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(71) Applicant: **DELPHI INTERNATIONAL OPERATIONS LUXEMBOURG S.À.R.L.** [LU/LU]; Avenue de Luxembourg, L-4940 Bascharage (LU).

(72) Inventor: **CORMIER, François**; 2, Sente des Ecoliers, Chenicourt, F-28210 Senantes (FR).

(74) Agent: **ROBERT, Vincent**; Delphi France SAS - IP Department, Bat. Le Raspail - ZAC Paris Nord 2, 22 avenue des Nations, CS 65059 Villepinte, F-95972 Roissy CDG Cedex (FR).

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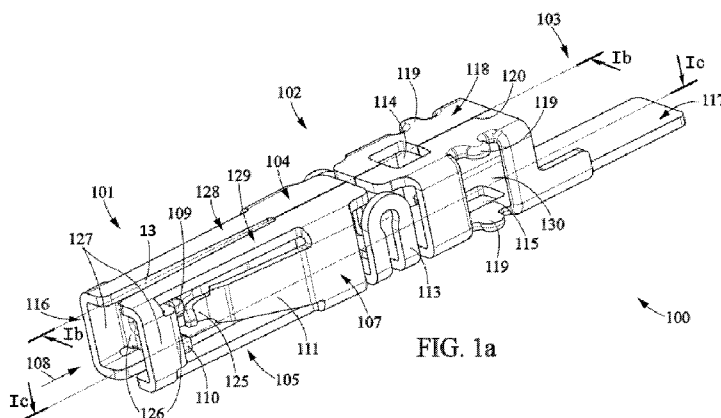


FIG. 1a

(57) Abstract: The present invention relates to an assembly of a male terminal and a one-piece female terminal (100), consisting of an elongated body having a longitudinal axis and comprising a contact section (101) with a front opening (108). The contact section (101) is divided into two elongated branches (128, 129) separated by a slit (13) extending from the front opening (108) along the longitudinal axis of the female terminal (100).

ASSEMBLY OF A FEMALE TERMINAL WHICH HAS A CONTACT SECTION DIVIDED INTO TWO BRANCHES AND A MALE TERMINAL

The present invention relates to one-piece electrical terminals, in particular one-piece female terminals.

5

In particular, the present invention is related to female terminals and features of such terminals which hold the male terminal inside of the female terminal.

10 There are two main classes of electrical terminals which are one-piece terminals and two-piece terminals. Two-piece terminals are beneficial because they are using an external cage which enables a greater flexibility to provide contact functions.

15

However, two-piece terminals also have some drawbacks. Mainly, their assembly is complex and they are, therefore, expensive to manufacture. Further, the external cage can be cumbersome.

20

Some cheaper applications, where room is limited, cannot use such two-piece terminals. In such cases, one piece terminals only can be used.

25 Various methods and features have been introduced to help the retention of the male terminal inside the female terminal.

For example, such features may comprise one or more of
30 resilient arms. The resilient arms are cut out of lateral walls of the female terminal body, and impose an elastic force onto the male terminal, which holds the male terminal in place inside of the female terminal. The resilient arms or lances also establish an electrical contact between the
35 male terminal and the female terminal.

However, this general arrangement may show some drawbacks. The male terminal is held in place by elastic force, i.e. a force which is applied to a specific contact point of the male terminal. The same specific contact point is also a contact point for establishing the electrical connection.

Thus, when the male terminal is moved, usually as a result of applied stress, e.g. vibrations or shifts, the contact point is rubbed by the resilient arms or lances and becomes damaged. As a result, a fretting corrosion occurs, and the electrical conductivity of the connection is compromised.

The present invention has notably for object to mitigate those drawbacks.

To this aim, a one-piece female terminal is provided, the one-piece terminal comprising an elongated body having a longitudinal axis, a contact section with a front opening. The contact section is divided into two elongated branches separated by a slit extending from the opening along the longitudinal axis of the female terminal.

With these features, the force which holds the male terminal inside the female terminal may be more easily adjusted, therefore increasing the reliability of the terminal assembly. The force may be adjusted to be strong enough to reliably hold the male terminal inside the female terminal, yet being not too strong so the damage of the male terminal is avoided.

In some embodiments, one might also use one or more features defined in the claims.

These features help the retention of the male terminal

inside the female terminal, reduce the damage of the electrical contact point between the male terminal and the female terminal, and further reduce the fretting corrosion.

5 Of course, different features, alternatives and/or embodiments of the present invention can be combined with each other in various arrangement to the extent that they are not incompatible or mutually exclusive of others.

10 The present invention will be better understood and other features and advantages will become apparent upon reading the following detailed description including embodiments for illustrative purposes with reference to the figures, presented as non-limitative examples, which can be used to
15 complete the understanding of the present invention and the description and, where appropriate, contribute to its definition, in which:

- Figure 1a shows a female terminal according to a first embodiment of the present invention,
- 20 - Figure 1b shows a cross section view along line Ib-Ib of the female terminal of Figure 1,
- Figure 1c shows a cross section view along line Ic-Ic of the female terminal of Figure 1,
- Figure 2a shows a female terminal according to a
25 second embodiment of the present invention,
- Figure 2b shows a cross section view along line IIb-IIb of the female terminal of Figure 2,
- Figure 2c shows a cross section view along line IIc-IIc of the female terminal of Figure 2,
- 30 - Figure 3a shows a female terminal according to a third embodiment of the present invention,
- Figure 3b shows a cross section view along line IIIb-IIIb of the female terminal of Figure 3,
- Figure 3c shows a cross section view along line
35 IIIc-IIIc of the female terminal of Figure 3,

- Figure 4a shows a top view of a female terminal according to a fourth embodiment,
- Figure 4b shows a bottom view of the female terminal of Figure 4a,
- 5 - Figure 4c shows a cross-section view of the female terminal of Figure 4a,
- Figure 4d shows a front view of an alternative design according to the fourth embodiment,
- Figure 5 shows a male terminal,
- 10 - Figure 6 shows a cross-section view of a plurality of terminals inserted into a housing.

It should be noted that, on figures, structural and/or functional elements which are common to different
15 embodiments may have the same reference sign. Thus, unless otherwise stated, these elements have structural, dimensional and material properties which are identical.

An example of a female terminal 100, 200, 300, 400
20 according to the present invention, as shown on Figures 1a to 1c, 2a to 2c and 3a to 3c and 4a to 4d, generally consists of an elongated box-shaped body having, respectively :

- a top wall 104, 204, 304, 404
- 25 - a bottom wall 105, 205, 305, 405
- a first lateral wall 106, 206, 306, 406 and
- a second lateral wall 107, 207, 307, 407.

The female terminal 100, 200, 300, 400 comprises:

- 30 - a contact section 101, 201, 301, 401
- an intermediate section 102, 202, 302, 402 and
- a connection section 103, 203, 303, 403

provided one after the other along a longitudinal axis of the female terminal 100, 200, 300, 400.

The connection section 103, 203, 303 comprises :

- a crimping portion,
- a body part 118, 218, 318, 418
- 5 - abutments 119, 219,
- a seam 120, 220, and
- openings 114, 214 and 115, 215.

When the female terminal 100, 200, 300, 400 is attached to
10 a wire, not currently shown, a crimping tab, not currently
shown, extending from each side of a crimping base 117,
217, 317, 417 is bent so as to surround the wire. A crimped
connection between the female terminal 100, 200, 300, 400
and the wire is established.

15

The connection section 103, 203, 303 further comprises
opposed openings 130, 230 and 131, 231. The opposed
openings 130, 230 and 131, 231 are shaped to receive a
plastic lance 602 of a housing to lock the female terminal
20 100, 200 in the housing.

The contact section 101, 201, 301, 401 comprises an front
opening 108, 208, 308, 408 formed by the top wall 104, 204,
304, 404 the bottom wall 105, 205, 305, 405 the first
25 lateral wall 106, 206, 306, 406 and the second lateral wall
107, 207, 307, 407.

A male terminal 500 is inserted through the front opening
108, 208, 308, 408. The male terminal 500 is preferably
30 coated in a conductive material such as gold, silver,
copper or the like.

The contact section 101, 201, 301, 401 further comprises
one or more lances 111, 211, 311, 411, advantageously one
35 or more resilient lances 111, 211, 311, 411, and, adjacent

to the front opening 108, 208, 308, retention arms 126, 226, 326, 426, advantageously resilient retention arms 126, 226, 326, 426.

5 The female terminal 100, 200, 300, 400 may be provided with the contact section 101, 201, 301, 401 divided into two separate branches 128, 228, 328, 428 and 129, 229, 329, 429 respectively, advantageously two separate resilient branches 128, 228, 328 and 129, 229, 329.

10

The branches 128, 228, 328, 428 and 129, 229, 329, 429 are terminated in the front portion 116, 216, 316, 416 with the retention arms 126, 226, 326, 426. This arrangement prolongs the retention arms 126, 226, 326, 426, so the
15 force applied by them is more easily adjustable and the contact provided by the retention arms 126, 226, 326, 426 is more flexible.

The branches 128, 228, 328, 428 and 129, 229, 329, 429 are
20 separated by the seam 120, 220, 320, 420 and by a U-shaped or a V-shaped slit 13, 23, which extends from the front opening 108, 208 towards the seam 120, 220.

The bottom wall 105, 205 bears a similar slit 13, 23 having
25 the same shape as that on the top wall 104, 204. The bottom wall 105, 205 has no seam.

Alternatively, the U-shaped or V-shaped slit 13, 23 can be replaced by a substantially elliptical slit 33.

30

Figures 3a to 3c show an embodiment, where both the top wall 304 and the bottom wall 305 comprise such an elliptical slit 33. The elliptical slits 33 are positioned symmetrically with respect to horizontal plane. In the
35 embodiment shown on Figures 3a to 3c, the branches 328, 329

are separated by the seam 320, the front part of which is not fastened and therefore can be opened. The seam 320 at the rear of the elliptical slits 33 may be fastened, for example by a laser weld point to stiffen the female terminal 300.

Figures 4a to 4d show an embodiment where the bottom wall 405 comprises an elliptical slit 43B. The top wall 404 comprises a transversal slot 43A.

10

In the embodiment shown on Figures 4a to 4d, the branches 428, 429 are separated by the seam 420, the front part of which is not fastened and therefore can be opened. An example of an opened seam 420 is shown on Figure 4d.

15

The length of the U- or V-shaped slit 13, 23, of the seam 320, 420, as well as the shape of the elliptical slit 33, 43B then allow to adjust forces holding the male terminal 500 inside.

20

Hence, as can be seen from Figures 4a to 4d, the female terminal 400 is provided with a long portion which is separated into two symmetric lateral portions which can flex with respect to their shown rest position.

25

The whole branch extending from the transversal slot 43A to the front opening 408 can bend outwards upon insertion of the male terminal 500.

At rest, the seams 420 are opposed to one another. The bending stiffness of the branches 428, 429 can be adopted using the length of the transverse slot 43A on the top wall 404 and the shape of the elliptical slit 43B on the bottom wall 405.

35

Preferably, the bending pattern on the two walls will be similar, although one of the two walls bears the seam 420. When the lance 411 is provided, it will be also bent by the male terminal 500.

5

The female terminal 100, 200, 300, 400 is preferably folded from a metal sheet. Once the sheet is folded, the opposite edges of the sheet face to form the seam 120, 220, 320, 420 in the top wall 104, 204, 304, 404. The seam 120, 220, 320, 420 may be welded in the portion adjacent the wire connection section 103, 203, 303, 403. The seam 120, 220, 320, 420 is not welded in the front portion, so it may form the elliptical slit 33, 43B. In the bottom wall 105, 205, 305, 405, the slit is formed during the stamping process.

15

In the embodiments shown on Figures 1a to 1c, 2a to 2c, 3a to 3c and 4a to 4d, there is a pair of lances 111, 211, 311, 411.

20 The lances 111, 211, 311, 411 are positioned symmetrically in the first lateral wall 106, 206, 306, 406 and the second lateral wall 107, 207, 307, 407.

25 The lances 111, 211, 311, 411 protrude from the first lateral wall 106, 206, 306, 406 and the second lateral wall 107, 207, 307, 407 towards the inside of the female terminal 100, 200, 300, 400 and towards the front opening 108, 208, 308, 408.

30 The lances 111, 211, 311, 411 may be attached on both sides, preferably, an end 125, 225, 325, 425 of the lances 111, 211, 311, 411, adjacent to the front opening 108, 208, 308, 408, is free.

35 The free end 125, 225, 325, 425 may be either tapered, as

shown of Figures 1a to 1c and 2a to 2c for the first and second embodiments of the present invention, or of essentially the same width along the lance 111, 211, 311, 411, as shown on Figures 3a to 3c and 4a to 4d, for the
5 third and fourth embodiments of the present invention.

At the free end 125, 225, 325, 425 of the lance 111, 211, 311, 411, there is a contact point 112, 212, 312, 412. Figures 1a to 1c and 2a to 2c show an example of a free end
10 125, 225 that is bent to an overall shape of a rounded curve, thus forming the contact point 112, 212. Figures 3a to 3c show an example of the contact point 312, 412 formed as a rounded protrusion projecting from the surface of the free end 325, 425.

15

Once the male terminal 500 is inserted, the point of contact 112, 212, 312, 412 contacts the male terminal 500 and establishes the electrical connection between the male terminal 500 and the female terminal 100, 200, 300, 400.

20

The point of contact 112, 212, 312, 412 might be coated in a conductive material such as gold or tin, an even the whole contact section can show such a coating.

25 Adjacent to the front opening 108, 208, 308, 408, retention arms 126, 226, 326, 426, advantageously resilient retention arms 126, 226, 326, 426 are positioned. Examples of such retention arms 126, 226, 326n 426 can be seen on Figures 1a to 1c, 2a to 2c and 3a to 3c.

30

The first lateral wall 106, 206, 306, 406 and the second lateral wall 107, 207, 307, 407 have, adjacent to the front opening 108, 208, 308, 408 a front portion 116, 216, 316, 416. The front portion 116, 216, 316, 416 further comprises
35 a part that is folded or bent inwardly.

The folded or bent part of the front portion 116, 216, 316, 416 forms an inwardly protruding plate, which may be further divided into at least two fingers 109, 209, 309, 409 and 110, 210, 310, 410 advantageously at least two resilient fingers 109, 209, 309, 409 and 110, 210, 310, 410.

The fingers 109, 209, 309, 409 and 110, 210, 310, 410 may be positioned symmetrically and protrude from the front portion 116, 216, 316, 416 of the contact section 101, 201, 301, 401 towards the inside of the female terminal 100, 200, 300, 400 and towards the connection portion 103, 203, 303, 403.

15

Two possible arrangements are shown on Figures 1a to 1c, 2a to 2c and 3a to 3c. Figures 1a to 1c show the fingers 109 being cut out of a tab 127 positioned at the front portion 116 and bent at an angle less than 90 degrees towards the inside of the terminal 100 and towards the connection section 103.

20

Figures 2a to 2c and 3a to 3c show a tab 227, 327 being elongated in the direction opposite to the direction towards the connection section 203, 303. The fingers 209, 309 are cut out of the tab 227, 327 and folded backwards and inside of the female terminal 200, 300.

25

The fingers 109, 209, 309, 409 and 110, 210, 310, 410 are spaced apart from each other, thus forming a passage 124, 224, 324, 424 between them. Each of the fingers 109, 209, 309, 409 and 110, 210, 310, 410 has a contact point which contacts the male terminal 500 when inserted. The contact point of each of the fingers 109, 209, 309, 409 and 110, 210, 310, 410 may be formed as a rounded protrusion, or

30

35

take any other suitable shape.

In the example from Figures 1a to 1c and 2a to 2c, the free end 125, 225 of the lance 111, 211 is tapered. The free end
5 125, 225 of the lance 111, 211 is positioned between the fingers 109, 209 and 110, 210, i.e. in the passage 124, 224.

The fingers 109, 209 and 110, 210 are short so as not to
10 reach the free end 125, 225 of the lance 111, 211, as shown on Figures 1a to 1c and 2a to 2c.

In such case, the free end 125, 225 of the lance 111, 211, especially the contact point 112, 212, lies in line with
15 the passage 124, 224 formed between the fingers 109, 209 and 110, 210.

In this way, when the male terminal 500 is inserted into the female terminal 100, 200, the friction which occurs
20 upon insertion between the male terminal 500 and the fingers 109, 209 and 110, 210 is applied only on the sides of the male terminal 400 and not in its center, where the lance 111, 211 touches the male terminal 500 and established an electrical contact. Thus the male terminal
25 400 is not damaged at the electrical contact point upon insertion.

In the embodiment shown on Figures 3a to 3c and 4a to 4d, the lance 311, 411 is long so as to have its free end 325, 425
30 425 surrounded by the front portion with the fingers 309, 409, 310, 410. This helps to protect the lance 311, 411 and secure the correct insertion of the male terminal 500.

As the contact point 312 lies between the fingers 309, 409
35 and 310, 410 when seen from the insertion direction, the

male terminal 500 is also not damaged upon insertion on the contact point 312.

Moreover, the part of the front portion 116, 216, 316, 416
5 that is folded or bent inwardly may also serve as a guiding portion, which leads the male terminal 500 inside the female terminal 100, 200, 300, 400.

As can easily be seen, the described features of all the
10 three above-described embodiments may be easily combined.

Once the male terminal 500 is inserted, it is encountered by the lances 111, 211, 311, 411 as well as by the front portion 116, 216, 316, 416.

15

The male terminal 500 is held in place by the front portion 116, 216, 316, 416 which applies force generated by the branches 128, 228, 328, 428 and 129, 229, 329, 429.

20 In the embodiment shown on Figures 1a-c, 2a-c, 3a-c and 4a-d, the male terminal 500 is held by the front portion 116, 216, 316, 416 which applies force generated by the branches 128, 228, 328, 428 and 129, 229, 329, 429 rather than the lances 111, 211, 311, 411.

25

The lances 111, 211, 311, 411 establish the electrical contact between the male terminal 500 and the female terminal 100, 200, 300, 400.

30 The lances 111, 211, 311, 411 may also help to hold the male terminal 500 inside the female terminal 100, 200, 300, 400 but the force applied by them is weaker than the force applied by the front portion 116, 216, 316, 416.

35 The intermediate section 102, 202, 302, 402 may optionally

comprise a spring section provided with a spring 113, 213, as shown on Figures 1a to 1c and 2a to 2c. The spring 113, 213 may be installed to help to relieve stress applied to the male terminal 500.

5

Once the stress is applied, the spring 113, 213 rather deforms than allows movements of the male terminal 500, therefore further reducing the movements of the male terminal 500 with respect to the female terminal 100, 200, and, especially, with respect to the contact point established by the lances 111, 211 and the fretting corrosion is further reduced.

For example, the spring 113, 213 may be formed as a generally S-shaped or U-shaped strip cut out of the top wall 104, 204, the bottom wall 105, 205, and/or first lateral wall 106, 206 and the second lateral wall 107, 207.

The female terminal could be provided inside a housing 600. Figure 6 shows a schematic view of the female terminal 100 accommodated in a housing 600.

The situation is only described for the first embodiment, but the second, third and fourth embodiments may cooperate with the housing 600 in a similar way.

The housing 600 is generally made of an insulating material, preferably plastic. The housing 600 comprises at least one compartment 603 for accommodating the female terminal 100. Preferably, there is a plurality of such compartments 603, each separated by walls 601. The housing 600 further comprises locking lances 602, protruding from the walls 601 towards insides of the compartments 603 and bearing locking pegs 604.

35

When the female terminal 100 is inserted into the housing 600, the locking lances 602 encounter the wire connection section 103, thus locking the female terminal inside the compartment 603 of the housing 600.

5

Even though the embodiment above is provided for a female terminal, a similar spring section could be provided for a male terminal. The female terminal and the male terminal according to the present invention are designated as electrical terminal.

10

Obviously, the present invention is not limited to embodiments which are here above described and provided only as examples. It also includes different modifications, and alternatives that may be considered by the person skill in the art as part of the present invention, including all combinations of different embodiments here above described, taken alone or in combination.

15

CLAIMS

1. Assembly of a male terminal (500) and a one-piece
5 female terminal (100, 200, 300, 400), consisting of an elongated body having a longitudinal axis and comprising a contact section (101, 201, 301, 401) with a front opening (108, 208, 308, 408),

wherein the contact section (101, 201, 301, 401) is divided
10 into two elongated branches (128, 129, 228, 229, 328, 329, 428, 429) separated by a slit (13, 23, 33, 43) extending from the front opening (108, 208, 308, 408) along the longitudinal axis of the female terminal (100, 200, 300, 400).

15

2. Assembly as in claim 1, **wherein** the contact section (101, 201, 301, 401) of the female terminal (100, 200, 300, 400) is further divided into at least two fingers (109, 110, 209, 210, 309, 310, 409, 410).

20

3. Assembly as in claim 2, **wherein** the fingers (109, 110, 209, 210, 309, 310, 409, 410) are spaced apart along a direction transverse to the longitudinal axis of the female terminal (100, 200, 300, 400).

25

4. Assembly as in any of the preceding claims, **wherein** the female terminal (100, 200, 300, 400) further comprises an intermediate section (102, 202, 302, 402) comprising a spring (113, 213).

30

5. Assembly as in any of the preceding claims, **wherein** the contact section (101, 201, 301, 401) comprises at least one lance (111, 211, 311, 411) and the female terminal (100, 200, 300, 400) further comprises a contact point
35 (112, 212, 312, 412).

6. Assembly as in claim 5, **wherein** the contact point (112, 212, 312, 412) of the female terminal (100, 200, 300, 400) is located at an end of the lance (111, 211, 311, 411)

5

7. Assembly according to any of the preceding claim, **wherein** the slit (13, 23, 33, 43) extends from a top wall (104, 204, 304, 404) and a bottom wall (105, 205, 305, 405) of the female terminal (100, 200, 300, 400).

10

8. Assembly as in claim 7, **wherein** the top wall (104, 204, 304, 404) bears a seam (120, 220, 320, 420), the slit (13, 23, 33, 43) extending frontward from the seam.

15 9. Assembly as in claim 8, **wherein** the top wall (404) comprises a transversal slot (43A) between the seam (420) and the slit (43).

20 10. Assembly according to any of claims 7 to 9, **wherein** the bottom wall (105, 205, 305, 405) bears a longitudinally elongated slot forming part of the slit (13, 23, 33, 43).

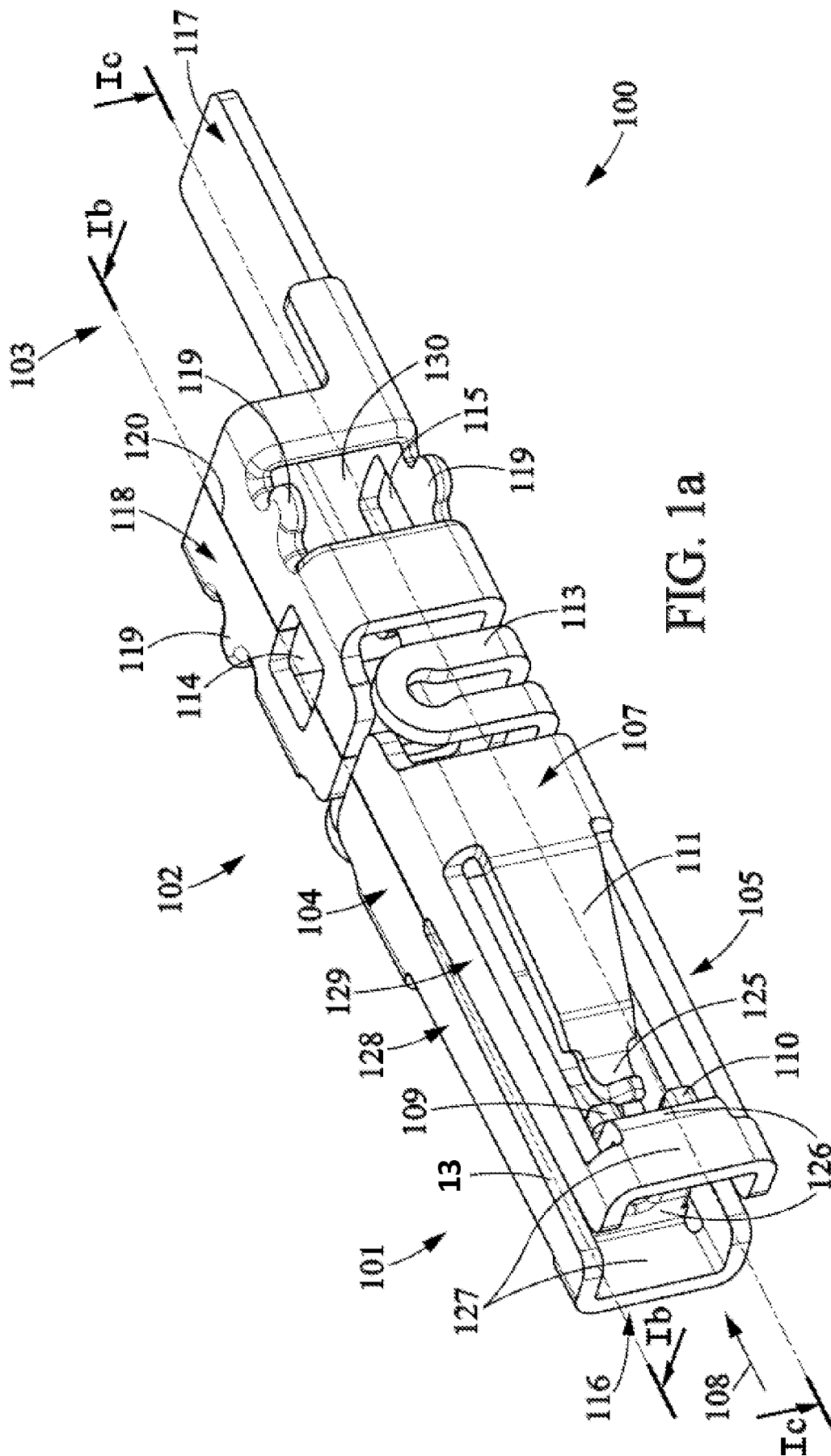
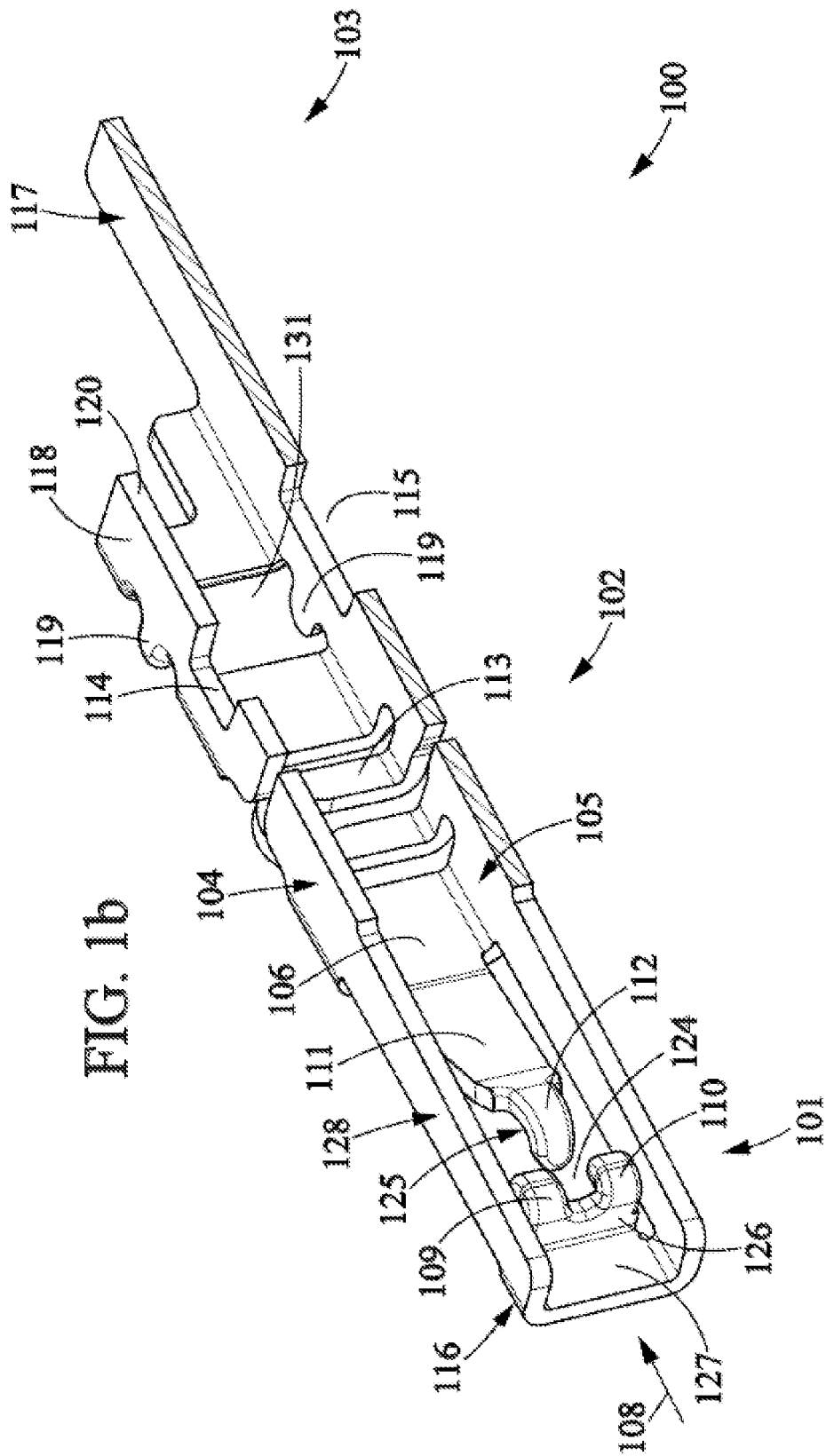
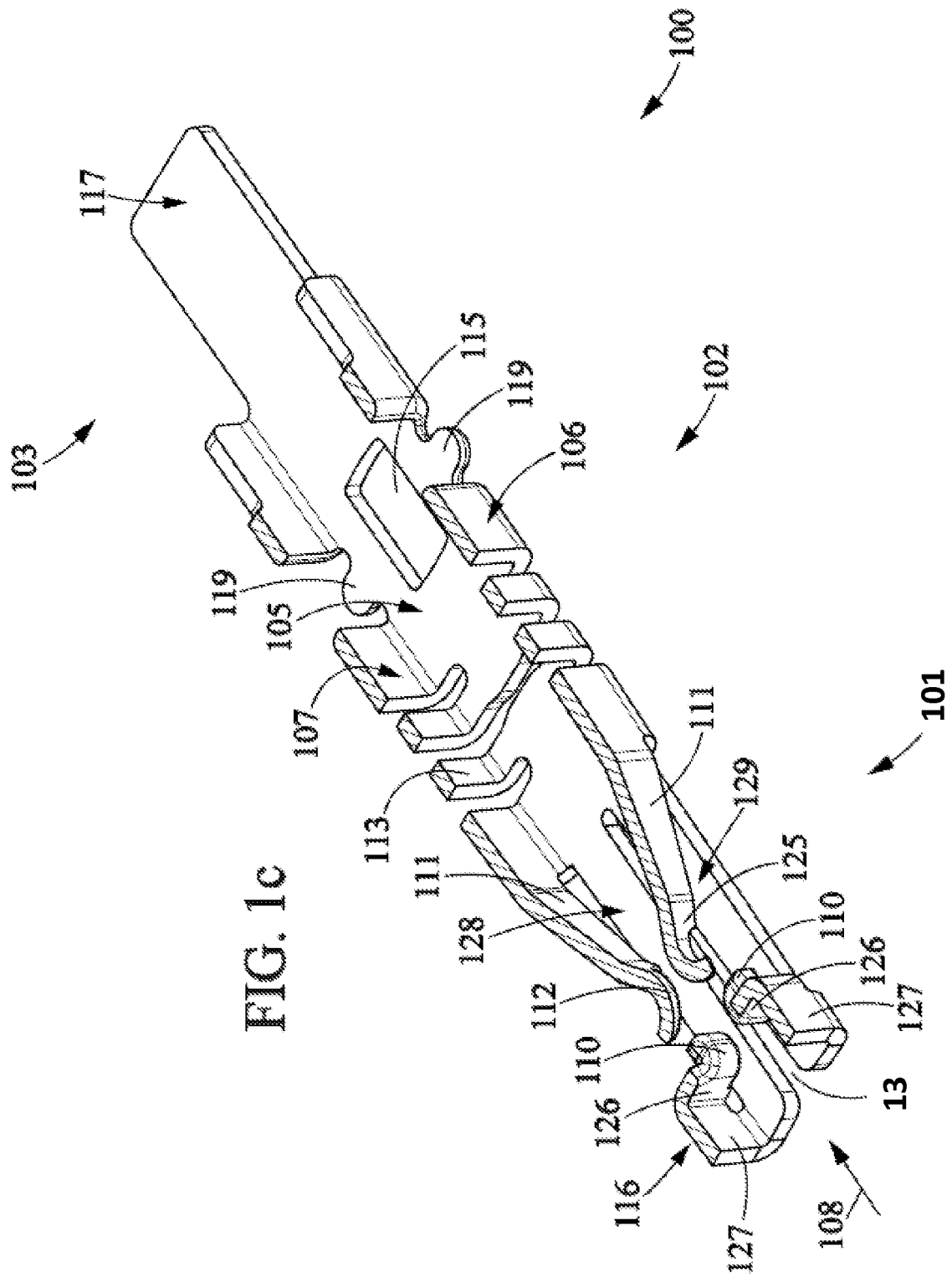
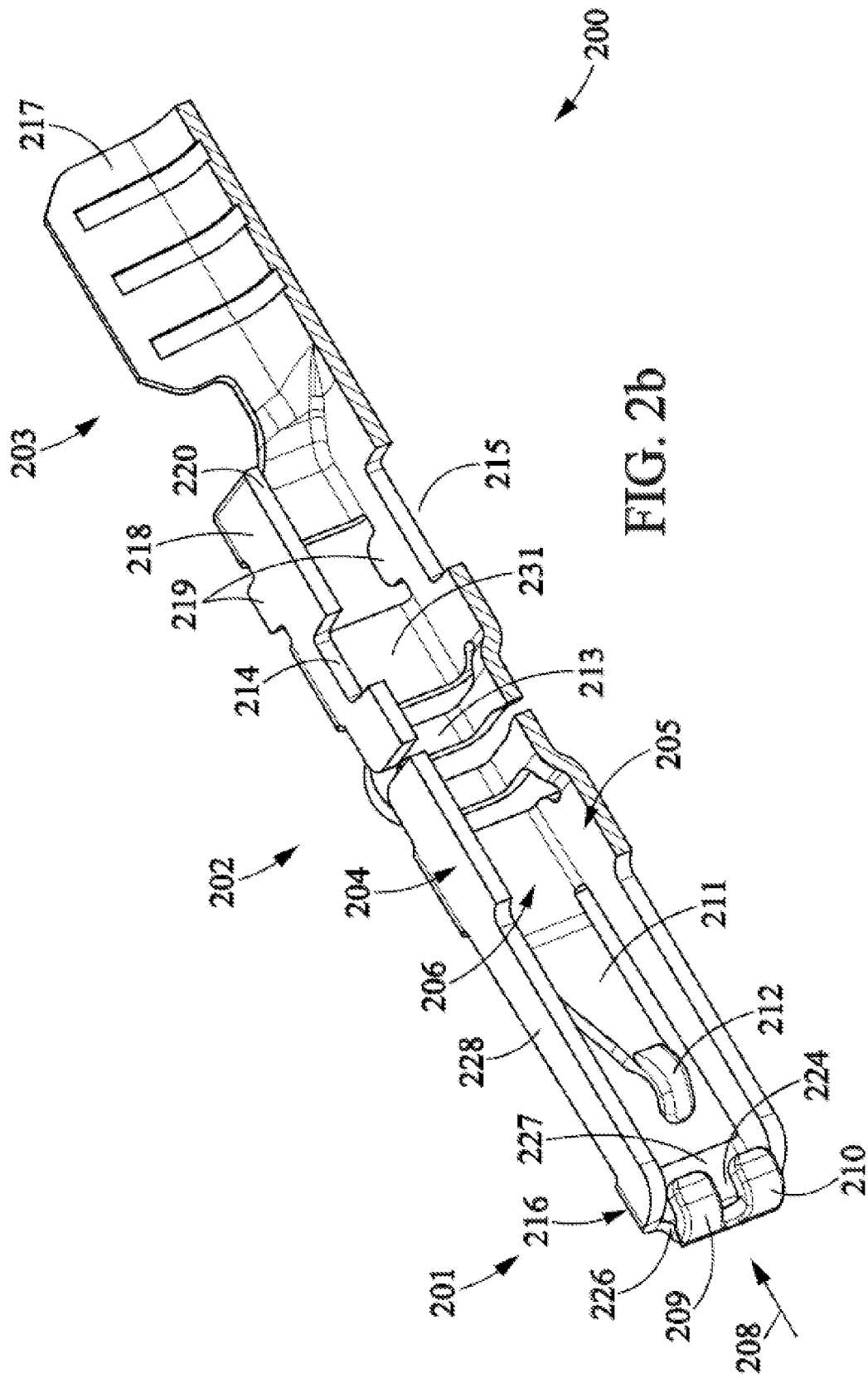
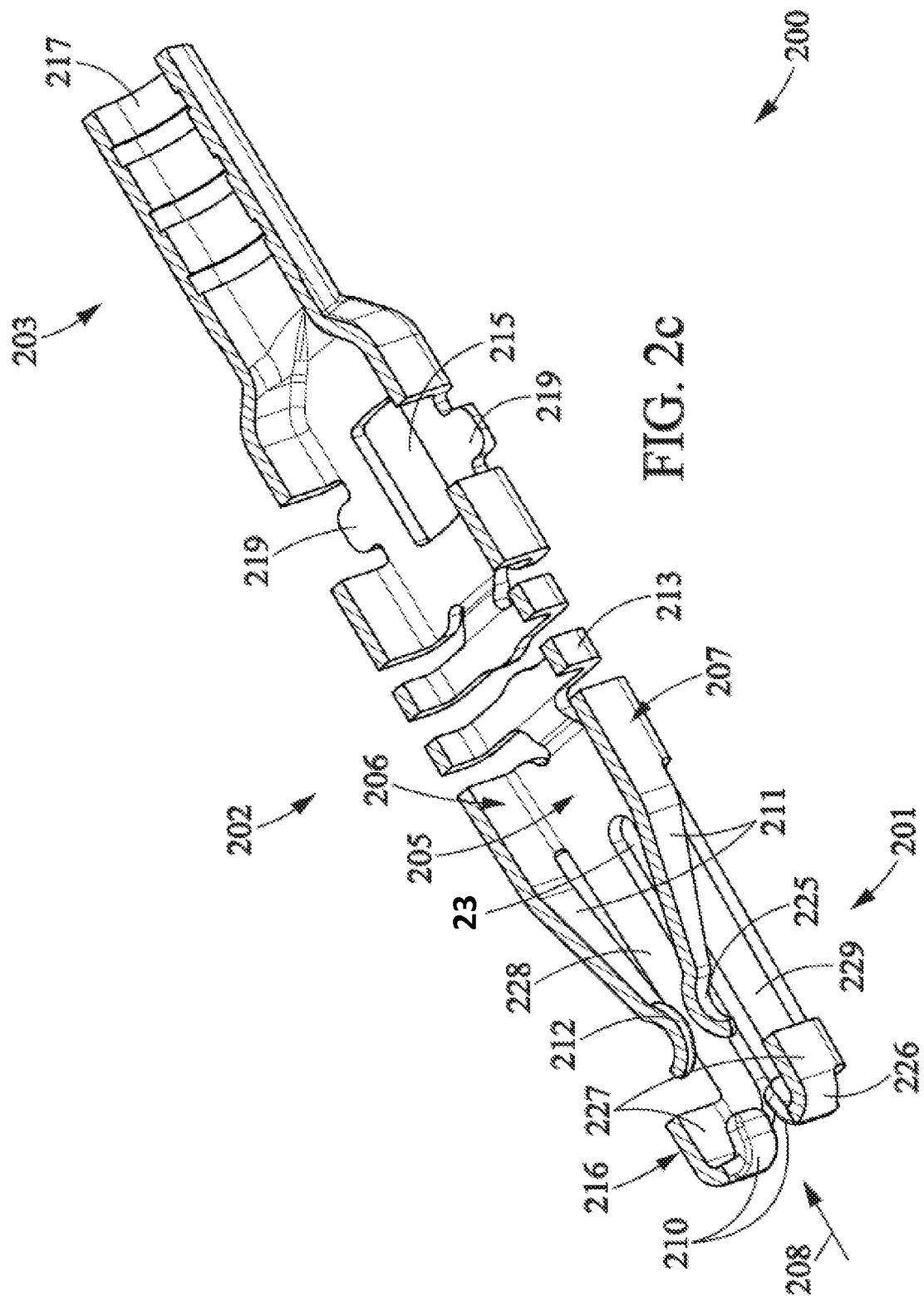


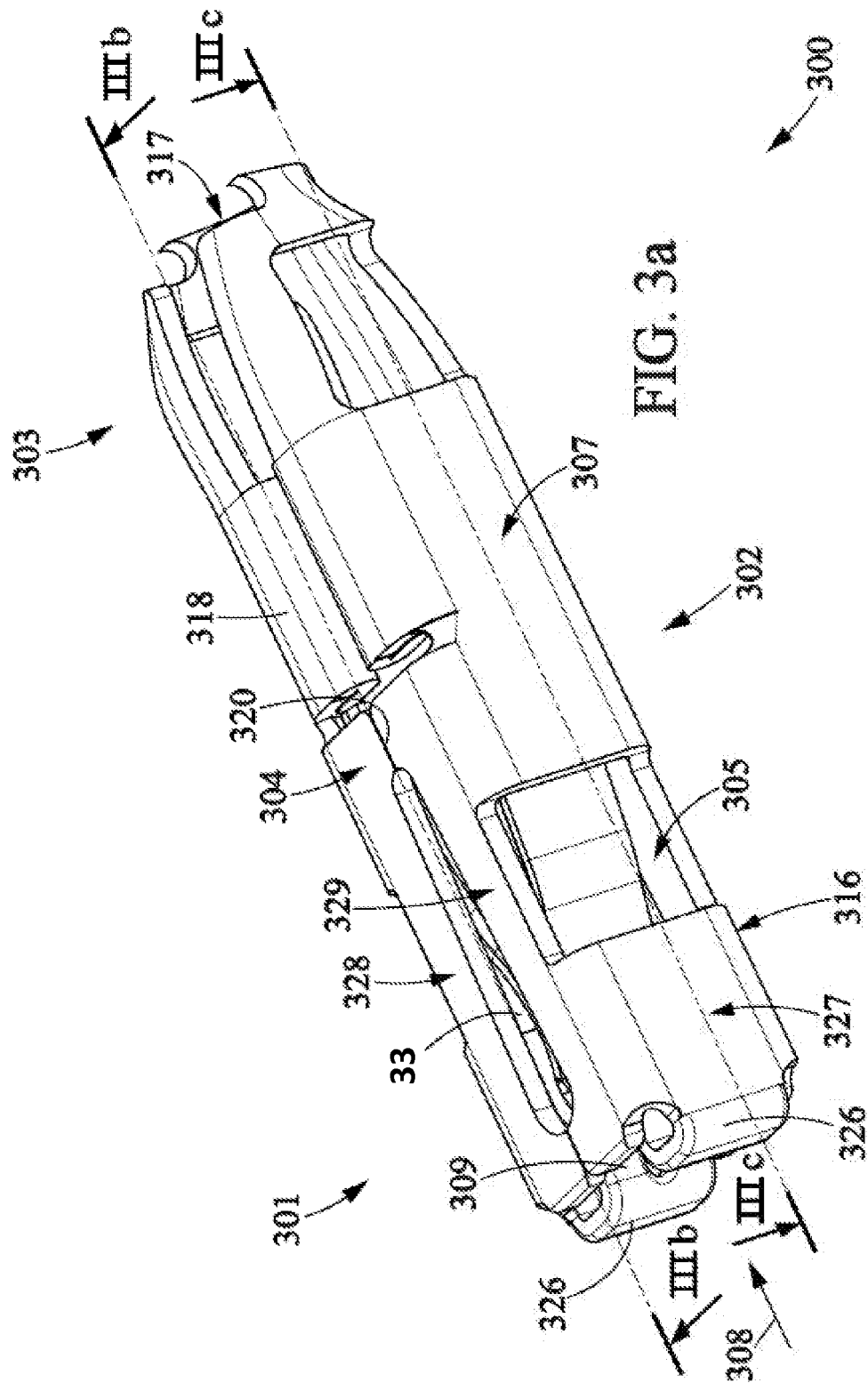
FIG. 1a

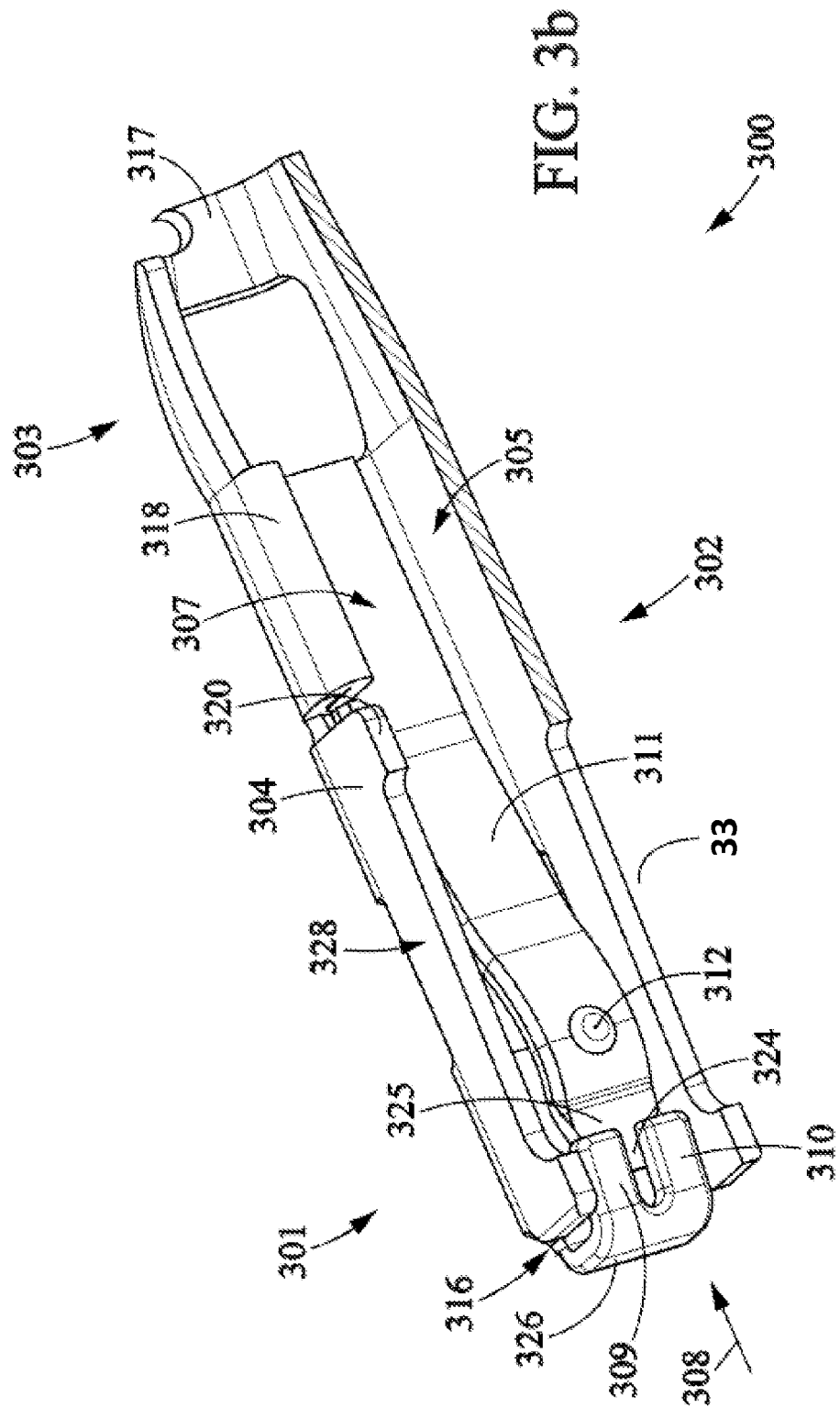


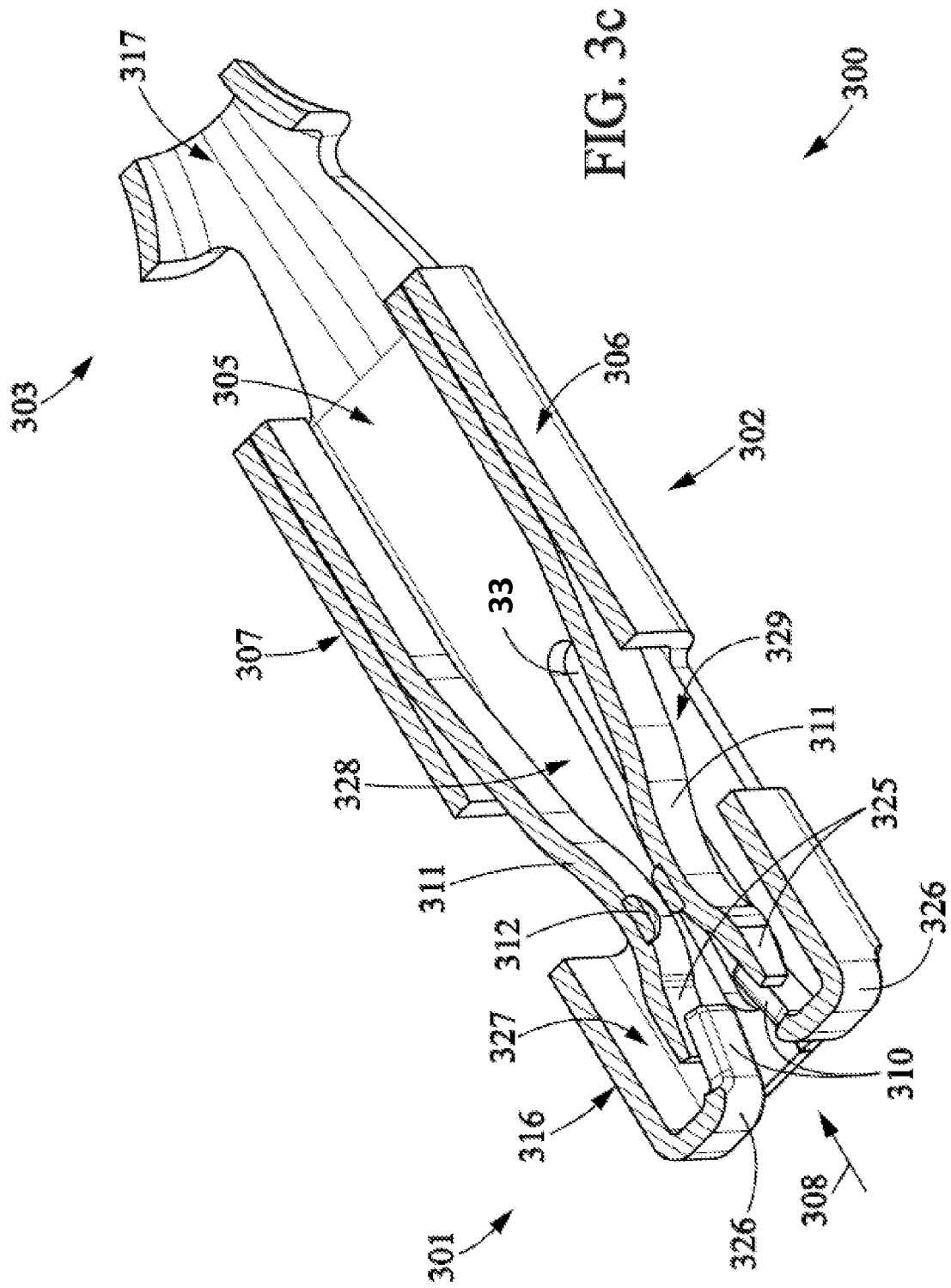


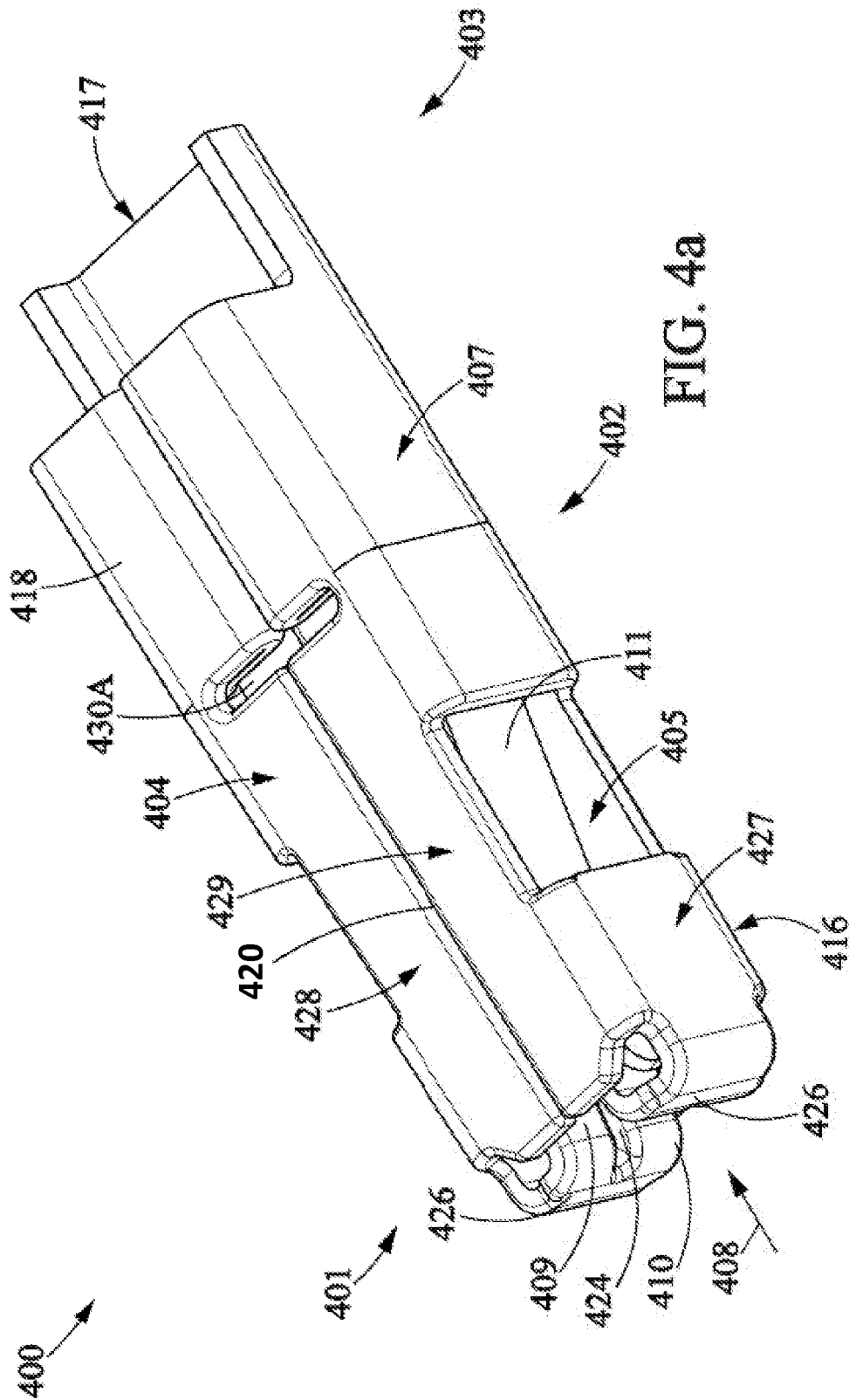


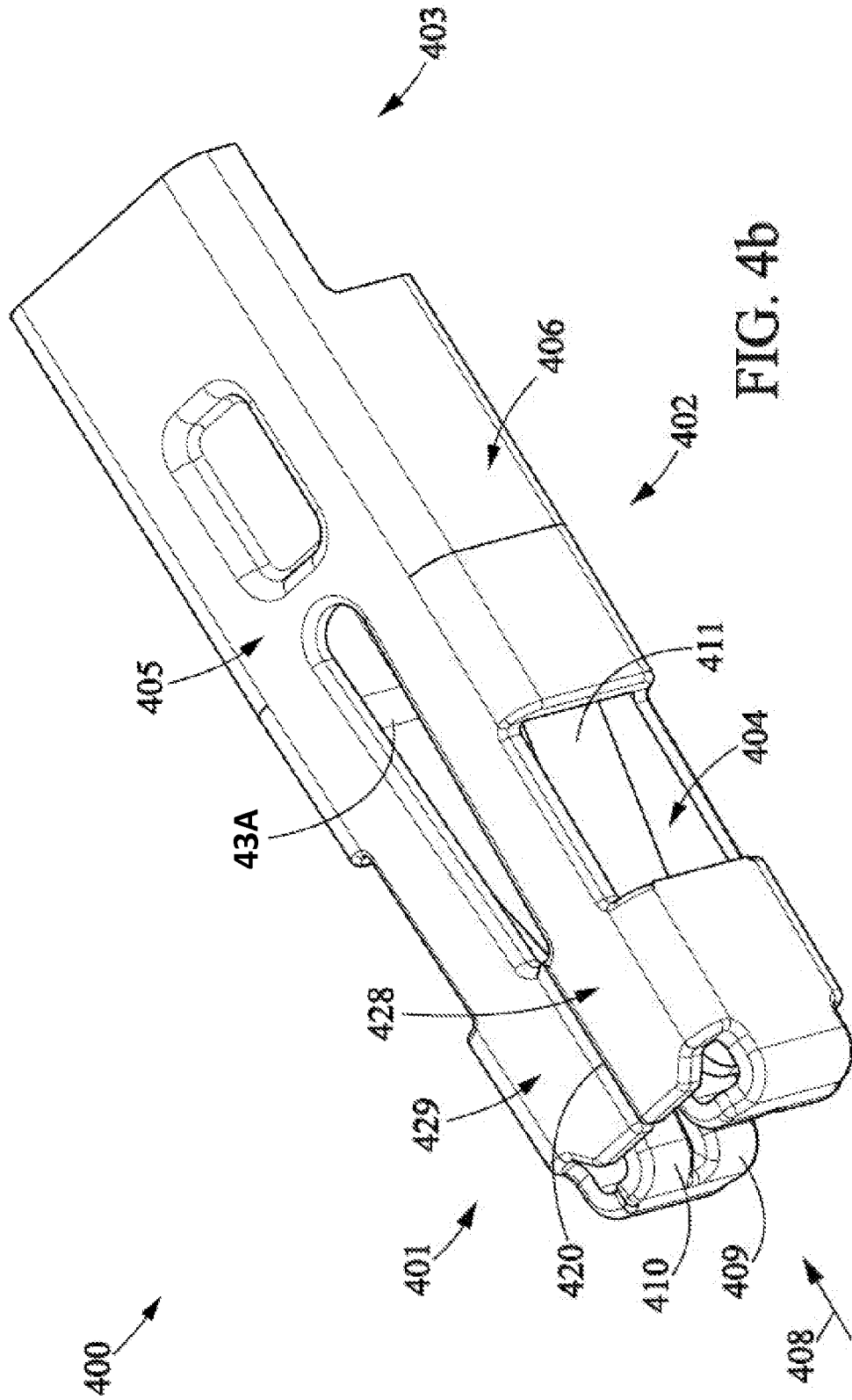


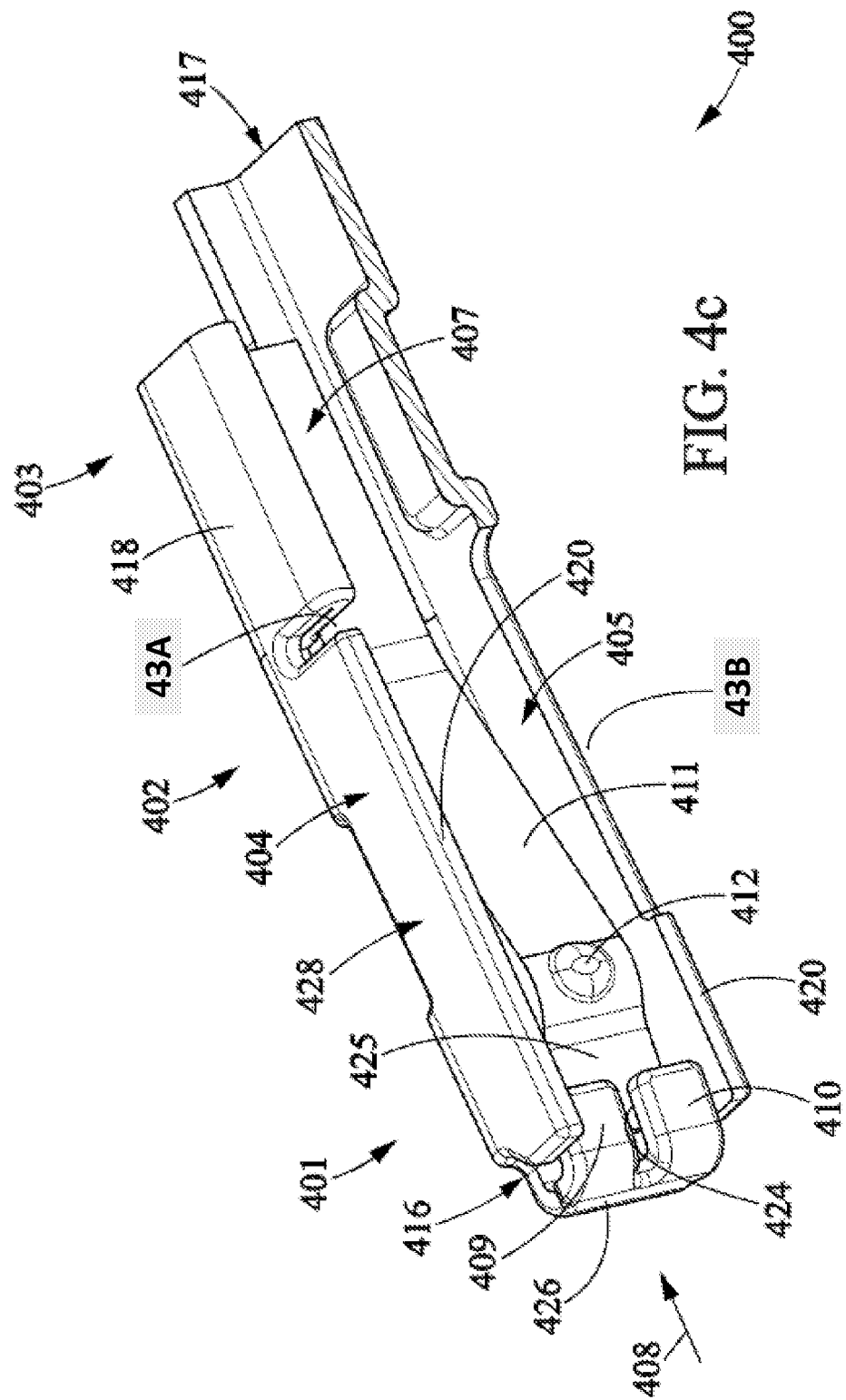












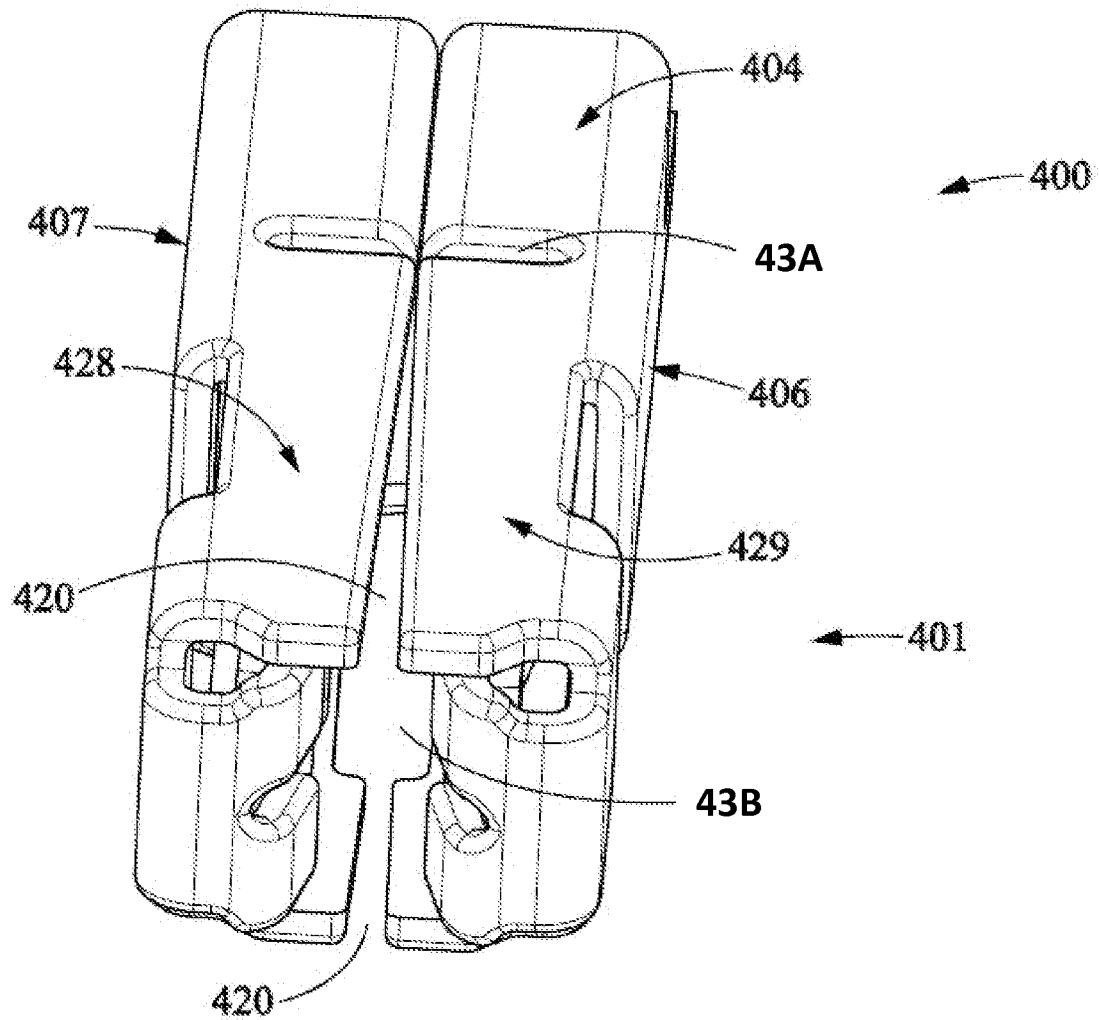


FIG. 4d

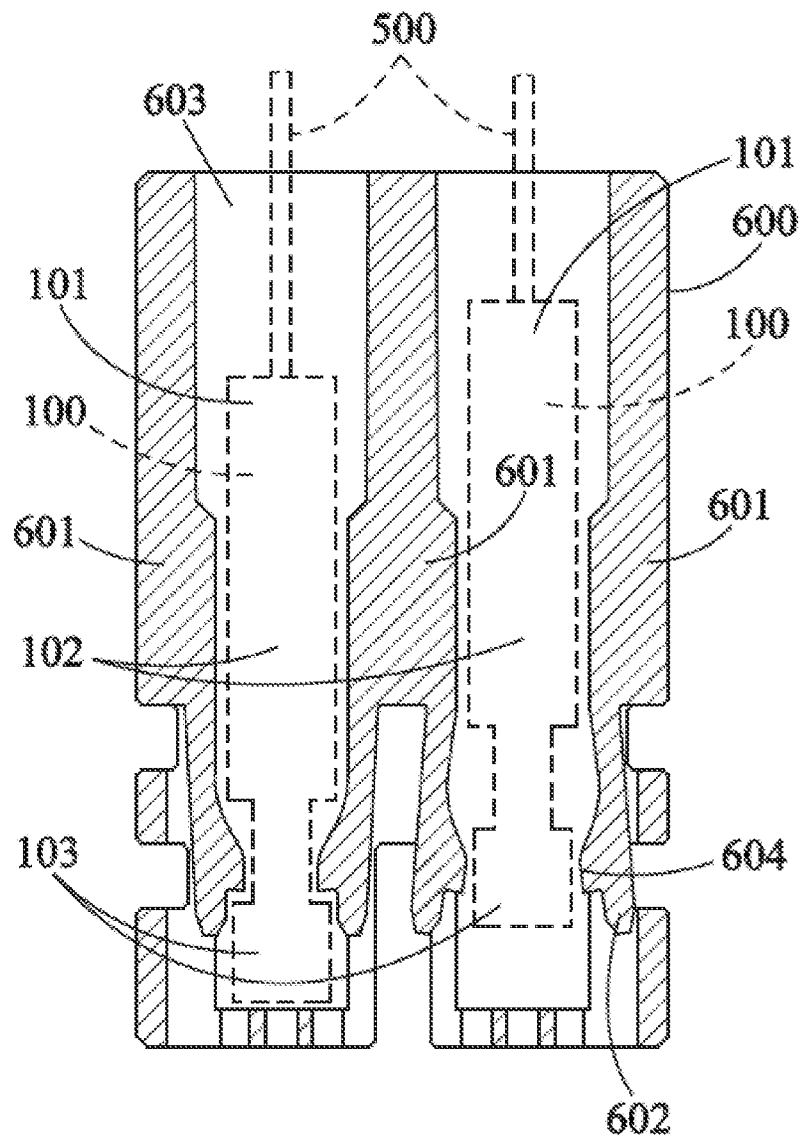
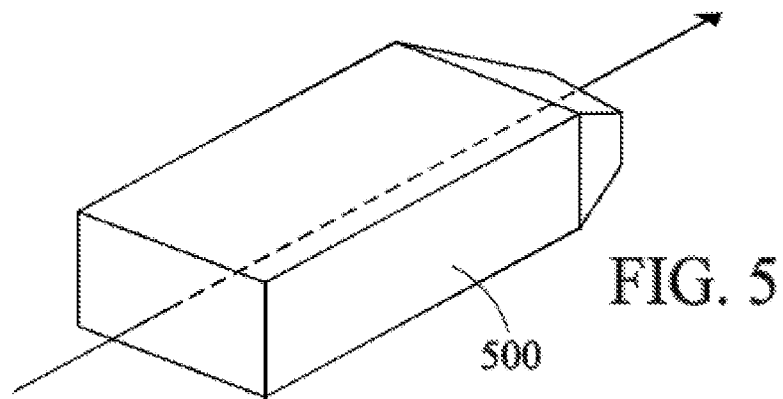


FIG. 6

INTERNATIONAL SEARCH REPORT

International application No

PCT/IB2012/002969

A. CLASSIFICATION OF SUBJECT MATTER
 INV. H01R13/11
 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)

EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
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European Patent Office, P.B. 5818 Patentlaan 2
 NL - 2280 HV Rijswijk
 Tel. (+31-70) 340-2040,
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