b
14
41
12
C
10
x
y
z

Fig. 2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22b
22a
26b
34b
23b
24b
26a
32a
34a
31b
31a
30a
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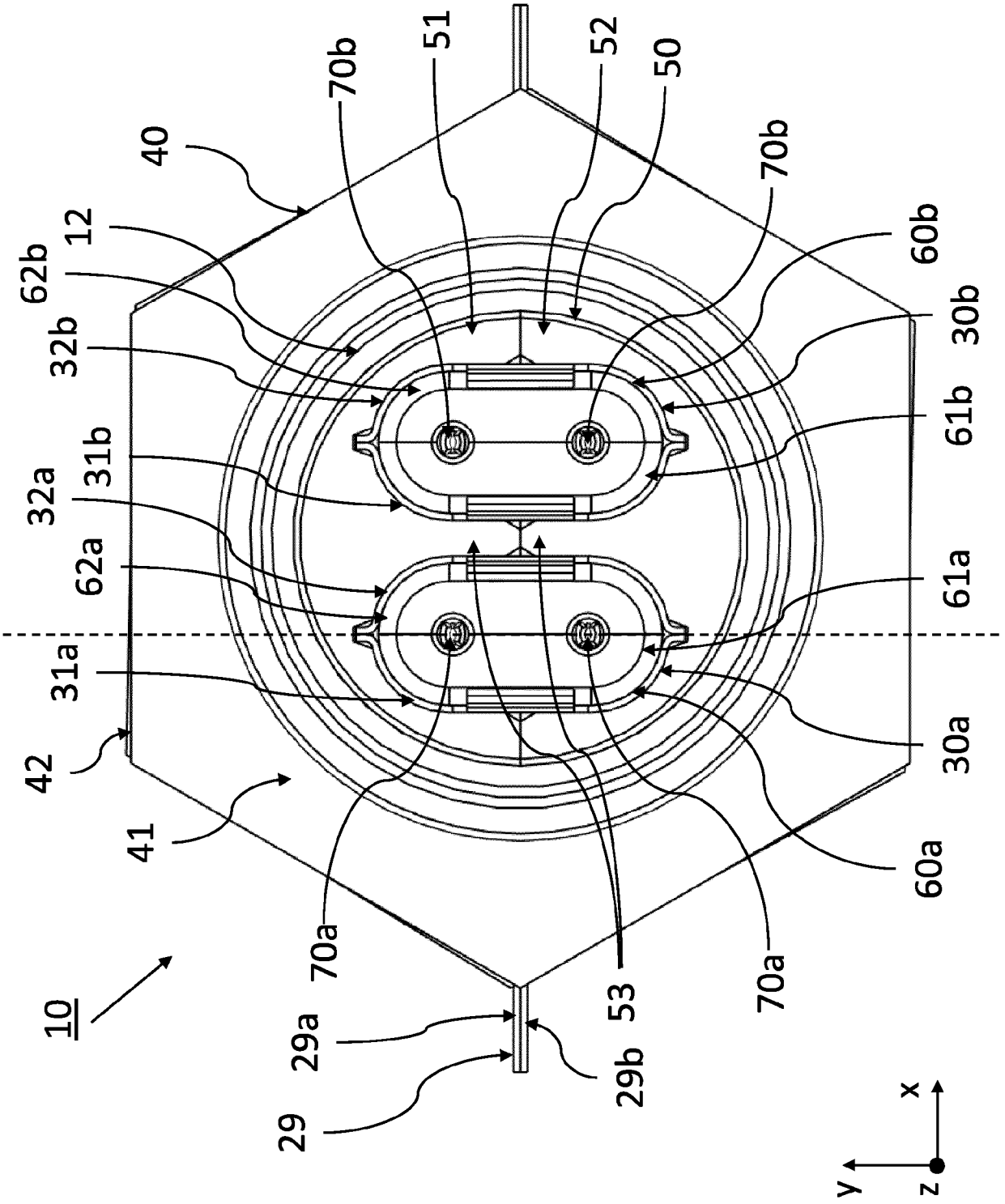
60a
36a
61a
38a
55
54
70b
52
50
55
36b
38b
53
10
C
x
y
z

Fig. 3


70b
51
52
50
40
70b
12
60b
62b
30b
32b
61b
31b
32a
62a
61a
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53
29a
29b
29
x
y
z

Fig. 4

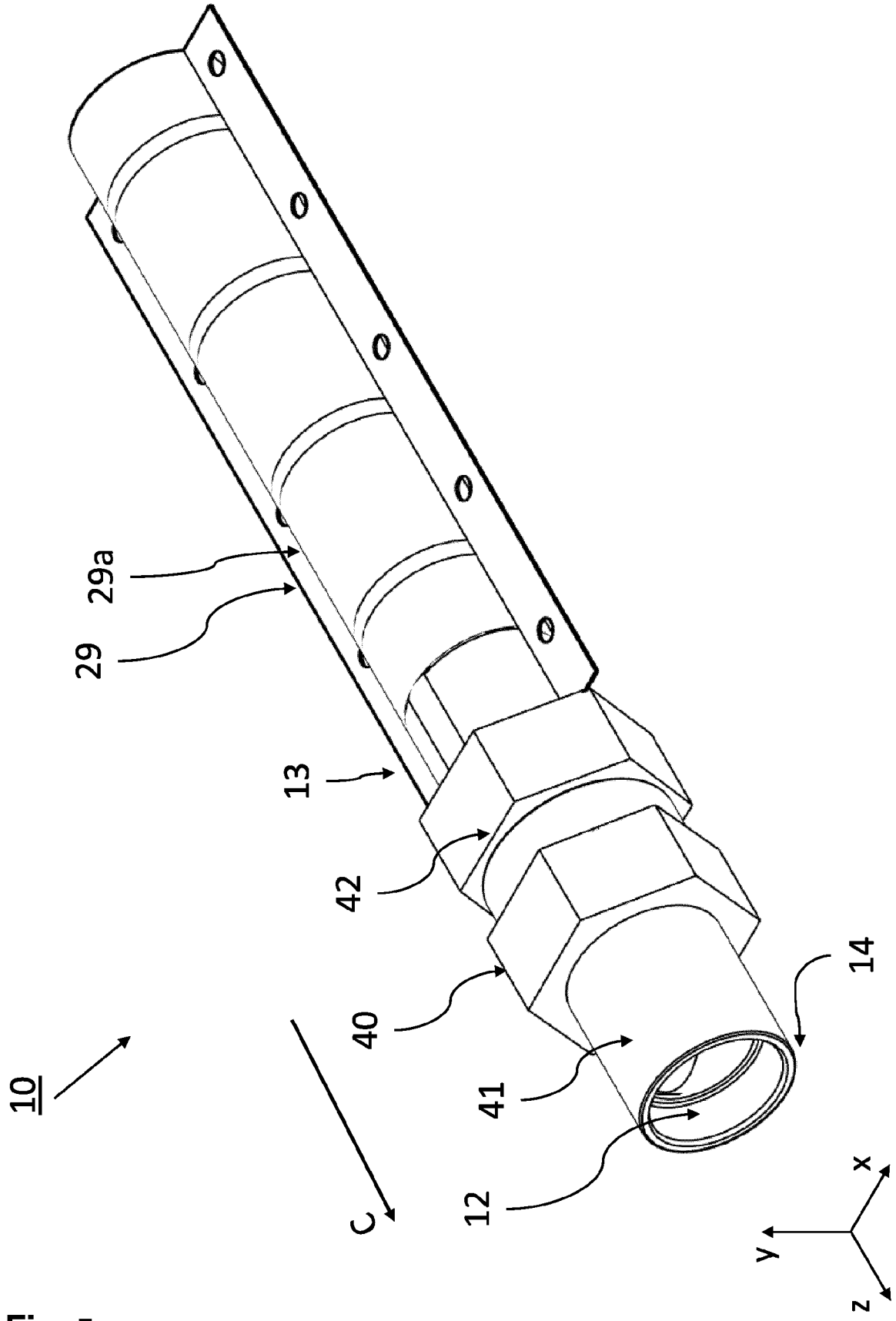
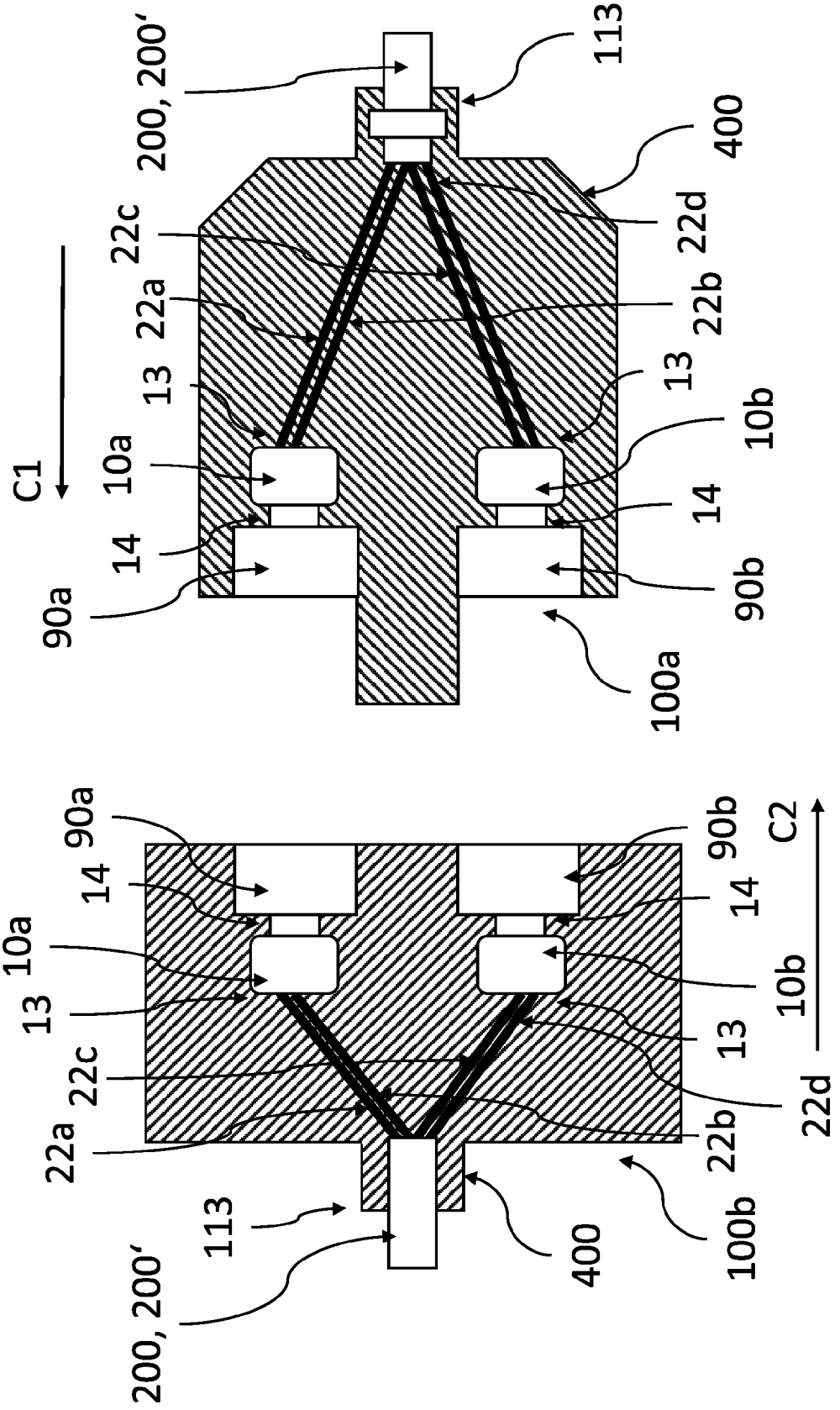



Fig. 5


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

Fig. 6

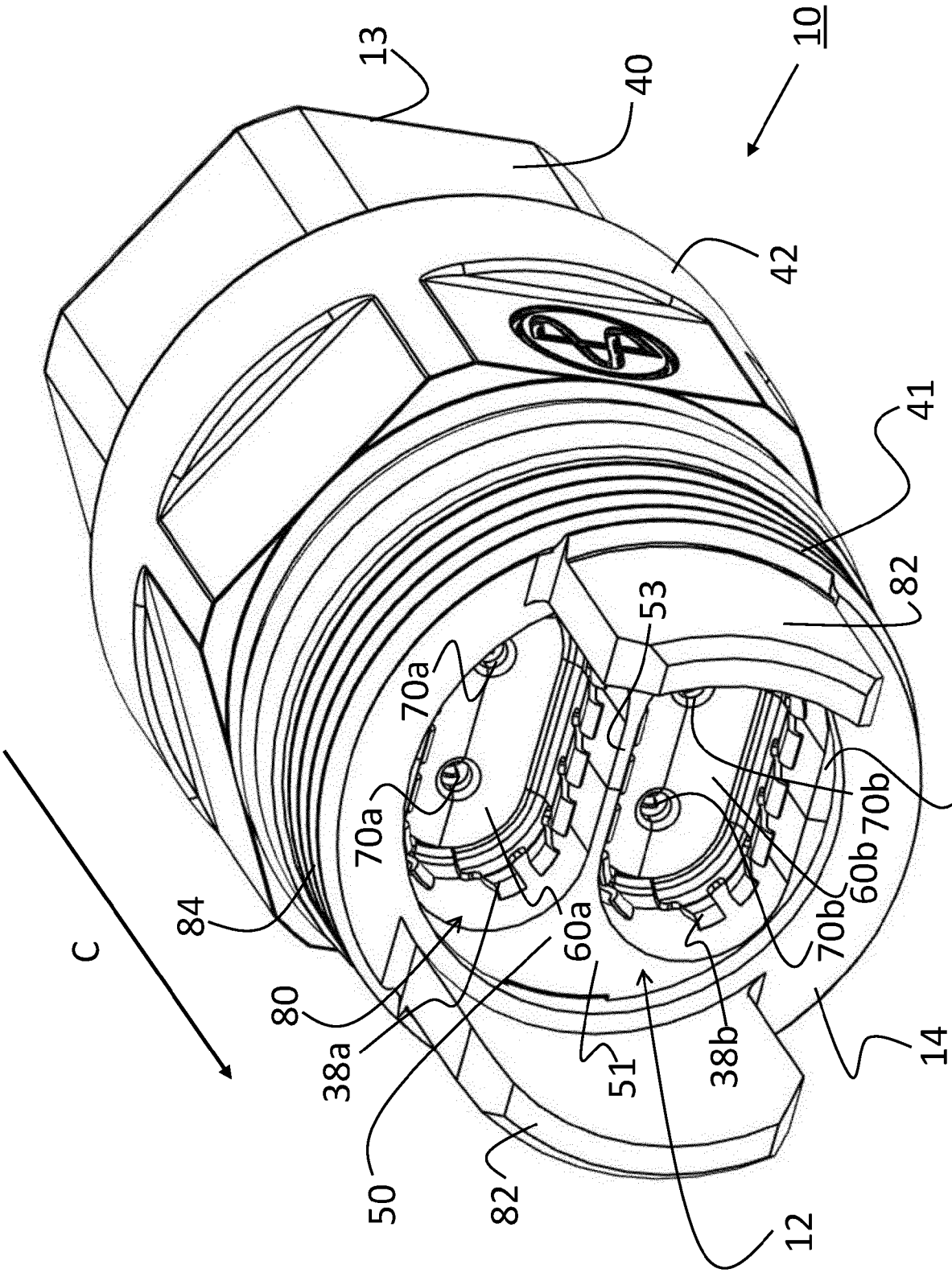
10
13
40
42
41
82
53
52
70a
70a
70b
60b
70b
60a
84
80
38a
51
38b
14
50
82
12
C

Fig. 7

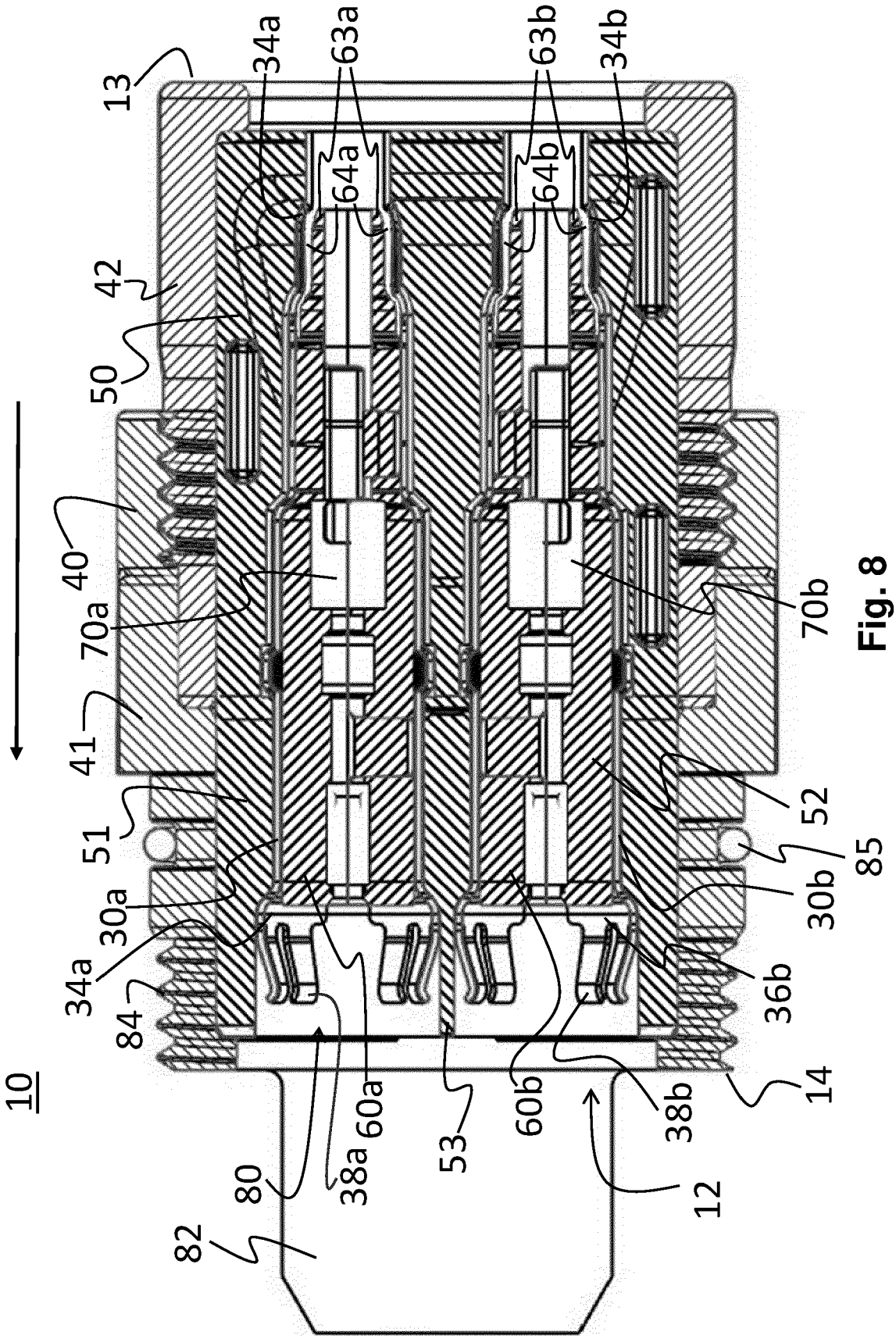
C
10
13
34a
63a
63b
34b
64a
64b
42
50
40
70a
70b
41
51
52
85
30a
30b
34a
84
36b
14
60a
60b
38a
38b
53
80
12
82

Fig. 8

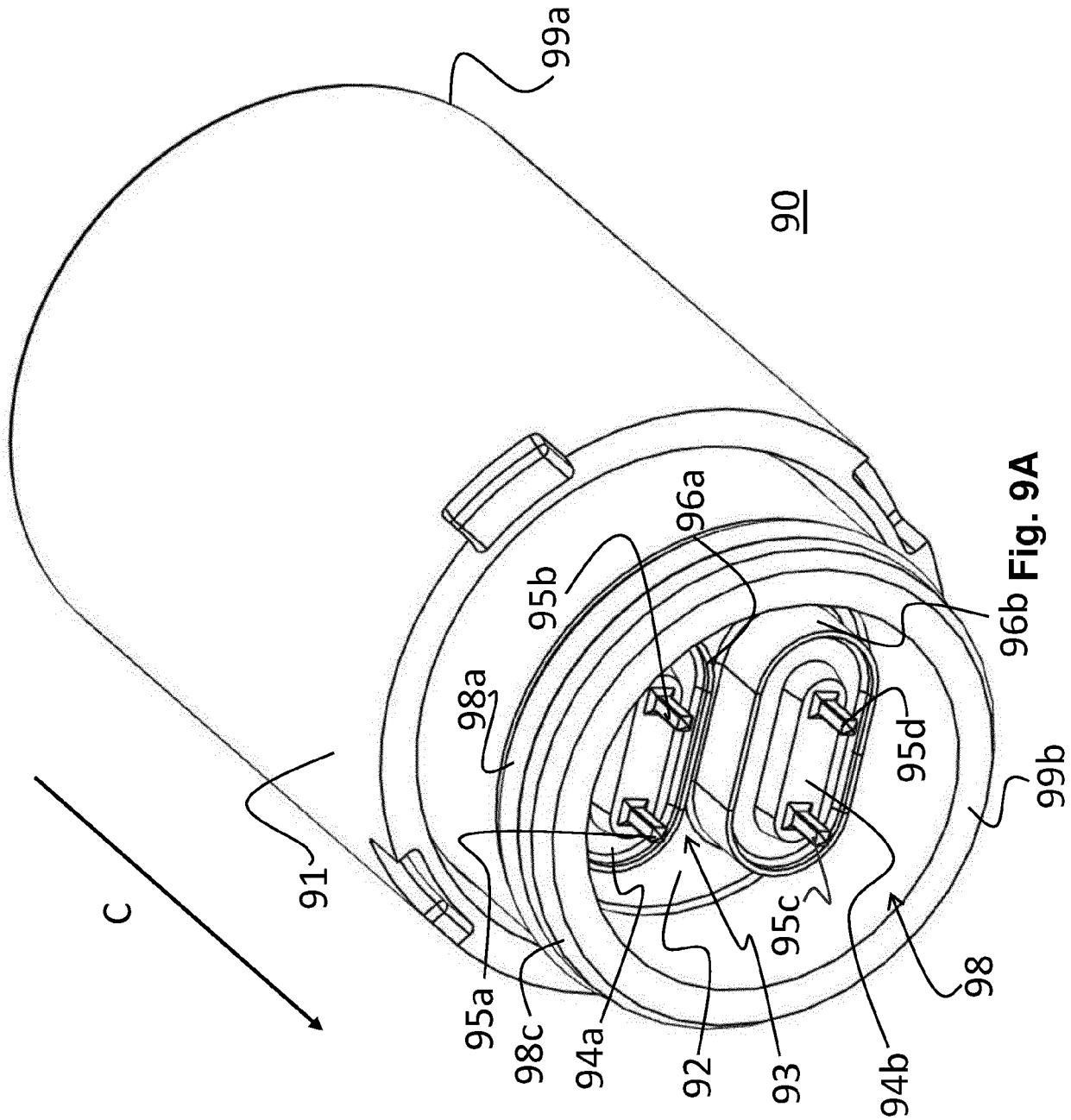


Fig. 9A

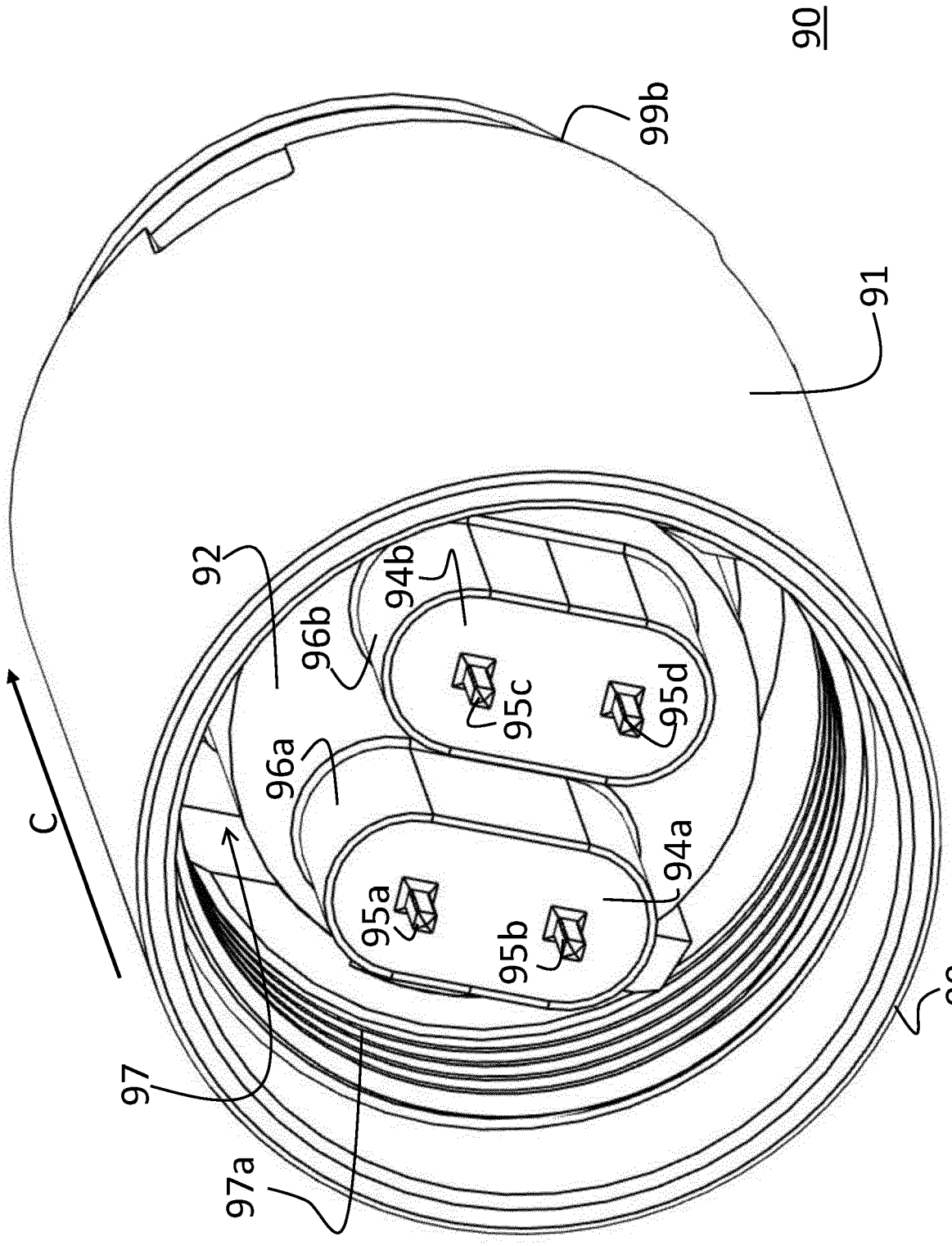


Fig. 9B

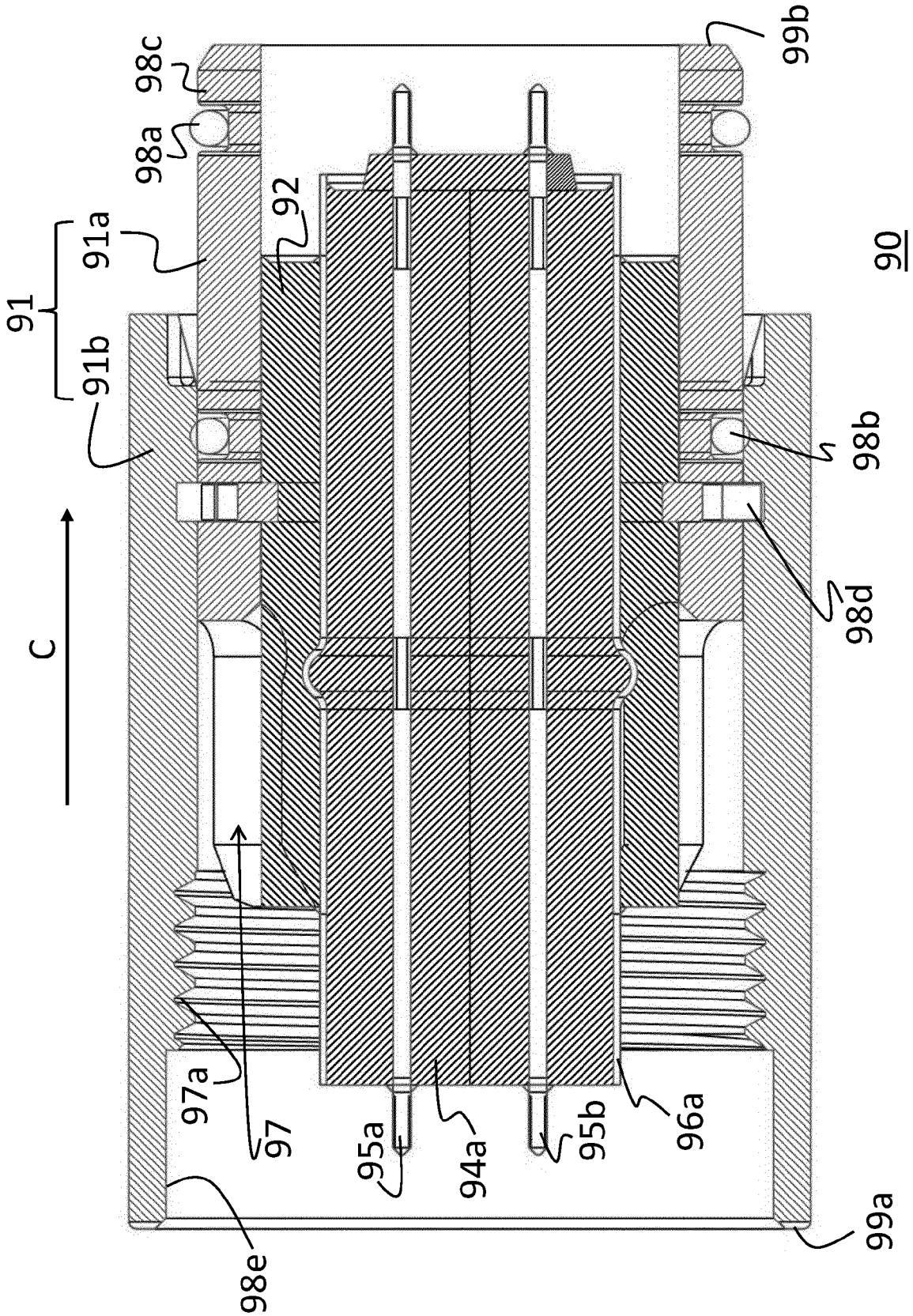
99b
98c
98a
92
91a
91
91b
90
98b
98d
C
97a
97
95a
94a
95b
96a
98e
99a

Fig. 10

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# EUROPEAN SEARCH REPORT

Application Number
EP 23 20 4736

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| Category | Citation of document with indication, where appropriate, of relevant passages | Relevant to claim | CLASSIFICATION OF THE APPLICATION (IPC) |
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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 | 19 March 2024 | Skaloumpakas, K |

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