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(54) Title: CONTACT CAVITY ELEMENT, METHOD FOR PRODUCING AND/OR EQUIPPING AN ELECTRIC CONNECTING DEVICE, ELECTRIC CONNECTING DEVICE AND ELECTRIC CONNECTOR

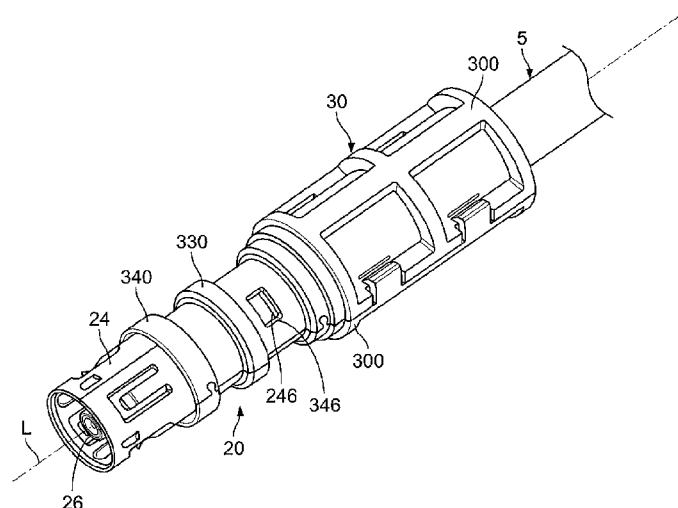


Fig. 2

(57) Abstract: The invention relates to a contact cavity insert for an electrical connection device (20), in particular an electrical connector, preferably a FAKRA connector, for the automotive sector, the contact cavity insert (30) being constructed in such a manner that, by means of the contact cavity insert (30), the electrical connection device (20) can be provided in a contact cavity of a connector housing of the electrical connector, the contact cavity insert (30) being constructed in two parts. The invention further relates to a method for equipping an electrical shielding device (24) with a contact cavity insert (30) and for producing an electrical connection device (20) for an electrical connector, preferably a FAKRA connector, for the automotive sector, a shell element (300) or a half-shell element (300) of the contact cavity insert (30) being provided in each case at mutually opposing sides on the shielding device (24), and there being produced inside the shielding device (24) an electrical contact device on which an electrical cable (5) is provided.



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**CONTACT CAVITY ELEMENT, METHOD FOR PRODUCING AND/OR  
EQUIPPING AN ELECTRIC CONNECTING DEVICE, ELECTRIC  
CONNECTING DEVICE AND ELECTRIC CONNECTOR**

5 The invention relates to a contact cavity insert for an electrical connection device, in particular an electrical connector, preferably a FAKRA connector, for the automotive sector. The invention further relates to a method for equipping an electrical shielding device or for equipping a connection device with a contact cavity insert or a method for producing a connection device for a connector. The invention further relates to a  
10 connection device and a connector having a contact cavity insert according to the invention or a connection device which is produced according to the invention.

In electrical engineering and electronics, there are known a large number of electrical pin or stud and socket connectors - referred to below as (electrical) connectors or counter-  
15 connectors - which serve to transmit electrical voltages, currents and/or signals with the greatest possible range of voltages, frequencies, data rates and currents. In particular in the automotive sector, such connectors and counter-connectors must permanently ensure correct transmission of signals and electrical power under dirty, damp and/or chemically aggressive conditions. Owing to a large range of applications for such connectors, a large  
20 number of specially constructed connectors are known. Such electrical plug type or counter-connectors may be assembled on an electrical line or another electrical device, such as, for example, a printed circuit board or on/in a housing of an electrical or electronic device. If a plug type or counter-connector is located on a line or cable, it is usually referred to as a (floating) connector or a (floating) coupling; if it is located on/in an  
25 electrical/electronic device, it is usually referred to as a flush type plug or a (flush type) socket. Furthermore, a counter-connector is often also referred to as a plug receiving member, particularly when the counter-connector has a support collar which is intended to ensure a more robust connection between the plug type connector and the counter-connector.

30

The electrical plug type connectors or counter-connectors must permanently ensure correct transmission of electrical signals and electrical power, mutually corresponding plug type connectors and counter-connectors in most cases having securing or locking devices for

permanently but generally releasably securing or locking the connector in/on the counter-connector. Furthermore, corresponding electrical contact elements, such as, for example, an electrical contact device and/or an electrical shielding device, that is to say, for example, an electrical connection device of the connector, must be securely received therein. Since  
5 the housings of the connectors are in most cases subject to a specific standard, such as, for example, the FAKRA standard, the most important dimensions of various manufacturers of the housings always have the same dimensions. In order to be able to accommodate a specific connection device in a housing of a connector, there is required in most cases a type of adapter by means of which the connection device can be adapted to the housing and  
10 can be mounted in a contact cavity of the housing. Such an adapter is referred to as a contact cavity insert below.

Depending on a configuration of such a contact cavity insert for the relevant contact cavity(ies) of the housing of the connector, there are limitations in terms of the  
15 configuration possibilities of the manufacturing method when producing or manufacturing the cable. It is thus necessary, for example, with many contact cavity inserts, for a shielding socket to have to be connected to a transport band of the shielding sockets via the plug face so that the relevant contact cavity insert can subsequently be assembled at all. This results in the problem of residual punched portions on the region of the shielding  
20 socket that is most sensitive during subsequent use thereof. It is further problematic that this situation also arises with a shielding socket of the counter-connector so that significant plugging problems occur if no corresponding subsequent processing is carried out, which again further increases the costs for the manufacturing. Furthermore, many of these contact cavity inserts are not compatible with specific contact securing members or retainers; this  
25 applies in particular to a FAKRA-2 contact securing member.

An object of the invention is to provide, for a contact cavity of a housing of an electrical connector, an improved contact cavity insert which enables more flexible handling of a manufacturing method when assembling an electrical cable. In this instance, it is preferably  
30 intended to be able to produce more degrees of freedom than in the prior art. In particular, it is intended to be able to dispense with connection of a shielding socket via its plug face to a transport band for the shielding socket. Furthermore, the contact cavity insert is intended to be constructed in a simple manner and is intended to be simple to handle, with

the production and also the subsequent assembly thereof being intended to be cost-effective.

An object of the invention is further to provide an improved method for equipping an electrical shielding device or an electrical connection device having a contact cavity insert. An object of the invention is further to set out an improved method for producing a connection device. These methods are time portions of a cable manufacturing operation so that an improved method for manufacturing the electrical cable can accordingly be produced. In this instance, the method is intended to be able to be carried out in a rational manner with flexible process management. In particular in one embodiment of the invention, a number of components or subassemblies, required for the manufacturing is intended to be reduced. In this instance, subsequent processing of the plug face of a shielding socket is further intended to be able to be dispensed with.

The object of the invention is achieved by means of a contact cavity insert for an electrical connection device, in particular an electrical connector, according to claim 1; by a method for equipping an electrical shielding device or for equipping a connection device with a contact cavity insert, according to claim 8; by a method for producing a connection device for a connector, according to claim 9; and by means of a connection device and a connector, preferably a FAKRA connector, for the automotive sector, according to claim 12. Advantageous developments of the invention will be appreciated from the dependent claims.

The contact cavity insert is first constructed in such a manner that an electrical connection device or an electrical contact device can be provided, for example, engaged, therewith in a contact cavity of a connector housing of an electrical connector. According to the invention, the contact cavity insert is constructed in two parts. A complete contact cavity insert preferably has two shell elements or two half-shell elements – referred to below simply as elements – which are preferably constructed in a substantially identical manner. It is naturally possible to use more than two substantially identical elements and also at least two non-identical elements according to the invention. The identical construction has the advantage that only one component which is, for example, provided twice, is sufficient to form a complete contact cavity insert which simplifies the production, assembly and

handling thereof and consequently minimises costs. These two elements may be secured to each other in a materially integral manner, positive-locking manner and/or non-positive-locking manner, the two elements being constructed in embodiments of the invention in such a manner that they can be welded, adhesively bonded, engaged or clipped with  
5 respect to each other.

In the method according to the invention, an electrical shielding device or an electrical connection device is provided with a contact cavity insert. To this end, there is provided on the shielding device or the connection device at mutually opposing sides an element of the  
10 contact cavity insert, the two elements being secured to each other during the provision or afterwards. In an alternative of the method according to the invention, an electrical connection device is produced and, beforehand or afterwards, an electrical shielding device is provided with a contact cavity insert. In this instance, an element of the contact cavity insert is provided on the shielding device at mutually opposing sides, respectively, and  
15 there is produced inside the shielding device an electrical contact device on which an electrical cable is preferably already provided, for example, crimped, clamped or soldered.

According to the invention, before or after the provision of the two elements on the electrical shielding or connection device, that is to say, also provision of the two elements  
20 on each other, it is possible to carry out a crimping operation, in particular an external crimping operation, for example, insulation crimping, of the shielding device with the cable. In one embodiment of the invention, using two transport bands which each have a plurality of elements which are mechanically connected to each other, it is possible to successively provide a plurality of shielding or connection devices with the contact cavity  
25 insert. In this instance, a single shielding device or connection device is preferably first inserted into a single element of a transport band. Subsequently, the relevant contact cavity insert is produced from a single element of the other transport band. This is similar to a zip fastening method in which a single shielding or connection device is provided several times between two associated elements which are transported on transport bands.  
30 Subsequently, the band which is produced can be separated or folded up or portioned for further processing or packaging.

For mutual assembly of two elements of the contact cavity insert one on the other, a single element has, at mutually opposing longitudinal portions at the same position with respect to a longitudinal axis, mutually corresponding assembly devices. A spacing of two mutually corresponding assembly devices with respect to the longitudinal axis is

5 substantially equal. In this instance, the two longitudinal portions of a single element are assembly portions or regions by means of which one element can be assembled on the other element. In embodiments of the invention, the mutually corresponding assembly devices may be constructed as mutually corresponding positioning devices and/or mutually corresponding catch devices. The mutually corresponding positioning or catch devices are  
10 preferably constructed at least partially in a positive-locking manner. The assembly or longitudinal portions may be constructed in a planar manner, two mutually corresponding assembly devices being provided so as to protrude from the respective face or so as to be directed therein. For the assembly, the respective assembly or longitudinal portions are each provided one on the other and secured to each other.

15

The mutually corresponding assembly devices are preferably a positioning projection and a positioning recess, and/or a catch projection and a catch recess, respectively. In this instance, a respective assembly device extends away from the respective assembly or longitudinal portion in a substantially tangential manner or in a peripheral direction or, for  
20 example, in a corresponding case tangentially or in a peripheral direction therein. It is further possible for an assembly device to extend on the respective longitudinal portion in a substantially radial or tangential manner or in a peripheral direction. That is to say, for example, that such an assembly device confers on the element in this region a shape which is radial or tangential or which extends in a peripheral direction and which simultaneously  
25 acts as a portion of the relevant assembly device. A single catch device of an element thus has, for example, a catch hook, whose catch face or catch projection extends substantially or in a longitudinal direction of the element or in a transverse direction relative thereto.

In embodiments of the invention, the contact cavity insert, that is to say, its elements, is/are  
30 constructed at a longitudinal end so as to be so short that, after it has been assembled on an electrical shielding device, a region of the shielding device that can be electrically contacted by a counter-connector remains substantially free therefrom. Furthermore, at a facing longitudinal end, the contact cavity insert or its elements may be constructed so as

to be so short that, when it/they are assembled on the shielding device, a crimping portion of the shielding device remains freely accessible. Alternatively, the contact cavity insert may substantially also cover the crimping portion. Preferably, an element of the contact cavity insert has at least one catch device, by means of which it can be engaged on a catch device of the connector housing and/or a catch device of a contact securing member of the electrical connector. In this instance, the catch device of the contact cavity insert or the respective element is preferably a catch shoulder. The catch device of the connector housing is preferably a catch spring and/or the catch device of the contact securing member is preferably a catch projection.

10

The invention is explained in greater detail below with reference to embodiments and the appended drawings. In the detailed Figures of the drawings:

Figure 1 is a two-dimensional sectioned side view of an electrical connector according to the invention which has been connected to an electrical counter-connector according to the invention;

15

Figure 2 is an oblique perspective view from above of an electrical connection device having a two-part contact cavity insert according to the invention;

Figure 3 is an illustration similar to Figure 2 of a second variant of the contact cavity insert according to the invention, with only a single half-shell element being illustrated;

20

Figure 4 is a sectioned perspective side view of the connector with a connection device which the first variant of the contact cavity insert according to the invention has;

Figure 5 is an illustration of the connector similar to Figure 4, the connection device having the second variant of the contact cavity insert according to the invention;

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Figure 6 is an oblique perspective view from above of the inner contour of a first embodiment of the first variant of the half-shell element according to the invention;

Figure 7 is a view similar to Figure 6 of the half-shell element from Figure 6 rotated through approximately 90° about its longitudinal axis;

Figure 8 is an oblique three-dimensional view from above of the inner contour of a second embodiment of the first variant of the half-shell element according to the invention;

30

Figure 9 is a view similar to Figure 6 of the outer contour of the half-shell element from Figure 8;

Figure 10 is a 3D view of a first assembly step of a method for producing a connection device according to the invention with a contact cavity insert;



Figure 11 is a 3D view similar to Figure 10 of a plurality of assembly steps for prefabricating an electrical cable with an electrical contact device;

Figure 12 is a view similar to Figure 10 of the provision of the prefabricated cable with its contact device in an electrical shielding device from the first assembly step;

- 5 Figure 13 is a view similar to the perspective view of Figure 10 of the production of an external crimping between a rear portion of the shielding device and a shield conductor and an outer insulation of the cable;

Figure 14 is again a view similar to the 3D view of Figure 10 of the provision of the first variant of the contact cavity insert according to the invention on the connection device

- 10 produced in Figure 13;

Figure 15 is an alternative to Figure 14, in which a plurality of contact cavity inserts are provided on a plurality of connection devices in a zip fastening method;

Figure 16 shows an alternative of the production method according to the invention following Figure 11, the second variant of the contact cavity insert according to the

- 15 invention being provided on the shielding device before the production of the external crimping;

Figure 17 is a perspective view of a five-piece sub-assembly of an electrical connection device for a counter-connector;

Figure 18 is also a perspective view of a three-piece sub-assembly of the connection device

- 20 for the counter-connector;

Figure 19 is a three-dimensional view, viewed laterally from the front, of a second embodiment of the second variant of the contact cavity insert according to the invention when the two elements of the contact cavity insert are connected; and

Figure 20 is a perspective view similar to Figure 19 of the contact cavity insert which is

- 25 composed of the two elements.

The invention is explained in greater detail below with reference to a coaxial plug type connection for an electrical connector or an electrical counter-connector. The following explanations substantially relate to the connector, but may be applied to the counter-

- 30 connector in the same manner, and naturally vice versa. The connector illustrated in the drawings is constructed in this instance as a floating coaxial plug type connector. However, it is also possible to transfer the invention to all electrical connections as long as an electrical contact cavity is intended to be provided with an electrical contact element or an

electrical connection device. It is thus possible, for example, to apply the invention to a pin or stud or socket plug type connector, a (floating) coupling, a (flush type) plug, a (flush type) socket, a plug receiving member, a socket receiving member, a header, an interface, etc. The invention is preferably used in a connector which is constructed in accordance  
5 with the FAKRA standard (FAKRA = Fachkreis Automobil = technical automotive sector), which is particularly relevant for the radio frequency (RF = radio frequency) or HF plug type connections (HF = high frequency) in the automotive sector.

Figure 1 illustrates two electrical connectors 1 according to the invention – connector 1 and  
10 counter-connector 1 – in a connected state. In this instance, the connector 1 has as the main components a connector housing 10, an electrical connection device 20 and a contact securing member 40, by means of which the connection device 20 can be secured in the connector housing 10 in at least one translation direction. In this instance, the contact  
securing member 40 may also be referred to as a retention member 40 or retainer 40, this  
15 engaging the connection device 20 by means of a catch device 440 (see Figures 4 and 5) which is preferably constructed as a secondary catch device 440 having in particular a catch shoulder or a catch projection.

Furthermore, the connector housing 10 has a catch device 130 which is preferably  
20 constructed as a primary catch device 130, in particular a catch plate 130 or catch projection having a catch shoulder, and by means of which the connection device 20 can also be secured in the connector housing 10 in at least one translation direction. The electrical connection device 20 is provided inside a contact cavity 12 of the connector housing 10. In this instance, the connection device 20 can be provided by means of a  
25 contact cavity insert 30 – adapter 30 – within the contact cavity 12, the contact cavity insert 30 providing a compatibility, in particular a FAKRA compatibility, with the contact cavity 12.

By means of the contact cavity insert 30, the connection device 20 is preferably engaged at  
30 two positions in the connector housing 10. To this end, the contact cavity insert 30 has a catch device 330, in particular a catch shoulder or a catch projection, this catch device 330 also preferably extending completely around the contact cavity insert 30, and by means of which the connection device 20 can be engaged with the primary catch device 130.

Furthermore, the contact cavity insert 30 has a catch device 330, in particular a catch shoulder or a catch projection, this catch device 330 also preferably extending completely around the contact cavity insert 30, and by means of which the connection device 20 can be engaged with the secondary catch device 440.

5

The electrical connection device 20 (see also Figures 2-5, 10-18) is constructed in this instance as a coaxial connection device 20, this comprising an electrical contact device 22 and an electrical shielding device 24 which surrounds it and which preferably acts as an external shielding contact 24. The contact device 22 is constructed as a pin or a stud

10 contact device 22 – connector 1 – or as a socket contact device 22 – counter-connector 1.

In other embodiments of the invention, the connection device 20 may be only a single contact device 22 or a single shielding device 24, or also comprise a plurality thereof.

Furthermore, the connection device 20 can be provided, in particular engaged, inside the connector housing 10 by means of the contact cavity insert 30. The contact cavity insert 30

15 may also be referred to as a contact cavity shaped piece 30 or contact cavity socket 30.

An electrical cable 5 or an electrical line 5 is electrically and mechanically connected to the electrical connection device 20, the contact device 22 of the connection device 20

being electrically connected to an electrical conductor 50 or inner conductor 50 which may

20 be constructed, for example, as a stranded conductor 50 (see also below). The shielding

device 24 of the connection device 20 is also electrically connected to an electrical shield conductor 54 or outer conductor 54 which may be constructed as a braid wire 54 or a braid

line 54 (see also below). Furthermore, the cable 5 has between the inner conductor 50 and

outer conductor 54 an electrical insulation 52 or an inner insulation 52 and outside the

25 outer conductor 54 an electrical insulation 56 or an outer insulation 56.

Figures 2 and 3 each illustrate an electrical connection device 20, the connection device 20 of Figure 2 showing a first variant of the contact cavity insert 30, which comprises

according to the invention two shell elements 300 or two half-shell elements 300 –

30 elements 300. Figure 3 shows a shell element 300 or half-shell element 300 – element 300

– according to the invention of a second variant of the contact cavity insert 30. Only

elements 300 of the relevant contact cavity insert 30 are referred to below. The two

elements 300 of a single contact cavity insert 30 can be provided with their inner contour

303 (see also Figures 6, 8) at least partially in a positive-locking manner on the electrical shielding device 24, the two elements 300 being able to be inserted one inside the other in specific regions and thus being retained on the connection device 20.

- 5 The shielding device 24 and a relevant element 300 or the contact cavity insert 30 may have mutually corresponding catch devices 246, 346 which retain the contact cavity insert 30 on the shielding device 24. In this instance, the shielding device 24 has a catch projection 246 and the element 300 has a catch recess 346. A catch device 244, in particular an inwardly directed catch projection 244, acts as an electrical insulation 26
- 10 which can be received inside the shielding device 24 (see also Figure 10) and which can also be referred to as an insulating sleeve 26 or dielectric 26, in the form of a catch. To this end, the insulation 26 correspondingly has a catch device 264, in particular a catch recess 264.
- 15 The contact cavity insert 30 according to the invention extends at the end thereof adjacent to a free end of the shielding device 24 as far as an inner beginning of a shielding portion, which can be electrically contacted at the inner side by a shielding portion of the counter-connector 1 (see Figure 1). In this instance, the contact cavity insert 30 rests with a front collar 360 on this shielding portion and cannot move further forward towards the free end
- 20 of the shielding device 24 owing to its geometry. In the first variant, the contact cavity insert 30 extends as far as the fixed end of the shielding device or even beyond, whereas the contact cavity insert 30 extends in contrast in the second variant of the invention as far as a rear crimping region of the shielding device 24 and leaves it free to such an extent that, when the contact cavity insert 30 is inserted, an external crimping 60, which can also be
- 25 referred to as an insulation crimping 60 or isocrimp 60, can still be produced with the electrical cable.

- Intermediate lengths of the contact cavity insert 30 between the first and second variant of the invention can of course be used. Furthermore, the contact cavity insert 30 may have a
- 30 second collar 370 (see Figures 6-8) for assembling the contact cavity insert 30 on the connection device 20. In the first variant of the invention, this is provided in a central region and, in the second variant of the invention, this is provided on an end portion of the contact cavity insert 30 that is directed towards the fixed end of the shielding device 24.

The second collar 370 is provided in this instance at an end of an external crimp element 60 that is directed towards the free end of the electrical connection device 20.

According to the invention, the first variant (Figures 1, 2, 4, 6-9, 14, 15, 17) and the second  
5 variant (Figures 3, 5, 16, 18-20) and the first embodiment (Figures 6, 7, 15) and second  
embodiment (Figures 2, 4, 8, 9, 14, 17) of the first variant, and the first embodiment  
(Figures 3, 5, 16, 18) and second embodiment (Figures 19, 20) of the second variant of the  
contact cavity insert 30 are constructed in two pieces, these two elements 30 being  
10 designed in a substantially identical manner, that is to say, they can preferably be mutually  
transposed. That is to say, with the correct orientation in a longitudinal direction L of the  
two elements 300, one element 300 can be moved into the other in a substantially  
coincident manner by means of rotation about this longitudinal axis L. A covering line of  
the contact cavity insert 30 is preferably substantially rotationally symmetrical, apart from  
15 recesses in an outer contour 305 (see Figure 9) of an element 300. A mutual assembly of  
the two elements 300 can be carried out in various manners, for example, by means of a  
welding method: welding with heat reflectors, ultrasound welding, vibration or friction  
welding, heating element welding; an adhesive-bonding method; clipping or engagement.

Two elements 300 of a contact cavity insert 30 are preferably engaged with each other, a  
20 respective element 300 having a catch device 320 which is constructed as an assembly  
device 320, such as, for example, a catch projection 322 or a catch plate 322 and a catch  
recess 324. Furthermore, a respective element 300 may have a positioning device 310  
which is constructed as an assembly device 310, such as, for example, a positioning  
projection 312 or a positioning recess 314 in order to correctly position the two elements  
25 300 with respect to each other; they act as a type of coding. The relevant catch devices 320;  
322, 324 and the relevant positioning devices 310; 312, 314 are preferably constructed so  
as to correspond to each other and are consequently at least partially positive-locking with  
respect to each other. For the mutual assembly of two elements 300, the assembly devices  
310, 320 are preferably located on mutually facing longitudinal portions 301, a respective  
30 longitudinal portion 301 preferably extending radially with respect to the contact cavity  
insert 30, that is to say, corresponding to a cross-section of a wall of the respective element  
300.

Figures 6 and 7 show the first embodiment of the first variant of the invention. In this instance, a positioning projection 312 and/or a catch projection 322 protrude substantially tangentially from a longitudinal portion 301, that is to say, the respective projection 312, 322 is located vertically on this longitudinal portion 301. A positioning recess 314 and/or a catch recess 324 is located at the same height with respect to the longitudinal direction L of the element 300 so as to extend tangentially into the relevant other longitudinal portion 301. Mutually associated positioning devices 310; 312, 314 and/or mutually associated catch devices 320; 322, 324 have the same spacing with respect to the longitudinal axis L of the element 300, which also preferably applies to the other embodiments of the invention. The positioning projections 312 are constructed as comparatively short pins and the positioning recesses 314 as the negative thereof on/in the respective longitudinal portion 301.

The catch projections 322 are preferably constructed as catch hooks 322 whose catch face can engage on a catch face in the respective catch recess 324. Preferably, a single catch hook 322 is constructed as a dual catch hook 322 with two catch faces, the catch hook 322 having a slot which extends from the free end thereof in the direction of the connection thereof to the element 300 so that the two catch hooks which are thereby produced are constructed so as to be resilient relative to each other. It is further preferable to use a catch hook 322 whose cross-section is constructed in a mushroom-like manner, whereas the respective catch recess 324 is constructed as the negative thereof. The respective catch face extends, in addition to a comparatively short extent in the longitudinal direction L, in a mainly radial direction, that is to say, in a transverse direction to the longitudinal direction L.

The assembly devices 310, 320 – that is, the positioning devices 310; 312, 314 and the catch devices 320; 322, 324 – may be provided on a single element 300 in such a manner that assembly devices 310, 320 which face each other with respect to the longitudinal axis L are constructed substantially in a mutually corresponding manner. That is to say, if they were able to be separated from the relevant longitudinal portion 301, the positioning devices 310; 312, 314 could engage one inside the other and engage the catch devices 320; 322, 324 with each other. This can relate to all variants and embodiments of the invention. That is to say also that in this instance a single element 300 is only similar to itself to a limited extent and it cannot thus be completely modelled on itself. An element can be

substantially modelled on itself only with the exception of its assembly devices 310, 320, 346. In another joining technique, such as, for example, adhesive bonding or welding, a respective element 300 may also be of mirror-symmetrical form.

5 Figures 8 and 9 show the second embodiment of the first variant of the invention. In this instance, a catch projection 322 protrudes from the relevant longitudinal portion 301 substantially in a peripheral direction, that is to say, the respective catch projection 322 extends at least with the outer side thereof in a peripheral direction of the element 300 which is preferably constructed in a partially circular manner at the outer side. A catch  
10 recess 324 which has a catch face which corresponds to the catch face of the catch projection 322 is at the same height with respect to the longitudinal direction L of the element 300 at the outer side on the relevant other longitudinal portion 301. The catch projections 322 are preferably constructed as catch hooks 322 which are resilient substantially in a tangential direction, and the catch recesses 324 are delimited by catch  
15 shoulders, corresponding catch faces, in addition to a comparatively short extent in the transverse direction relative to the longitudinal direction L, extending substantially in the longitudinal direction L of the element 300.

A positioning projection 312 and a positioning recess 314 of the second embodiment are  
20 preferably constructed as in the first embodiment. It is further possible to again use catch hooks 322 and catch recesses 324 which are mushroom-shaped in cross-section. The first embodiment of the second variant of the invention may, in the same manner as the two embodiments of the first variant, have the catch devices 320; 322, 324 and/or the positioning devices 310; 312, 314 of the first variant. Embodiments of the second variant  
25 of the invention are preferably constructed so as to be shorter in the longitudinal direction L than embodiments of the first variant.

With reference to Figures 10-14, a first assembly or production process of an electrical connection device 20 having an electrical cable 5 is explained in greater detail. The  
30 electrical insulation 26 is first separated from a transport band and engaged in an electrical shielding device 24; see Figure 10. Subsequently, as illustrated in Figure 11, the insulation is removed from the cable 5 and the shielding conductor 54 and the inner insulation 52 are partially removed. Furthermore, an electrical contact device 22 is removed from a transport

band and crimped with its crimping portion 222 to the inner conductor 50 of the cable 50. Afterwards, the shielding conductor 54 is widened. Afterwards, the prefabricated cable 5 which has been produced in this manner with the pin or stud portion 220 of the contact device 20 at the front is inserted from the rear into the shielding device 24, which has in  
5 the meantime been removed from its transport band (see Figure 10), the widened shielding conductor 54 being arranged at the outer side on a crimping portion of the shielding device 24.

Subsequently, a crimping operation of the crimping portion of the shielding device 24, the  
10 shielding conductor 54 which is arranged thereon and the outer insulation 56 which adjoins the electrical cable 5 at the rear is carried out using an external crimping element 60, whereby an electrical connection device 20 is produced; see Figure 13. Figure 14 shows the provision of the first variant of the contact cavity insert 30 according to the invention on the connection device 20. First, an element 300 which has been separated from a  
15 transport band 350 (cf. Figure 15) is provided at a side of the connection device 20 in the central/outer crimping region thereof. Subsequently, a second element 300 which has also been separated from a transport band 350 (cf. Figure 15) is provided at a facing side of the connection device 20 and engaged with the first element 300. The connection device 20 which has a contact cavity insert 30 and which is produced in this manner can now be  
20 placed in the connector housing 10 (see Figure 4).

Figure 15 shows an alternative to the production step in Figure 14, the mutually corresponding elements 300 remaining on the respective transport band 350. In one of these transport bands 350, the connection devices 20 which have preferably been produced  
25 as described above are successively placed in the elements 300 which are provided at that location. Furthermore, with another transport band 305 which is opposite the first transport band 350, the first elements 300 with the elements 300 of the second transport band 350 are also successively closed (zip fastener principle). A band is thereby produced which has connection devices 20 which are mechanically connected to each other and which have  
30 contact cavity inserts 30.

An alternative of the production method according to the invention following Figure 11 is illustrated in Figure 16. In this instance, before producing the insulation crimping 60 or



outer crimping 60 using the outer crimping element 60, the second variant (see also Figures 19, 20) of the contact cavity insert 30 according to the invention is provided on the electrical shielding device 24. That is to say, the electrical connection device 20 is not yet completed and the contact cavity insert 30 is provided on the shielding device 24 before it  
5 is completed. This can be carried out, for example, as described above, the shielding device 24 still being able to be located on its transport band; the zip fastening principle can also be used here in the same manner.

Subsequently, the shielding device 24 is connected to the prefabricated cable 5, the cable 5  
10 with its pin or stud portion 220 of the contact device 20 at the front being inserted from the rear into the shielding device 24, the widened shielding conductor 54 being arranged at the outer side on the crimping portion of the shielding device 24. Subsequently, the crimping of the crimping portion of the shielding device 24, the shielding conductor 54 which is arranged thereon and the outer insulation 56 which adjoins the electrical cable 5 at the rear  
15 is carried out. An electrical connection device 20 having a contact cavity insert 30 which is provided thereon is thereby produced.

Figures 17, 18 show the two variants of the invention in each case for an electrical connection device 20 for a counter-connector 1 which is constructed as an electrical socket  
20 plug type connector 1, the electrical cable 5 being omitted. In this instance, Figure 17 shows a five-piece subassembly of the connection device 20, similarly to the first variant of the invention, and Figure 18 a three-piece subassembly of the connection device 20, similarly to the second variant of the invention. It is particularly advantageous in the second variant of the invention that the electrical shielding device 24 can already be  
25 delivered to a manufacturer in a state with the contact cavity insert 30 and in this manner two of five components which have to be handled can be omitted.

Figures 19, 20 show the second embodiment of the second variant of the invention. In this instance, a positioning projection 312 and/or a catch projection 322 protrude from the  
30 longitudinal portion 301 of an element 300 substantially in the peripheral direction, that is to say, the respective projection 312, 322 extends at least partially in the direction of the generator of the contact cavity insert 30 (see Figure 20). A positioning recess 314 and/or a catch recess 324 is at the same height with respect to the longitudinal direction L of a

facing element 300 so as to extend into the respective other longitudinal portion 301, at least partially in the peripheral direction. The relevant positioning projection 312 and/or the relevant catch projection 322 may be constructed in this instance as a peripheral plate and the relevant positioning recess 314 or the relevant catch recess 324 may be constructed  
5 as the negative thereof on/in the respective longitudinal portion 301, and thus has the shape of a recess which extends at least partially in the peripheral direction.

There are preferably located on a single element 300 of a contact cavity insert 30 at the front side thereof at mutually opposing peripheral sides mutually corresponding catch  
10 devices 320; 322, 324, a single catch device 320 being able to have both a catch projection 322 and a catch recess 324. In this instance, the front side is the side which faces a free end of a fabricated electrical connection device 20 (see Figure 3, 16 (right)). When two elements 300 are assembled, a catch projection 322 of a first catch device 320 can be engaged in a catch recess 324 of a second catch device 320, a catch projection 322 of the  
15 second catch device 320 being able to be engaged in a catch recess 324 of the first catch device 320. Such catch devices 320; 322, 324 may naturally also be provided in another portion of the element(s) 300, that is to say, the contact cavity insert 30.

The or a catch device 320 of the element 300 is again preferably constructed so as to be at  
20 least partially resilient in a tangential direction. In this embodiment of the invention, when two elements 300 are joined together, the sliding faces of two corresponding catch devices 320 first abut each other in a planar manner. When the elements 300 are moved further towards each other, they slide on each other so that the corresponding catch devices 320 engage with each other on catch faces of the catch projections 322 (see Figure 20). In this  
25 instance, the respective catch face assumes a specific angle, for example, a 30° to 75° angle with respect to its relevant catch face. Instead of using two sliding faces, the corresponding catch devices 320 may also have an edge and a sliding face.

A positioning device 310 which is constructed as a peripheral plate 312 (positioning  
30 projection 312) or as a peripheral recess 314 (positioning recess 314) is preferably located in a central region of the longitudinal portion 301 of an element 300. In this instance, the positioning device 310 may further serve to engage two elements 300, the peripheral plate 312 preferably having a lateral catch projection 322 which protrudes in the longitudinal

direction L and which can be engaged in a catch recess 324 of the peripheral recess 314 or which can be engaged with a projection which is provided in the peripheral recess 314.

This may naturally also be constructed the other way round. Catch projections 322 which protrude in the longitudinal direction L are preferably located at both transverse sides of the peripheral plate 312; in a similar manner, the peripheral recess 314 has catch recesses 324 or catch projections.

A positioning device 310 which is constructed as a positioning projection 312 or positioning recess 314 is preferably located at a rear side facing away from the front side of the relevant element 300 or the contact cavity insert 30. In this instance, it is preferable for one positioning projection 312 and one positioning recess 314 to be provided for each peripheral side and element 300; consequently, when two elements 300 are joined together, four positioning projections engage in four positioning recesses 314.

The features of the four embodiments or the two variants of the invention explained above can naturally be used with each other. That is to say that, for example, a feature of the first embodiment of the first variant can be used in an embodiment of the second variant or the second embodiment of the first variant. It is possible to proceed in this manner with all the features of the invention.

**CLAIMS**

1. Contact cavity insert for an electrical connection device (20), in particular an electrical connector (1), preferably a FAKRA connector (1), for the automotive sector,
- 5 the contact cavity insert (30) being constructed in such a manner that the electrical connection device (20) can be provided in a contact cavity (12) of a connector housing (10) of the electrical connector (1) by means of the contact cavity insert (30), the contact cavity insert (30) being constructed in two parts.
- 10 2. Contact cavity insert according to claim 1, the contact cavity insert (30) having two shell elements (300) or two half-shell elements (300) which are preferably constructed in a substantially identical manner,
- the two shell elements (300) or half-shell elements (300) being able to be secured to each other particularly in a materially integral manner, positive-locking manner and/or non-
- 15 positive-locking manner, and
- the two shell elements (300) or half-shell elements (300) preferably being constructed in such a manner that they can be welded, adhesively bonded, engaged or clipped with respect to each other.
- 20 3. Contact cavity insert according to either of the preceding claims, for mutual assembly of two shell elements (300) or half-shell elements (300) one on the other, a single shell element (300) or half-shell element (300) having, at mutually opposing longitudinal portions (301) at the same position with respect to a longitudinal axis (L), mutually corresponding assembly devices (310, 320),
- 25 the mutually corresponding assembly devices (310, 320) preferably being constructed as mutually corresponding positioning devices (310) and/or mutually corresponding catch devices (320) and two mutually corresponding assembly devices (310, 320) preferably being constructed at least partially in a positive-locking manner.
- 30 4. Contact cavity insert according to any one of the preceding claims, the mutually corresponding assembly devices (310) each being a positioning projection (312) and a positioning recess (314), and/or the mutually corresponding assembly devices (320) being a catch projection (322) and a catch recess (324),

an assembly device (310, 320) extending away from the respective longitudinal portion (310) in a substantially tangential manner or in a peripheral direction, extending into the respective longitudinal portion (310) in a substantially tangential manner or in a peripheral direction, or extending on the respective longitudinal portion (310) in a substantially radial or tangential manner or in a peripheral direction.

5. Contact cavity insert according to any one of the preceding claims, a single catch device (320) of a single shell element (300) or half-shell element (300) having a catch hook, whose catch face or catch projection extends in a longitudinal direction (L) of the shell element (300) or half-shell element (300) or in a transverse direction relative thereto.

6. Contact cavity insert according to any one of the preceding claims, the contact cavity insert (30) or the shell elements (300) or half-shell elements (300) thereof being constructed at a longitudinal end in such a manner that, when it/they are assembled on an electrical shielding device (24) of the electrical connection device (20), a region of the shielding device (24) that can be electrically contacted by a counter-connector (1) remains substantially free and/or, at a facing longitudinal end, the contact cavity insert (30) or the shell elements (300) or half-shell elements (300) thereof being constructed in such a manner that, when it/they are assembled on the electrical shielding device (24) of the electrical connection device (20), a crimping portion of the shielding device (24) remains freely accessible or can be substantially covered.

7. Contact cavity insert according to any one of the preceding claims, the contact cavity insert (30) or a shell element (300) or half-shell element (300) having at least one catch device (330, 340), by means of which it can be engaged on a catch device (130) of the connector housing (10) and/or a catch device (440) of a contact securing member (40) of the electrical connector (1), the catch device (330, 340) of the contact cavity insert (30) or the shell element (300) or half-shell element (300) preferably having a catch shoulder, the catch device (130) of the connector housing (10) preferably having a catch spring and/or the catch device (440) of the contact securing member (40) preferably having a catch projection.

8. Method for equipping an electrical shielding device (24) or an electrical connection device (20) with a contact cavity insert (30), for an electrical connector (1), preferably a FAKRA connector (1), for the automotive sector,  
there being provided on the shielding device (24) or the connection device (20) at mutually  
5 opposing sides a shell element (300) or a half-shell element (300) of the contact cavity insert (30), and the two shell elements (300) or half-shell elements (300) being secured to each other during provision or afterwards.
9. Method for equipping an electrical shielding device (24) with a contact cavity insert (30)  
10 and for producing an electrical connection device (20) for an electrical connector (1), preferably a FAKRA connector (1), for the automotive sector,  
a shell element (300) or a half-shell element (300) of the contact cavity insert (30) being provided in each case at mutually opposing sides on the shielding device (24), and there  
being produced inside the shielding device (24) an electrical contact device (24) on which  
15 an electrical cable (5) is provided.
10. Method according to any one of the preceding claims, a crimping operation (60), in particular an external crimping operation (60) of the shielding device (24) with the cable (5) being carried out before or after the provision of the two shell elements (300) or half-shell  
20 elements (300) on the electrical shielding device (24) or connection device (20).
11. Method according to any one of the preceding claims, a plurality of electrical shielding devices (24) or connection devices (20) successively being provided with the contact cavity insert (30) using two transport bands (350) which each have a plurality of shell  
25 elements (300) or half-shell elements (300) which are mechanically connected to each other,  
a single shielding device (24) or connection device (20) preferably first being inserted into a single shell element (300) or half-shell element (300) of the one transport band (350) and subsequently the relevant contact cavity insert (30) being produced from a single shell  
30 element (300) or half-shell element (300) of the other transport band (350).
12. Electrical connection device or electrical connector, preferably a FAKRA connector (1), for the automotive sector,

- the electrical connection device (20) or an electrical connection device (20) for the connector (1) having a contact cavity insert (30) which is constructed in accordance with any one of claims 1 to 7, or
- the electrical connection device (20) or an electrical connection device (20) being produced
- 5 for the connector (1) according to any one of claims 8 to 11.

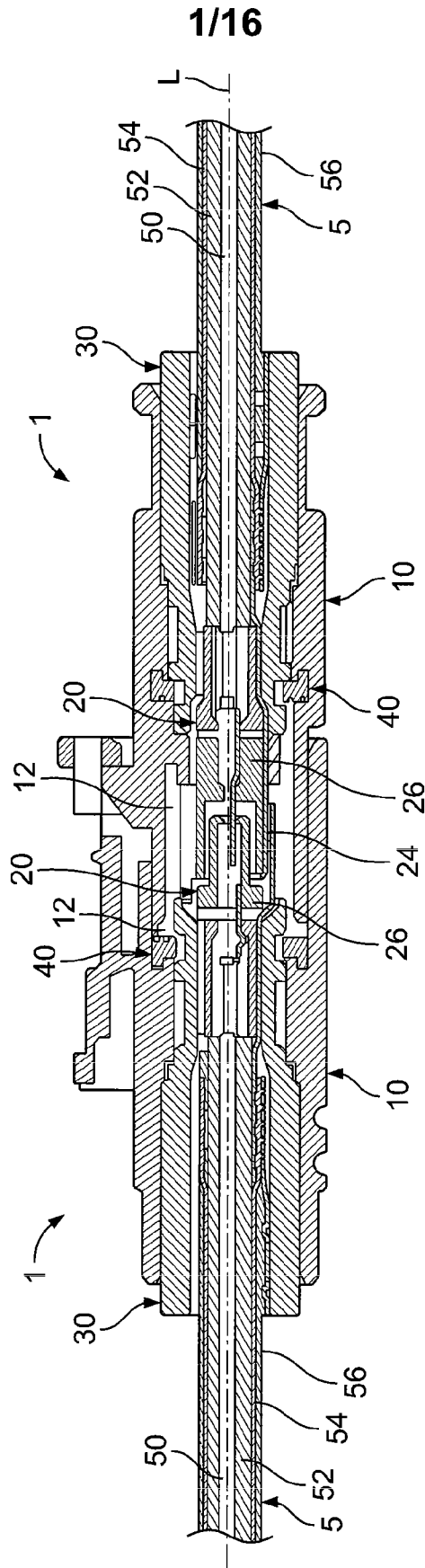
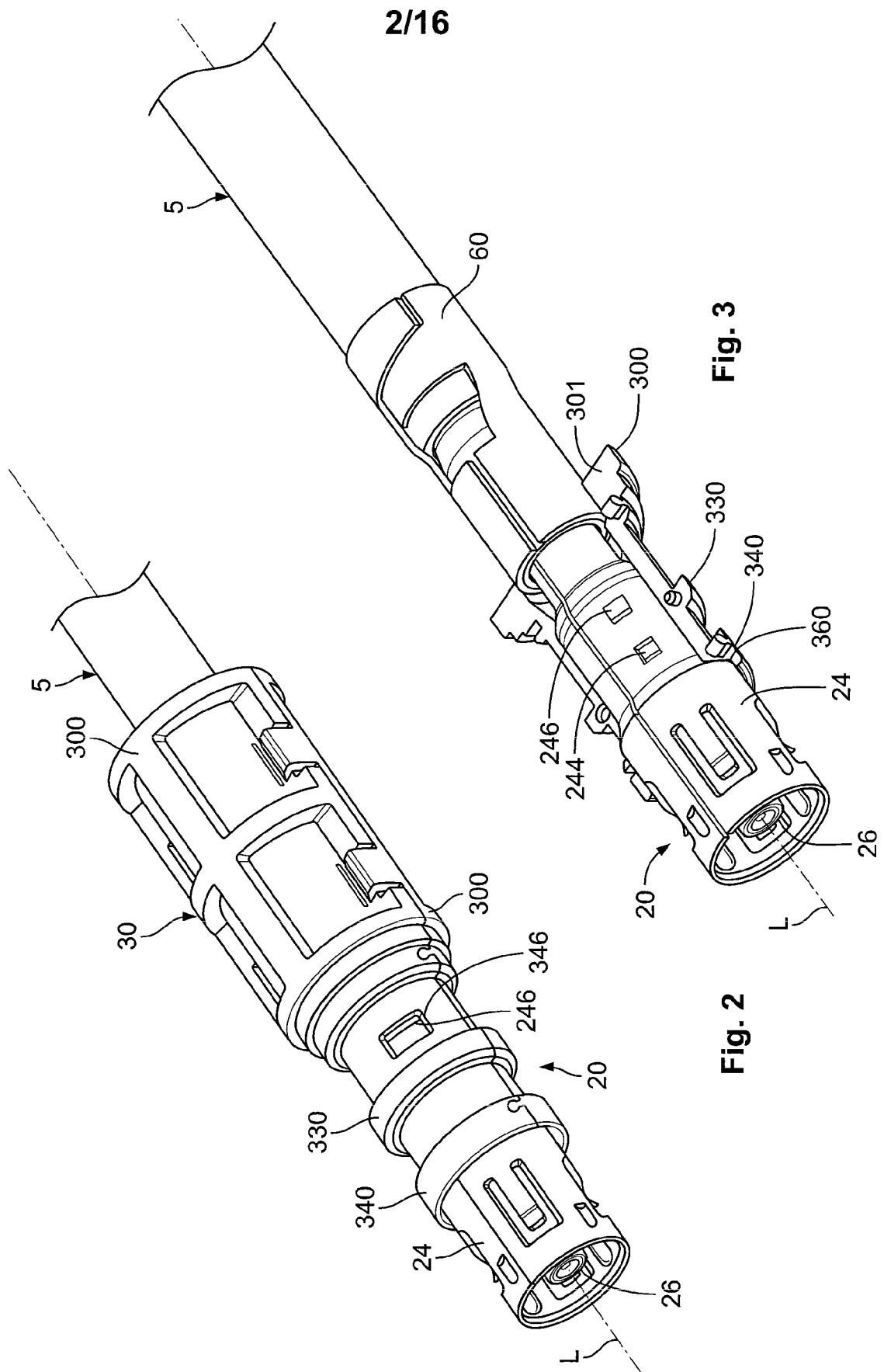


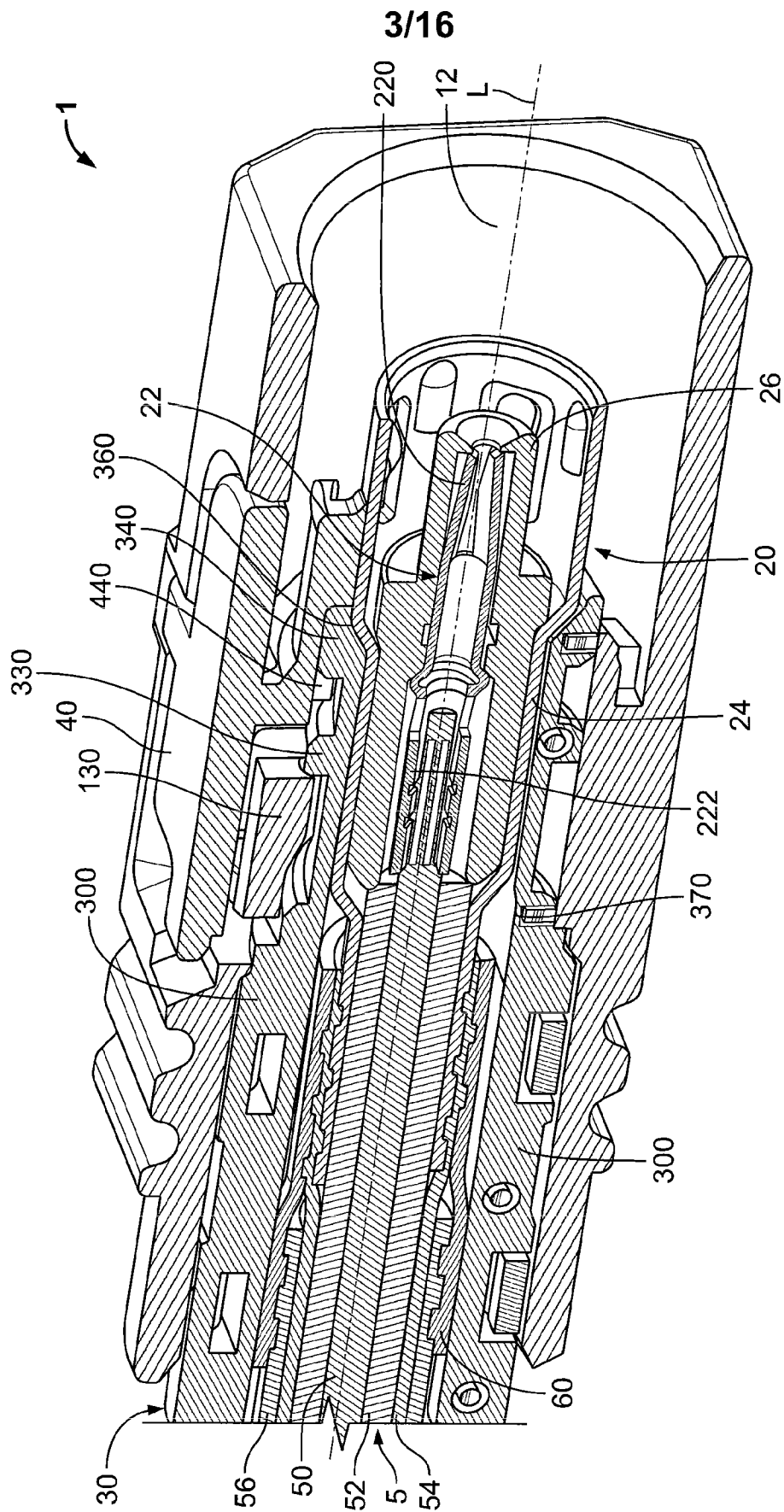
Fig. 1



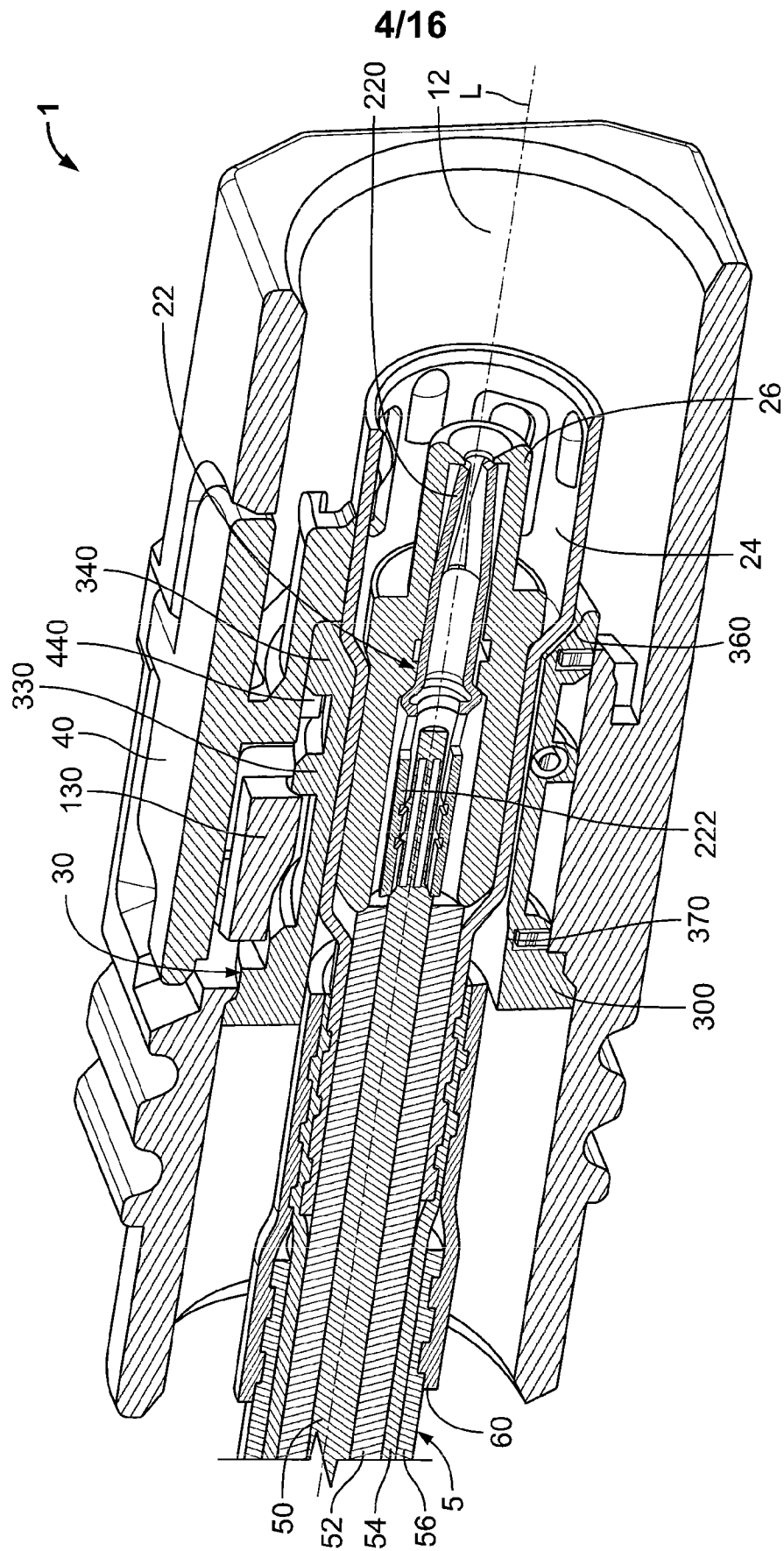


**Fig. 3**

**Fig. 2**



**Fig. 4**



**Fig. 5**

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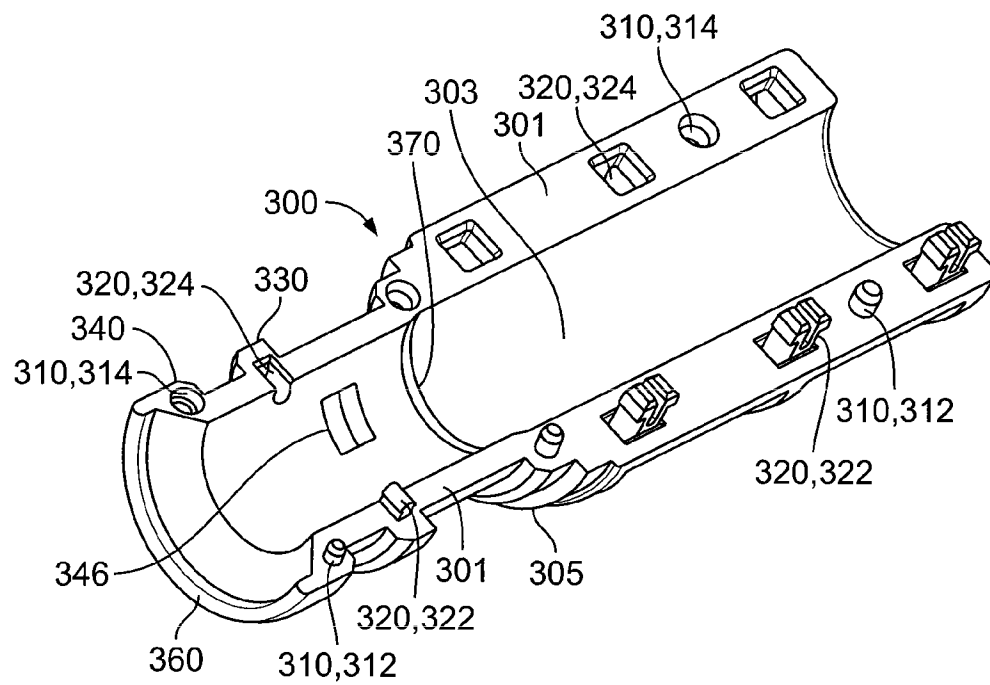


Fig. 6

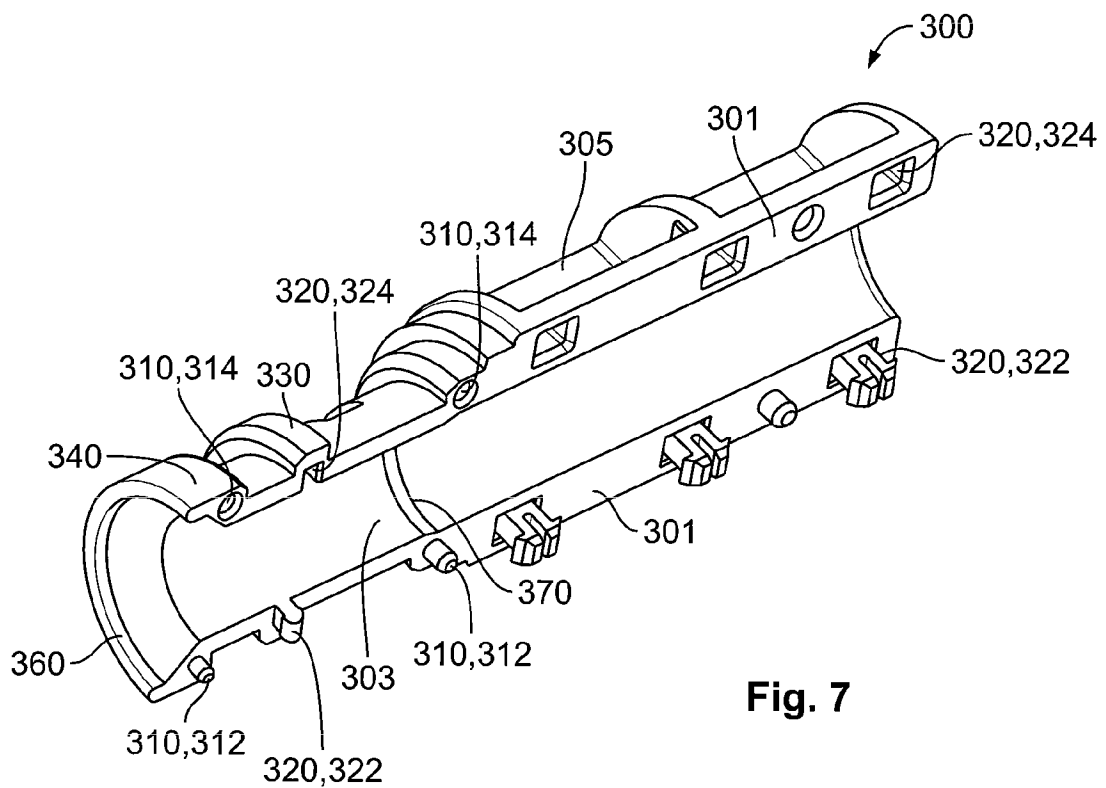


Fig. 7

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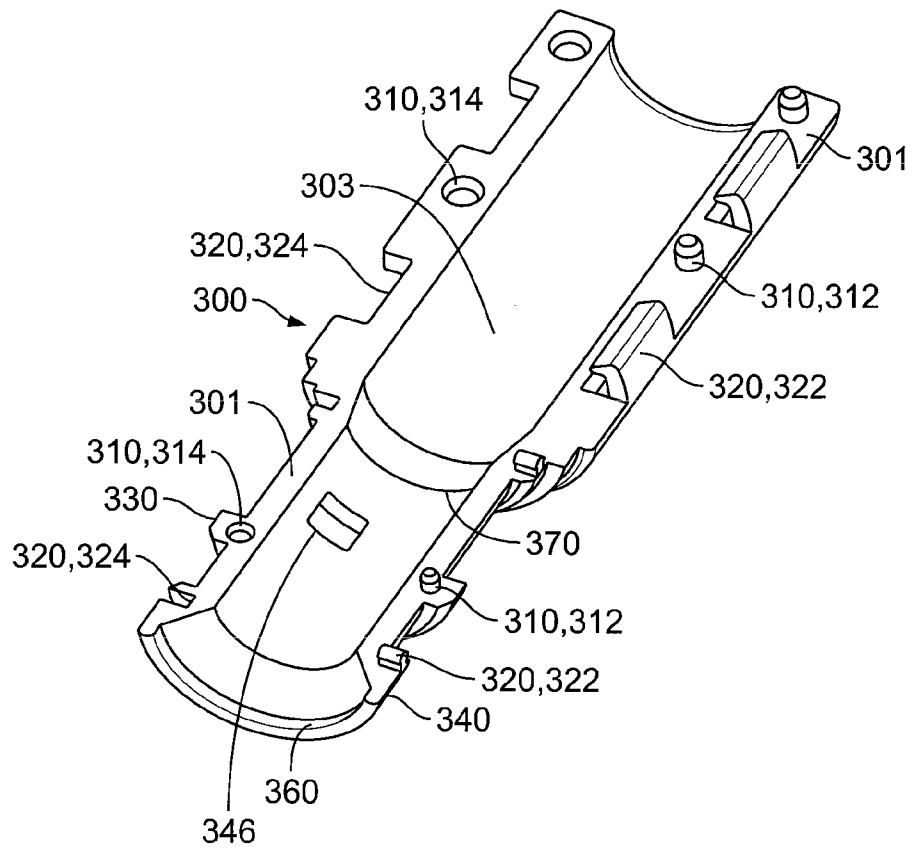


Fig. 8

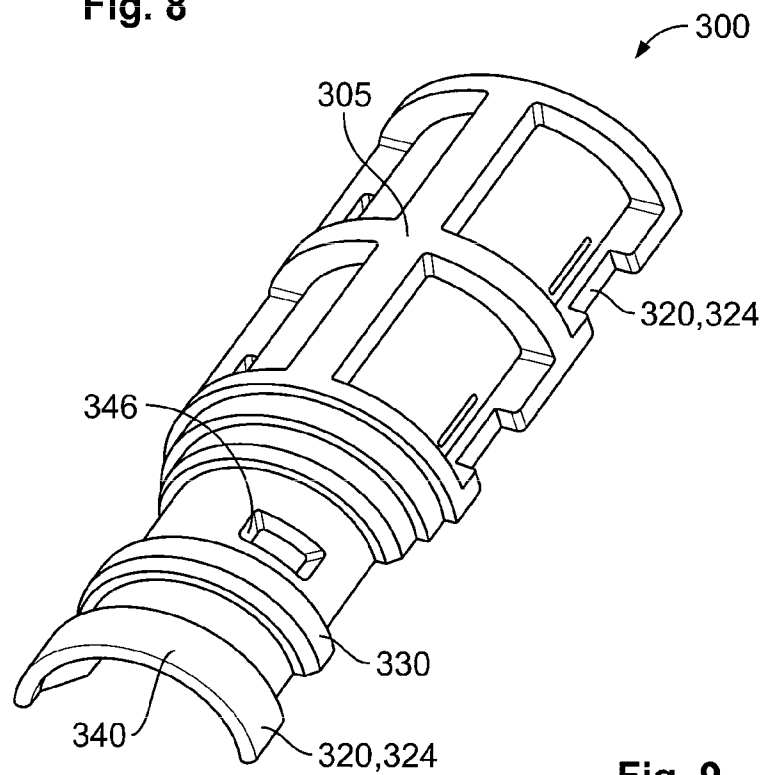


Fig. 9

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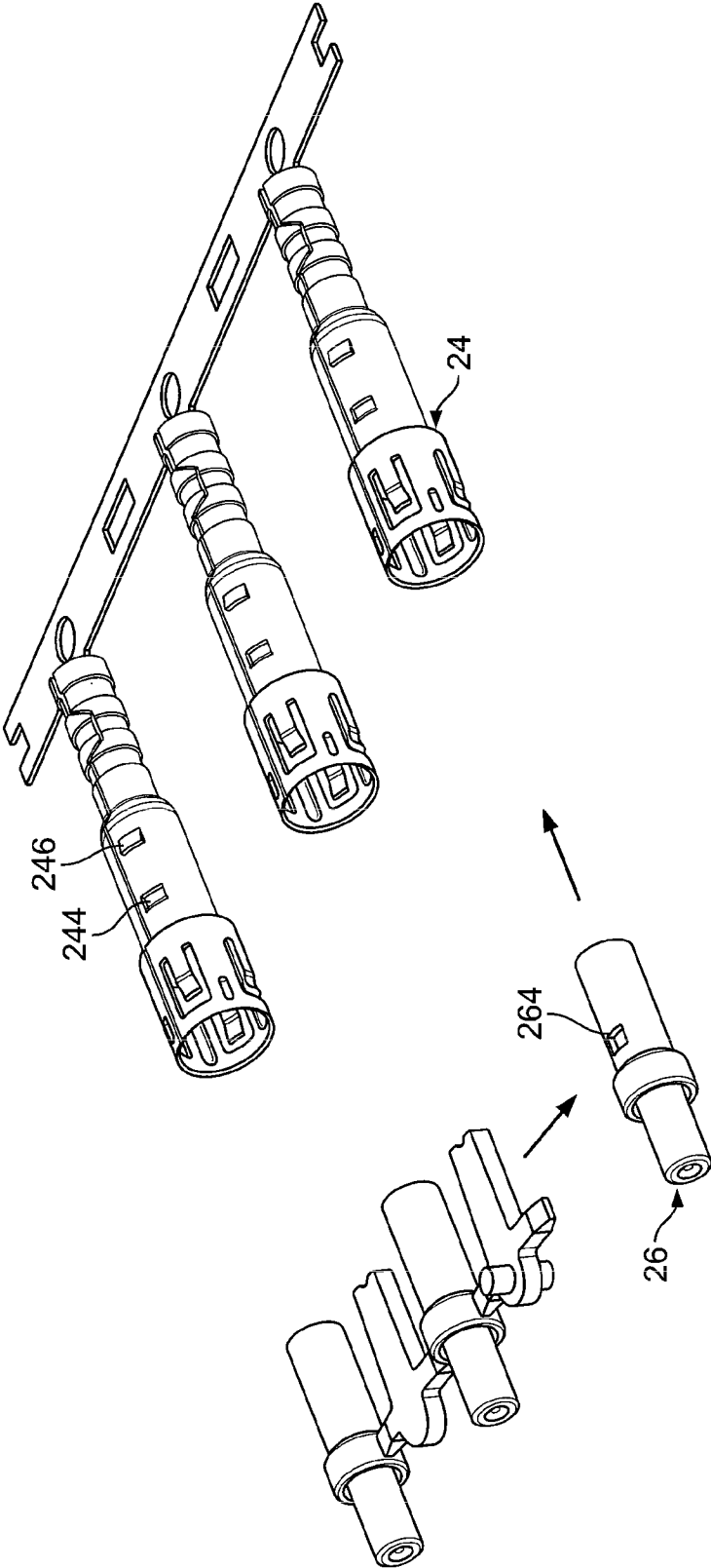


Fig. 10

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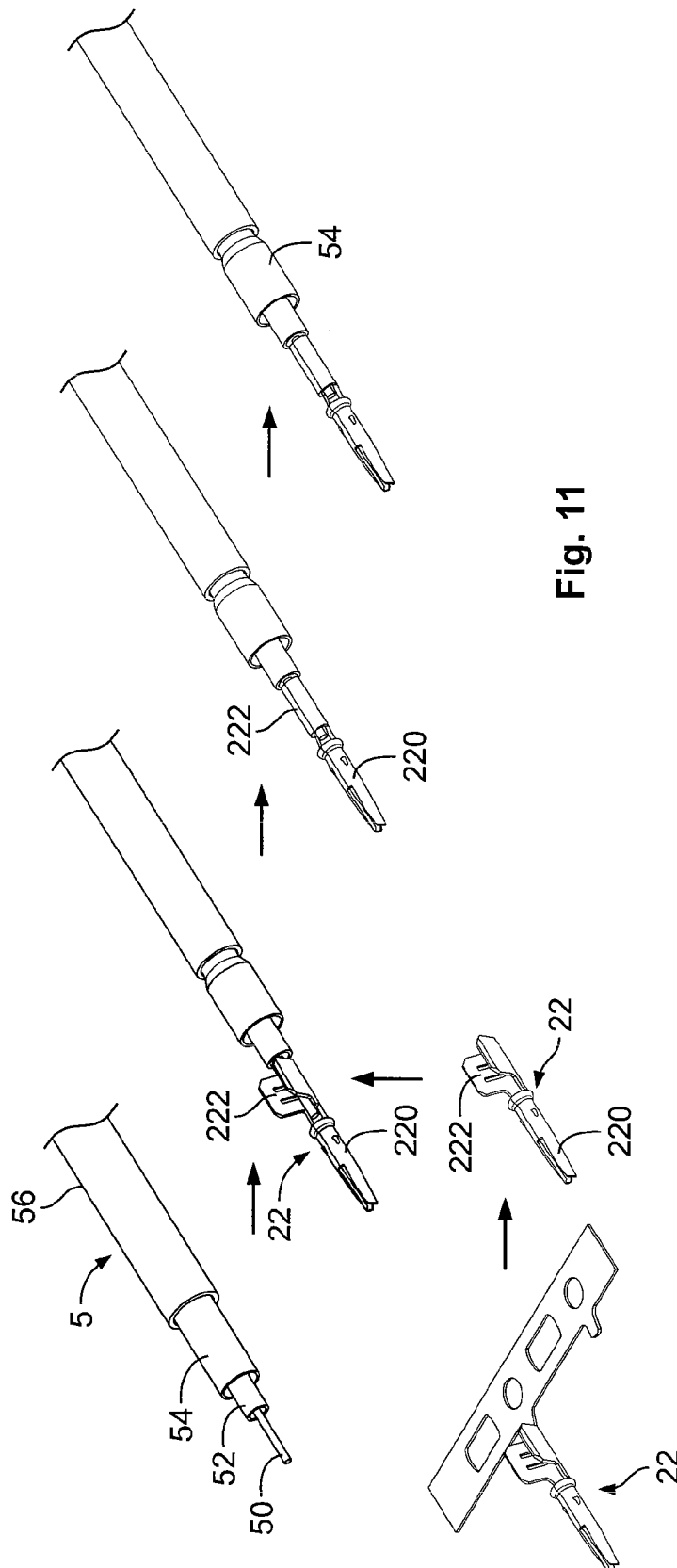
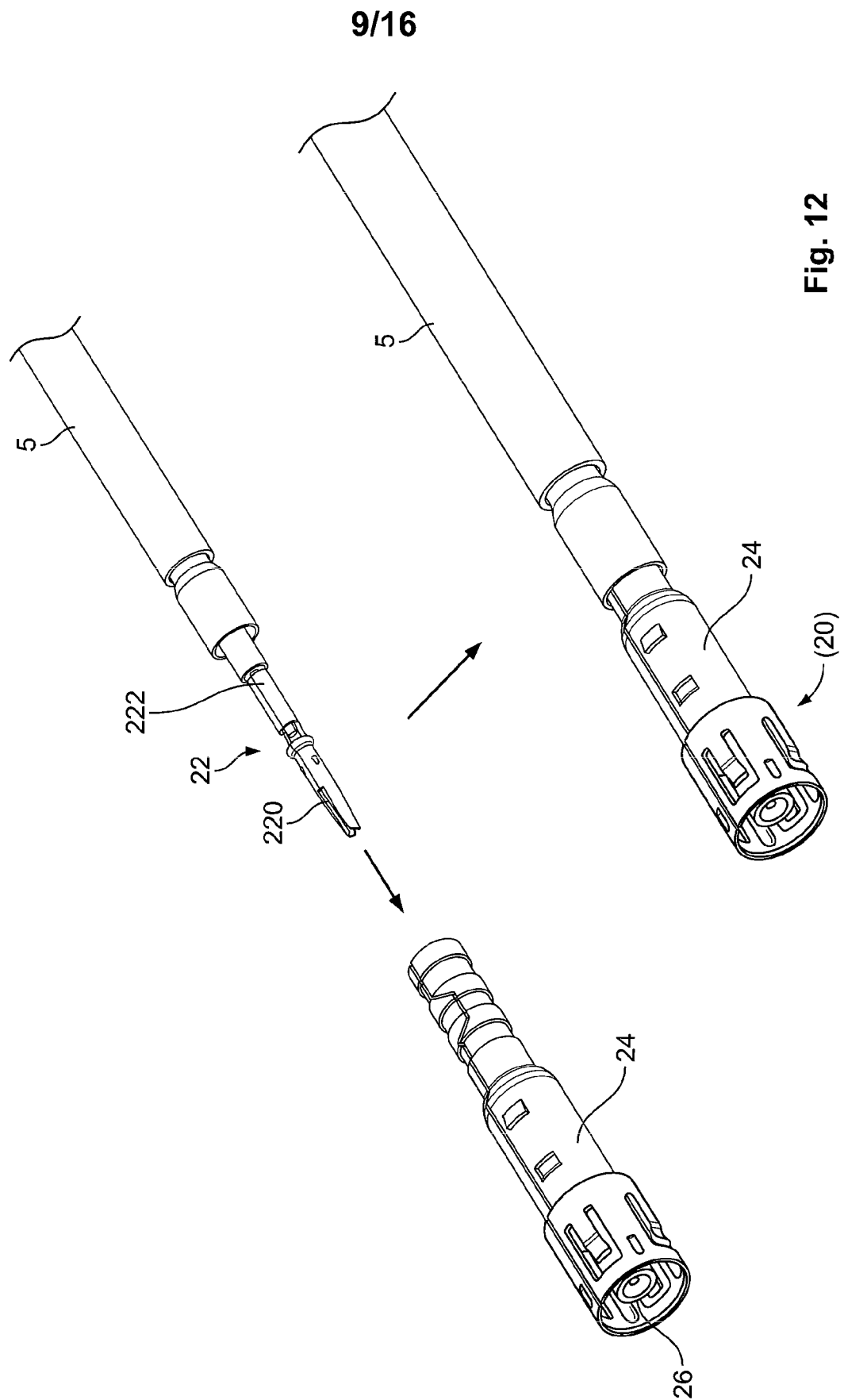
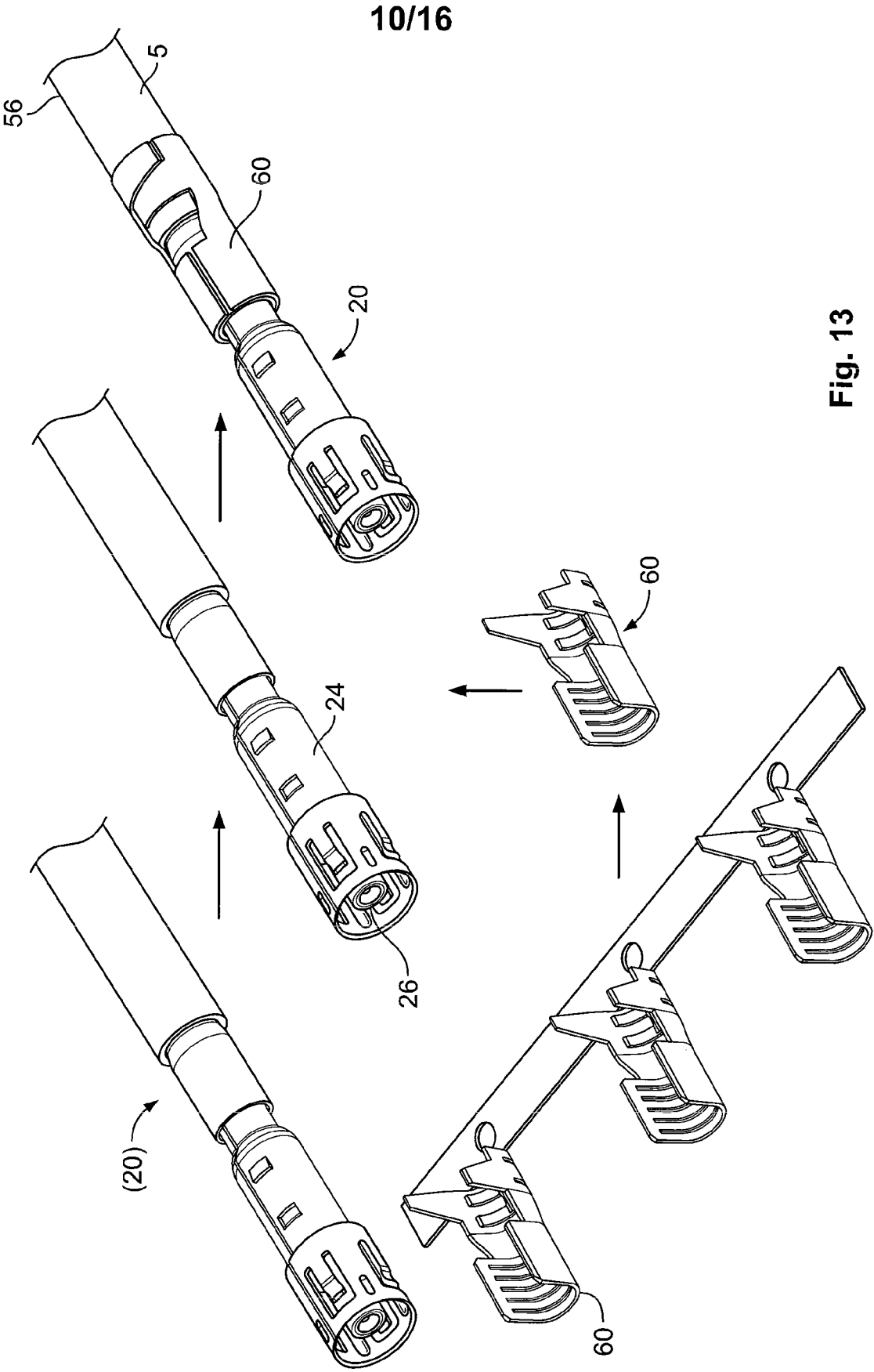


Fig. 11







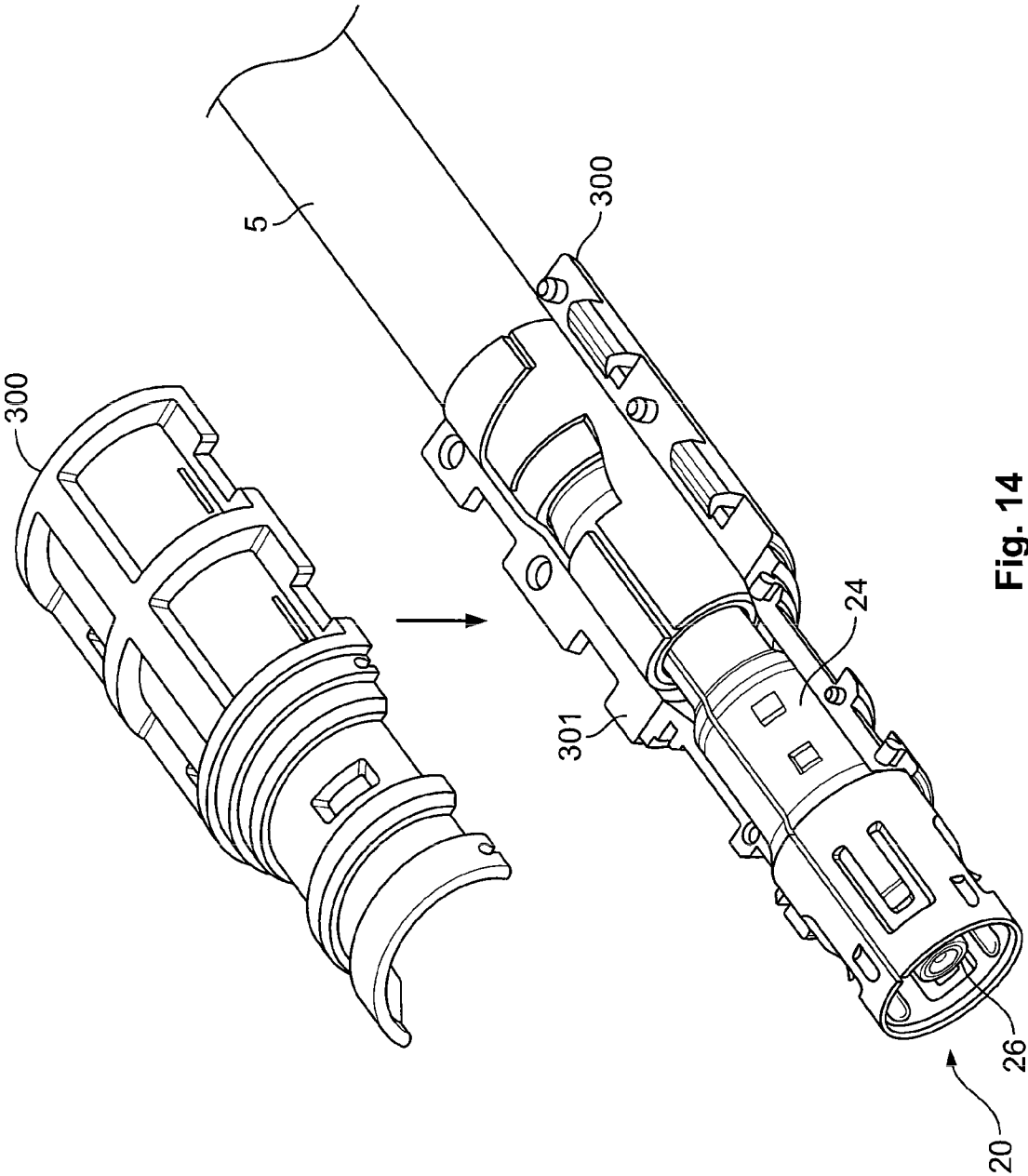


Fig. 14

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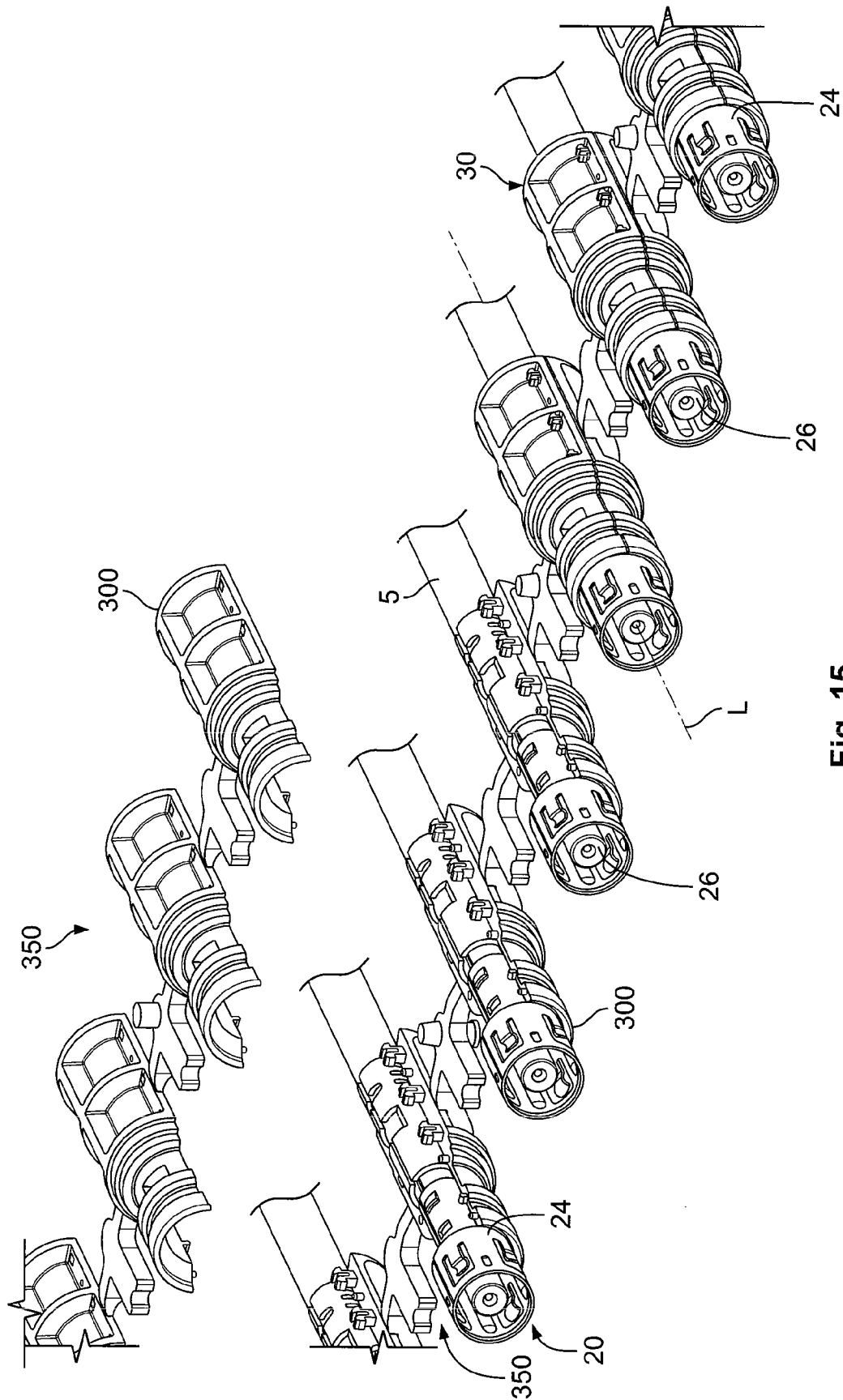


Fig. 15

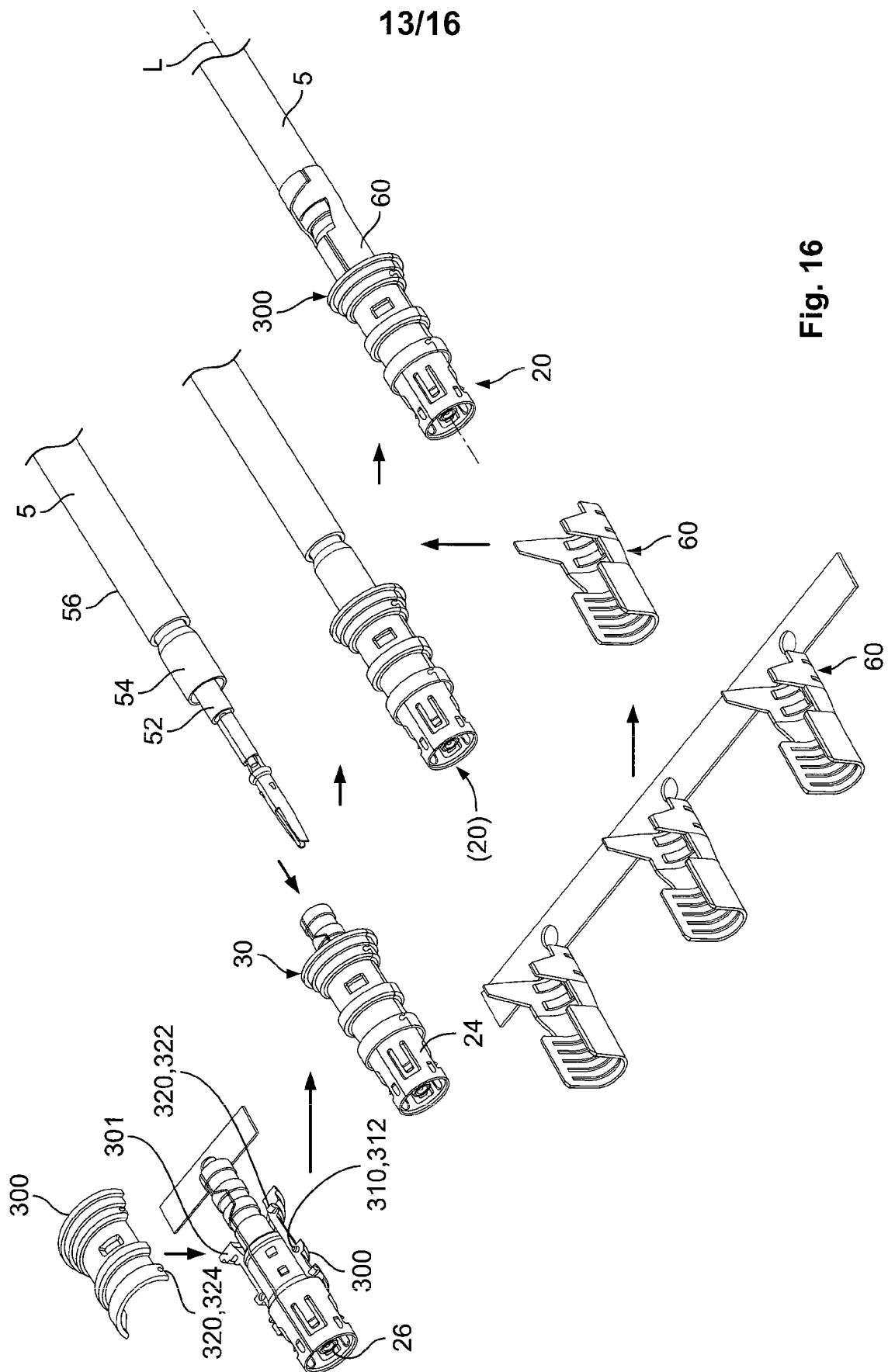


Fig. 16

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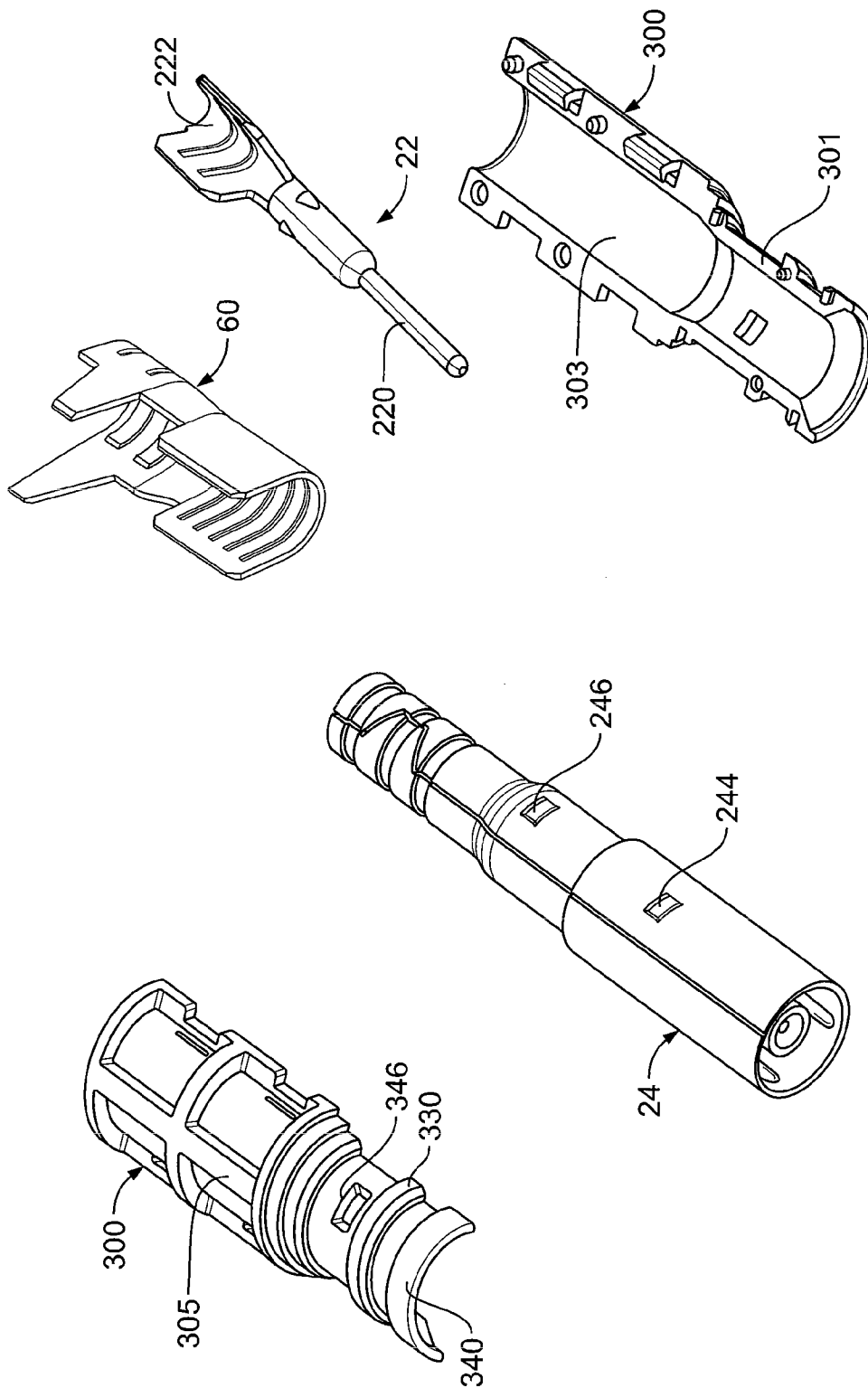


Fig. 17

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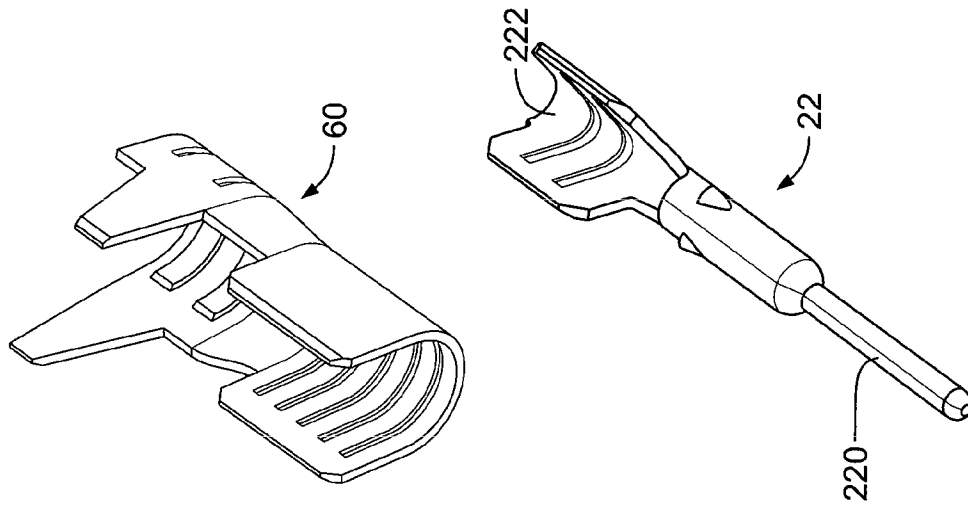
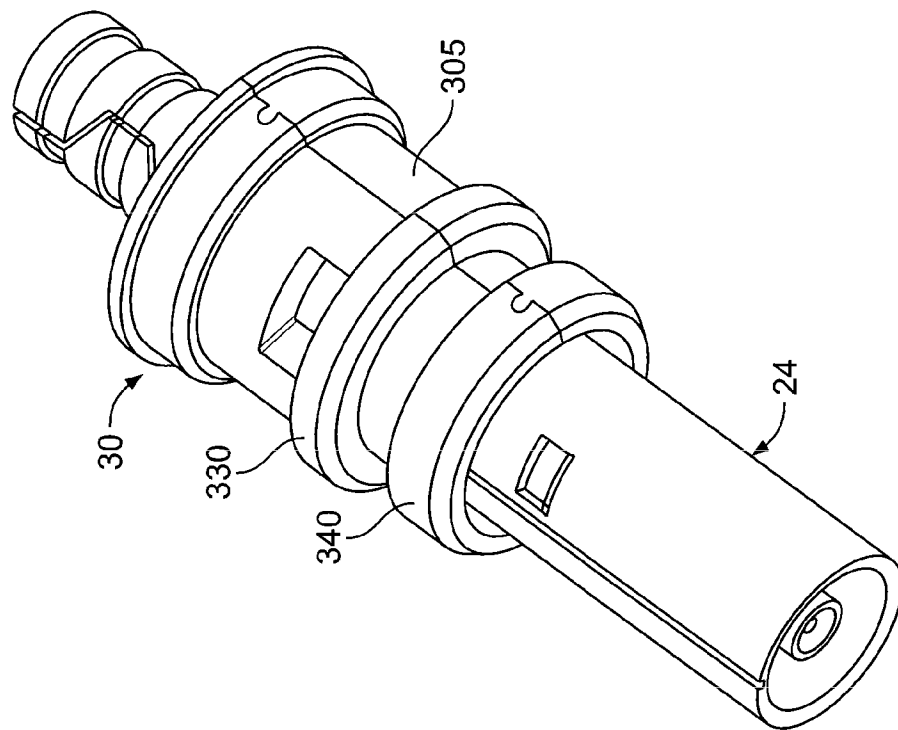


Fig. 18



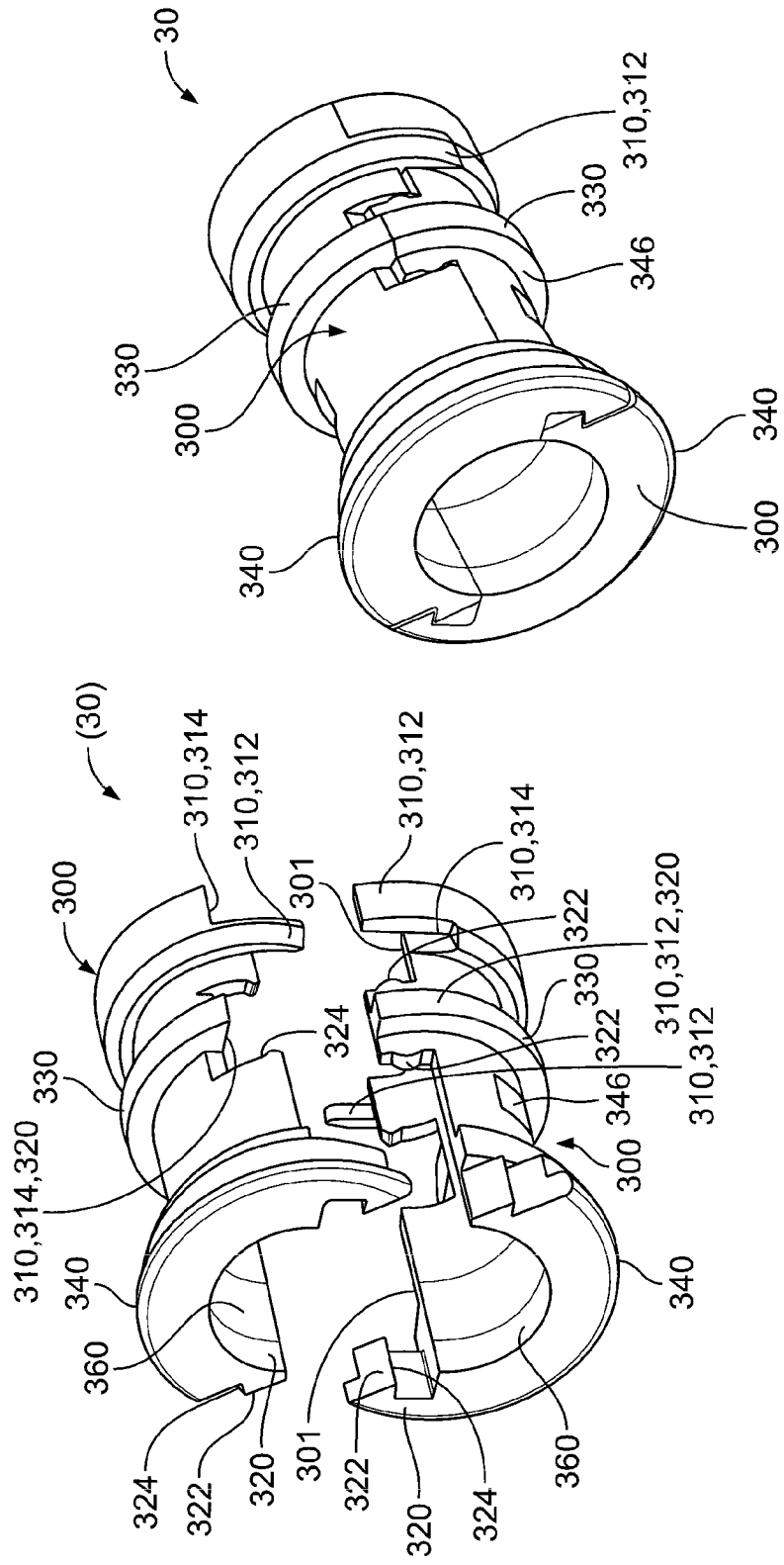


Fig. 19

Fig. 20

# INTERNATIONAL SEARCH REPORT

International application No  
PCT/EP2012/059658

A. CLASSIFICATION OF SUBJECT MATTER  
INV. H01R13/506 H01R24/38  
ADD.

According to International Patent Classification (IPC) or to both national classification and IPC

## B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)  
H01R

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EP0-Internal, WPI Data

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

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Further documents are listed in the continuation of Box C.



See patent family annex.

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Date of the actual completion of the international search

17 September 2012

Date of mailing of the international search report

24/09/2012

Name and mailing address of the ISA/

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Fax: (+31-70) 340-3016

Authorized officer

Bouhana, Emmanuel



# INTERNATIONAL SEARCH REPORT

International application No  
PCT/EP2012/059658

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

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Information on patent family members

International application No

PCT/EP2012/059658

| Patent document<br>cited in search report |    | Publication<br>date | Patent family<br>member(s) | Publication<br>date |
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