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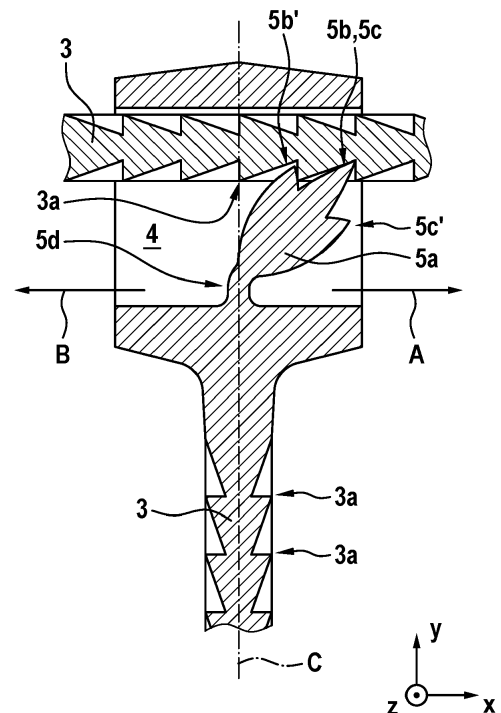
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(54) **BIDIRECTIONAL CABLE TIE DEVICE**

(57) The disclosure relates to a cable tie device (1) with a head unit (2) and a strap unit (3), where the head unit (2) has a window (4) with a pawl element unit (5), which pawl element unit (5) is configured to engage with the strap unit (3) when the strap unit (3) is slid into the window (4) and to hold the strap unit (3) in the window (4); wherein the pawl element unit (5) comprises a first edge (5c, 5c') that is configured to engage with the strap unit (3) and to hold the strap unit (3) in the window (4) when the strap unit (3) is slid into the window (4) along a first insertion direction (A); and the pawl element unit (5) comprises a second edge (5b, 5b') that is configured to engage with the strap unit (3) and to hold the strap unit (3) in the window (4) when the strap unit (3) is slid into the window (4) along a second insertion direction (B); while the first insertion direction (A) and the second insertion direction (B) are opposite directions so as to provide a cable tie device (1) maintaining reliable fastening with improved usability.

Fig. 5a



Description

Field of the invention

[0001] The disclosure relates to a cable tie device with a head unit and a strap unit, where the head unit has a window with a pawl element unit, which pawl element unit is configured to engage with the strap unit when the strap unit is slid into the window and to hold the strap unit in the window.

Background

[0002] Cable tie (also known as a quick tie, hose tie, zip tie, or tie wrap) is a type of fastener for holding items together, primarily electrical cables and wires. Because of their low cost, ease of use, and binding strength, cable ties are ubiquitous, finding use in a wide range of other applications.

[0003] The 1958' US 3 022 557 A gives an overview of the basic functioning principle. HellermannTytons' US 11 027 902 B2 and US 11 117 724 B2 describe more recent aspects of cable tie devices.

[0004] Although existing cable ties are already relatively easy to use and have a reliable fastening mechanism, there still are some situations where existing cable ties do not provide the ideal usability, in particular in tight spaces and/or in poor lighting.

[0005] The technical problem to be solved is therefore to provide a cable tie device maintaining reliable fastening with improved usability.

Overview

[0006] This problem is solved by the objects of the independent claim. Advantageous embodiments will be apparent from the dependent claims, the description and the figures.

[0007] One aspect relates to a cable tie device with a head unit and a strap unit, where the head unit has a window with a pawl element unit. The pawl element unit is part of the head unit and configured to engage with the strap unit when the strap unit is slid into the window and to hold the strap unit in the window in a closed position. When the pawl element unit is engaged with the strap unit in the closed position, a loop is formed by the strap unit and head unit. The cable tie device may comprise further units such as an attachment unit with e.g. a mushroom head to attach the cable tie device to some external structure. Preferably, the head unit comprises only one window for the strap unit.

[0008] The pawl element unit comprises a first edge that is configured to engage with the strap unit and to hold the strap unit in the window when the strap unit is slid into the window along a first insertion direction. The first edge is a flexible edge, i.e. it is flexible relative to the rest of the head unit (the head unit except the pawl element unit which may comprise other flexible parts such as the

second edge described below). So the first edge is configured to be moved by the strap unit when the strap unit is slid into the window along the first insertion direction and prevent the sliding of the strap unit opposite to the first insertion direction once the strap unit is in the closed position.

[0009] The pawl element unit also comprises a second edge that is configured to engage with the strap unit and to hold the strap unit in the window when the strap unit is slid into the window along a second insertion direction. So the second edge is configured to be moved by the strap unit when the strap unit is slid into the window along the second insertion direction and prevent the sliding of the strap unit opposite to the second insertion direction once the strap unit is in the closed position. The second edge, too, is a flexible edge.

[0010] The second edge may be independent of the first edge, i.e. it may be flexible independently of the first edge. Alternatively, the second edge may be mechanically coupled to the first edge, for instance by being arranged on a common pawl element. In some embodiments, first edge and second edge may also be identical edges, i.e. they may be a common edge acting as first edge or as second edge in dependence upon from which insertion direction the strap unit is slid into the window.

[0011] There also may be more than one first edges and/or more than one second edges. If more than one first and/or second edges are present, one of the more edges may be said common edge acting as first edge or as second edge in dependence upon from which insertion direction the strap unit is slid into the window. The at least one first edge and/or the at least one second edge may be metal edges or plastic edges. Metal edges have the advantage that they engage with the strap unit basically by cutting into the strap unit resulting in infinitely fine adjustment as no strap teeth are required. Plastic edges are easier to produce.

[0012] Said first insertion direction and the second insertion direction are opposite, i.e. anti-parallel directions. So the head unit accepts insertion of the strap unit from two different insertion directions. The cable tie device may thus be referred to as "bidirectional cable tie device" as it allows insertion of the strap unit from two direction where the pawl element unit has two stable states each with a closed loop. This gives the advantage that the degree of symmetry of the cable tie device is increased. The increased symmetry improves usability, in particular in tight spaces and/or in poor lighting since the number of possible user errors is reduced as compared to a standard cable tie devices where the strap unit can be slid into the window in the closed position only from one side. Thus, the described approach also saves time by avoiding wrong insertion direction.

[0013] In one embodiment, it is provided that the pawl element unit comprises at least one (i.e. one or more than one) pawl element which is bendable with respect to the rest of the head unit in the first insertion direction and in the second insertion direction by the strap unit when the

strap unit is slid into the window either along the first or along the second direction. The first and the second edge are arranged on the respective pawl element, which thus may be referred to as a common pawl element. In particular, the common pawl element may be bendable along the insertion directions around a neutral position in a range of at least $\pm 25^\circ$, preferably at least $\pm 35^\circ$, even more preferably $\pm 45^\circ$ around a neutral position.

[0014] Positive angles mark a bending in one of the insertion directions, negative angles mark a bending in the other one of the insertion directions. These values have been proven to be particularly useful in improving usability (i.e. a useful balance of flexibility and reliability)

[0015] On said at least one common pawl element, more than one respective first and/or second edges may be arranged. If the common pawl element has more than one first/second edges, preferably the edges of one kind are arranged in a row behind each other in either one of the insertion directions. So then the first edges are arranged in a first row and/or the second edges in a second row different from the first row. The rows of different edge kinds may, however, also align. It is then advantageous if at least one edge of the aligned edge rows is a common edge, preferably a central edge with a first edge and a second edge as next neighbors in the respective different directions. This gives the advantage that the rest of the head unit can be rigid, i.e. the at least pawl element being the only flexible part of the head, which results in a very reliable fastening in spite of the exceptional flexibility of the pawl element.

[0016] Preferably, the at least one pawl element is formed in one piece with the rest of the head unit and is connected to the rest of the head unit by a film hinge. Therein, the first edge and/or the second edge are arranged at an end of the pawl element which is remote to the film hinge. So the hinge at an end of the pawl element proximal to the margin of the window, the edge(s) are located at an end of the pawl element distal to the margin of the window. This gives the advantage of an easily controllable manufacturing, where flexibility and stability of the pawl element can be defined precisely. The precise definition can be used for improved reliability and usability.

[0017] It may be provided that the first edge and the second edge each extend, in a width direction perpendicular to the insertion directions as well as perpendicular to a main extension direction of the strap unit (when straight, i.e. not forming the closed loop and reaching a maximal distance from the head unit with a tip of the strap unit), along the pawl element to a significant share, in particular at least by 30%, preferably at least by 40%, most preferably by essentially equal parts, of a width of the pawl element in said width direction. In particular, the pawl element preferably may be point symmetric with regard to a symmetry axis running along the main extension direction of the (straight) strap unit. This gives the advantage that the extension of the edges is maximized and/or balanced, again improving usability due to in-

creased reliability and predictability of the cable tie device performance.

[0018] In a further embodiment, it is provided that the pawl element unit comprises two pawl elements, where each of the pawl elements are arranged such that, when the strap unit is slid in the window, they are arranged on opposite sides of the strap unit. Thus, each of the pawl elements is arranged on diametrically opposite margins of the window. This gives the advantage of more space for the edges, thus an increased maximal force for the engagement of the pawl element unit with the strap unit. More reliability and improved usability are consequences.

[0019] Therein, the pawl element unit may comprise four pawl elements and at least two first edges and at least two second edges. The pawl elements form a first and a second set of pawl elements, each set comprising two pawl elements and each set being arranged, when the strap unit is slid in the window, on opposite sides of the strap unit. Furthermore, each set of pawl elements has a pawl element with one of the first edges (preferably only one edge) and another pawl element with one of the second edges (preferably only one second edge). Preferably, the one pawl element with the first edge of the first set is next neighbor to the another pawl element with the second edge of the second set, and the one pawl element with the first edge of the second set is next neighbor to the another pawl element with the second edge of the first set. Therein, whether a pawl element is next neighbor or not is assessed with respect to the main extension direction of the (straight) strap unit. This gives the advantage of a particularly simple pawl element design with increased maximal force for the engagement of the pawl element unit with the strap unit, in particular when a metal frame for the pawl elements is provided.

[0020] In another embodiment, it is provided that the at least one pawl element is made with or from metal, in particular the pawl element unit made with or from metal. For instance, the pawl element unit may comprise a metal frame on which the individual metal pawl elements (with metal edges) are arranged. The metal parts can be integrated into the cable tie device when it is injection-molded with plastic. Alternatively, the cable tie device can be injection-molded from plastic (only).

[0021] In one embodiment, it is provided that the strap unit has, on opposite sides of the strap unit, teeth that the edges are configured to engage with when engaging with the strap unit. This is particularly advantageous if the cable tie device is made from plastic to improve reliability.

[0022] In yet another embodiment, it is provided that, with respect to a main extension plane of the (straight) strap unit, the head unit is arranged to a significant share, in particular at least by 30%, preferably at least by 40%, most preferably by essentially equal parts, on both sides of the main extension plane. The resulting haptic symmetry mirrors the functional symmetry and thus further improves usability: The user feels that both sides of the cable tie device are identical and mentally associates the

possibility to form a closed loop regardless of the insertion direction.

[0023] The features and combinations of features described, including those of the general introduction, as well as the features and combinations of features disclosed in the figure description or in the figures alone, may be used not only alone or in the combination described, but also with other features or without some of the features disclosed, without departing from the scope of the invention. Consequently, embodiments are also part of the invention which are not explicitly shown and described in the figures, but which can be produced by separately combining the individual features disclosed in the figures. Therefore, embodiments and combinations of features which do not comprise all features of an originally formulated independent claim are also to be considered disclosed. Furthermore, embodiments and combinations of features are to be regarded as disclosed which deviate from or go beyond the combinations of features described in the dependencies of the claims.

[0024] In the context of the present disclosure, "transverse/along" may be understood as "at least substantially vertical/parallel", i.e. "vertical/parallel" or "substantially vertical/parallel", i.e. vertical/parallel except for a predetermined deviation. The predetermined deviation can, for example, be at most 15°, preferably at most 5°, particularly preferably at most 3°. Accordingly, "oppositely oriented" may be understood in the context of the present disclosure as "at least substantially oppositely oriented" i.e. "at least substantially anti-parallel oriented". The limitation "substantially" may also refer to a percentage predetermined maximum permissible deviation, for example at most 15%, preferably at most 5%, particularly preferably at most 3%.

Detailed description

[0025] Exemplary embodiments are described in more detail below with reference to schematic drawings. Therein show

- Fig. 1 different views on a first exemplary embodiment of a bidirectional cable tie device;
- Fig. 2 different views on a second exemplary embodiment of a bidirectional cable tie device;
- Fig. 3 different views on a third exemplary embodiment of a bidirectional cable tie device;
- Fig. 4 a view on a fourth exemplary embodiment of a bidirectional cable tie device; and
- Fig. 5 different views on a fifth exemplary embodiment of a bidirectional cable tie device;

[0026] In the figures, the same or functionally identical features are provided with the same reference signs.

[0027] Figure 1a shows a perspective view on a first exemplary embodiment of a bidirectional cable tie device. The cable tie device 1 has a head unit 2 and a strap unit 3, where the head unit has a window 4 with a pawl element unit 5. The pawl element unit 5 is configured to engage, here by means of teeth 3a, with the strap unit 3 when the strap unit 3 is slid into the window 4 and to hold the strap unit 3 in the window 4 so as to form a closed loop. In Fig. 1b, the head unit 2 is shown with the strap unit 3 slid into the window 4 and held there, i.e. fixed in the window 4 against an unintentional movement of the strap unit 3 in a direction opposite to a first insertion direction A (positive x-direction here). In this example, the teeth 3a are provided on two main sides 3b, 3c of the strap unit 3.

[0028] In Fig. 1c, the head unit 2 and the pawl element unit 5 are shown in more detail. The pawl element unit 5 comprises a pawl element 5a that extends into the window 4 (which has, in this example, a cross-shaped diameter in the drawing plane). The pawl element 5a is connected, in the present example, to the rest of the head unit 2 via a film hinge 5d that allows bending the pawl element 5a in and out of the drawing plane, which is the main extension plane of the straight strap unit 3 here. For example, the film hinge 5d can be designed such it allows a bending of the pawl element 5a in range from -45° to +45° around a neutral middle position.

[0029] A first edge 5c and a second edge 5b are arranged at an end of the pawl element 5a remote to the film hinge 5d. The first edge 5c is configured to engage with the strap unit 3 and to hold the strap unit 3 in the window 4 when the strap unit 3 is slid into the window 4 along the first insertion direction A (Fig. 1d, positive x-direction). The second edge 5b is configured to engage with the strap unit 3 and to hold the strap unit 3 in the window 4 when the strap unit 3 is slid into the window 4 along a second insertion direction B (Fig. 1d, negative x-direction).

[0030] In the shown embodiment, first edge 5c and second edge 5b each extend, in a width direction perpendicular to the insertion directions A, B as well as to a main extension direction D of the strap unit 3, along the pawl element 5a to essentially equal parts of a width of the pawl element 5a in said width direction. So the edges 5c, 5b are of equal length here and do not, in an orthogonal projection onto the main extension plane of the (straight) strap unit 3, i.e. here the drawing plane, overlap. This may be referred to as a parallel arrangement of the edges 5c, 5b on the pawl element 5a. Both edges 5c, 5b have the same distance from the film hinge 5d, fostering the symmetric function of the cable tie device 1.

[0031] As apparent from Fig. 1d, which shows a cross-section along the line A-A of Fig. 1c, the edges 5c, 5b are offset in the insertion directions A, B with respect to each other and a central axis C of the strap unit 3 which runs between them. In the present example, the pawl element 5a and even the complete head unit 2 with the strap unit 3 are point symmetric with regard to the central axis C (parallel to the y-axis in the present example). So the

head unit 2 is arranged, in the present example, to equal parts on both sides of a main extension plane of the strap unit 3 that comprises the central axis C and runs perpendicular to the insertion directions A, B. Figure 1e illustrates said double offset in a perspective view. The point-symmetric design of the pawl element 5a allows to insertion-mold the cable tie device 1 without undercut.

[0032] In Fig. 2a, a pawl element unit 5 with two pawl elements 5a, 5a' is shown in a perspective view similar to that of Fig. 1e. Each of the pawl elements 5a, 5a' is arranged on diametrically opposite sides of the window 4, such that when the strap unit 3 is slid in the window 4 they are arranged on opposite sides of the strap unit 3. Each of the pawl elements 5a, 5a' comprises, in the present example, as in the example of Fig. 1, a respective first edge 5c, 5c' and a respective second edge 5b, 5b'. The first edge 5c of the one pawl element 5a is, with respect to the edges 5c', 5b' of the other pawl element 5a' next neighbor to the first edge 5c'. The second edge 5b of the one pawl element 5a is, with respect to the edges 5c', 5b' of the other pawl element 5a' next neighbor to the second edge 5b'. This increases the maximal force for the engagement, but may not be required with metal pawl elements 5a as they will be described with reference to Fig. 3.

[0033] As in Fig. 2, the example of Fig. 3 has a pawl element unit 5 with two first edges 5c, 5c' and two second edges 5b, 5b'. However, the pawl element unit 5 comprises four pawl elements 5a, 5a', 5a'', 5a''' here, each pawl element 5a, 5a', 5a'', 5a''' having but one edge 5c, 5c', 5b, 5b'. Thus, the pawl element 5a, 5a', 5a'', 5a''' form two sets, a first set of pawl elements 5a, 5a''' and a second set of pawl elements 5a', 5a'' such that the pawl elements 5a, 5a', 5a'', 5a''' of each set feature first edges 5c, 5c' and second edges 5b, 5b'. The pawl elements 5a, 5a' of one set of pawl elements are arranged at one side of the window 4, the pawl elements 5a', 5a''' of the other set of pawl element are arranged at the other side of the window 4. The different sets combine their effects in that one pawl elements of one set serves as an abutment for the pawl elements' edge of the next neighbor pawl element of the other set when the strap unit is inserted in the respective insertion direction. So for instance pawl element 5a (of the one set) serves as abutment for the edge 5b of pawl element 5a' (of the other set) when the strap unit 3 is inserted in the window 4 in insertion direction B and fixed against being removed in the opposite direction afterwards. Herein, Fig. 3b shows a cross-section according to line A-A of Fig. 3a.

[0034] In the present example, the pawl elements 5a, 5a', 5a'', 5a''' are made from metal and supported by a metal frame structure 5e (Fig. 3c) that fits the window 4. The metal frame structure 5e can be mold into the remaining plastic parts of the cable tie device 1. This design allows to refrain from film hinges as proposed in advantageous variants of the other embodiments. Figure 3d shows the strap unit 3 with its tip 3d slid through the window 4. There, pawl element 5a and pawl element 5a'

(not shown) interfere with a removal of the strap unit 3 in a direction against insertion direction A, whereas pawl element 5a'' and pawl element 5a''' (not shown) would clear such a removal, but press the strap unit 3 against pawl element 5a and pawl element 5a' (not shown) such that the edges 5c, 5c' engage with the strap unit 3 to interfere with said removal.

[0035] Figure 4 shows a view on another exemplary embodiment that is made of plastic. There, the pawl element unit 5 comprises two pawl elements 5a, 5a'. Each of the pawl elements 5a, 5a' is arranged on diametrically opposite sides of the window 4, such that when the strap unit 3 is slid in the window 4 they are arranged on opposite sides of the strap unit 3. However, contrary to the embodiment of Fig. 2, the pawl elements 5a, 5a' are offset with respect to each other in the width direction. Furthermore, each of the pawl elements 5a, 5a' has edges of only one kind: so one pawl element 5a has two first edges 5c, 5c', and the other pawl element 5a' has two second edges 5b, 5b'. The one pawl element 5a with the first edges 5c, 5c' allows sliding the strap unit 3 through the window 4 in the first insertion direction A, but blocks the removal of the strap unit 3 in the opposite direction B thereafter. The other pawl element 5a' with the second edges 5b, 5b' allows sliding the strap unit 3 through the window 4 in the second insertion direction B, but blocks the removal of the strap unit 3 in the opposite direction A thereafter. The different first edges 5c, 5c' are arranged, as viewed in the insertion directions, behind each other in a row, which may be referred to as a serial arrangement of the first edges 5c, 5c' on the pawl element 5a. Similarly, as the different second edges 5b, 5b' are arranged, as viewed in the insertion directions, behind each other in a row, it may be referred to a serial arrangement of the second edges 5b, 5b' on the pawl element 5a' in the present example. However, the example show depicts a parallel arrangement of first edges 5c, 5c' with respect to the second edges 5b, 5b' (and vice versa).

[0036] Figure 5 shows another embodiment with one pawl element 5a that comprises both first edges 5c, 5c' and second edges 5b, 5b'. In contrast to the example of Fig. 1, the different types of edges 5c, 5c', 5b, 5b' are arranged in a common row behind each other, and each extend over the full width (in z-direction) of the pawl element 5a here. Thus the embodiment of Fig. 5 shows a serial arrangement of both first and second edges 5c, 5c', 5b, 5b'. This allows multiple edges of one kind, i.e. the first edges 5c, 5c' or the second edges 5b, 5b' to engage with the strap 3 together. This increases the possible load on the latching.

[0037] As apparent from Fig. 5b, the edges of one kind, i.e. first edges 5c, 5c' and second edges 5b, 5b', respectively, may be arranged at different distances from the hinge 5d. This allows two different edges of one kind to engage with the teeth 3a of the strap unit 3 at the same time, as shown in Fig. 5a and similar to what is shown in the example of Fig. 4.

Claims

1. Cable tie device (1) with a head unit (2) and a strap unit (3), where the head unit (2) has a window (4) with a pawl element unit (5), which pawl element unit (5) is configured to engage with the strap unit (3) when the strap unit (3) is slid into the window (4) and to hold the strap unit (3) in the window (4);
characterized in that
 - the pawl element unit (5) comprises a first edge (5c, 5c') that is configured to engage with the strap unit (3) and to hold the strap unit (3) in the window (4) when the strap unit (3) is slid into the window (4) along a first insertion direction (A); and
 - the pawl element unit (5) comprises a second edge (5b, 5b') that is configured to engage with the strap unit (3) and to hold the strap unit (3) in the window (4) when the strap unit (3) is slid into the window (4) along a second insertion direction (B); wherein
 - the first insertion direction (A) and the second insertion direction (B) are opposite directions.
2. Cable tie device (1) according to claim 1,
characterized in that
the pawl element unit (5) comprises at least one pawl element (5a, 5a') which is bendable with respect to the rest of the head unit (2) in the first and in the second insertion direction (A, B) by the strap unit (3) slid into the window (4), with the first and the second edge (5c, 5c', 5b, 5b') being arranged on the respective pawl element (5a, 5a').
3. Cable tie device (1) according to claim 2,
characterized in that
 - the at least one pawl element (5a, 5a') is formed in one piece with the rest of the head unit (2) and is connected to the rest of the head unit (2) by a film hinge (5d, 5d'); with
 - the first edge (5c, 5c') and/or second edge (5b, 5b') being arranged at an end of the pawl element (5a, 5a') which is remote to the film hinge (5d, 5d').
4. Cable tie device (1) according to any one of the preceding claims 2 and 3,
characterized in that
 - first edge (5c, 5c') and second edge (5b, 5b') each extend, in a width direction perpendicular to the insertion directions (A, B) as well as to a main extension direction (D) of the strap unit (3), along the pawl element (5a, 5a') to a significant share, in particular at least by 30%, preferably at least by 40%, most preferably by essentially
- equal parts, of a width of the pawl element (5a, 5a') in said width direction; where
- the pawl element (5a, 5a') preferably is point symmetric with regard to a symmetry axis running along the main extension direction of the strap unit (3).
5. Cable tie device (1) according to any one of the preceding claims,
characterized in that
the pawl element unit (5) comprises two pawl elements (5a, 5a'), with each of the pawl elements (5a, 5a') being arranged, when the strap unit (3) is slid in the window (4), on opposite sides of the strap unit (3).
6. Cable tie device (1) according to a claim 5,
characterized in that
 - the pawl element unit (5) comprises at least two first edges (5c, 5c') and at least two second edges (5b, 5b'); and
 - the pawl element unit (5) comprises four pawl elements (5a, 5a', 5a'', 5a'''); with
 - a first and a second set of pawl elements (5a, 5a', 5a'', 5a'''), each comprising two pawl elements (5a, 5a', 5a'', 5a''') and each set being arranged, when the strap unit (3) is slid in the window (4), on opposite sides of the strap unit (3); wherein
 - each set of pawl elements (5a, 5a', 5a'', 5a''') having a pawl element (5a, 5a''') with one of the first edges (5c, 5c') and another pawl element (5a', 5a'') with one of the second edges (5b, 5b'), preferably with the one pawl element (5a) with the first edge (5c) of the first set being next neighbor to the another pawl element (5a') with the second edge (5b) of the second set, and with the one pawl element (5a''') with the first edge (5c') of the second set being next neighbor to the another pawl element (5a'') with the second edge (5b') of the first set.
7. Cable tie device (1) according to any one of the preceding claims,
characterized in that
the at least one pawl element (5a, 5a') is made with or from metal, in particular the pawl element unit (5) made with or from metal.
8. Cable tie device (1) according to any one of the preceding claims,
characterized in that
the strap unit (3) has, on opposite sides of the strap unit (3), teeth (3a) that the edges (5c, 5c', 5b, 5b') are configured to engage with.
9. Cable tie device (1) according to any one of the preceding claims,
characterized in that

with respect to a main extension plane of the strap unit (3), the head unit (2) is arranged to a significant share, in particular at least by 30%, preferably at least by 40%, most preferably by essentially equal parts, on both sides of the main extension plane. 5

10. Cable tie device (1) according to any one of the preceding claims,
characterized in that
the cable tie device (1) is injection molded from or with plastic. 10

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Fig. 1a

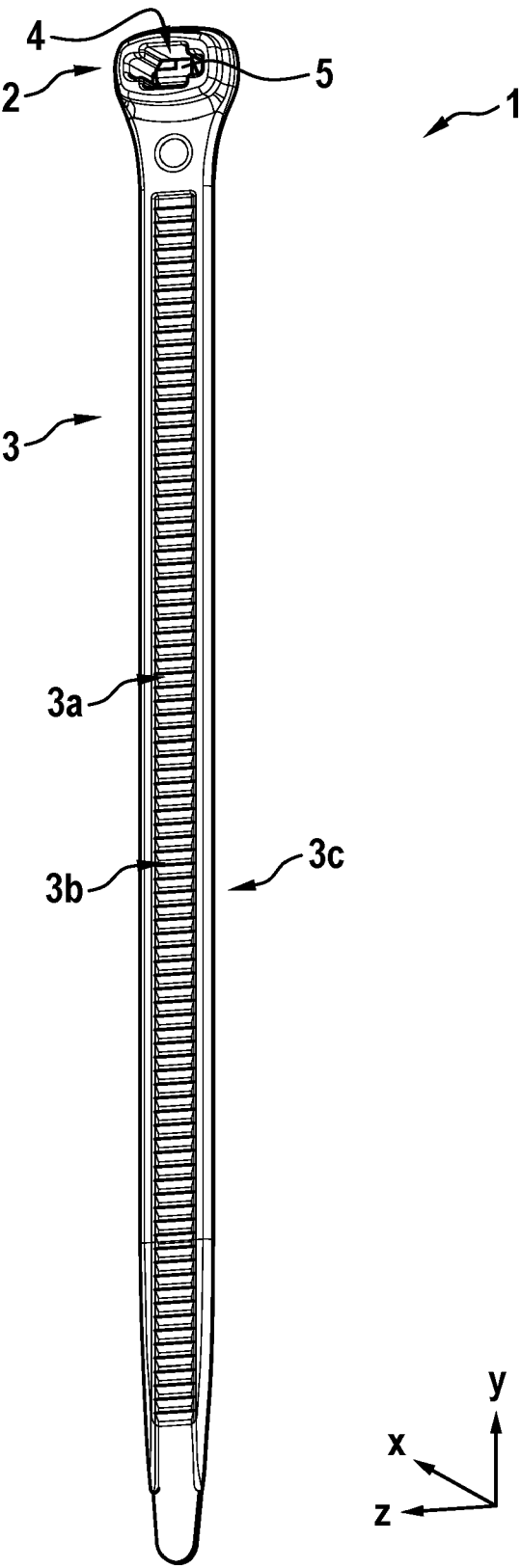


Fig. 1b

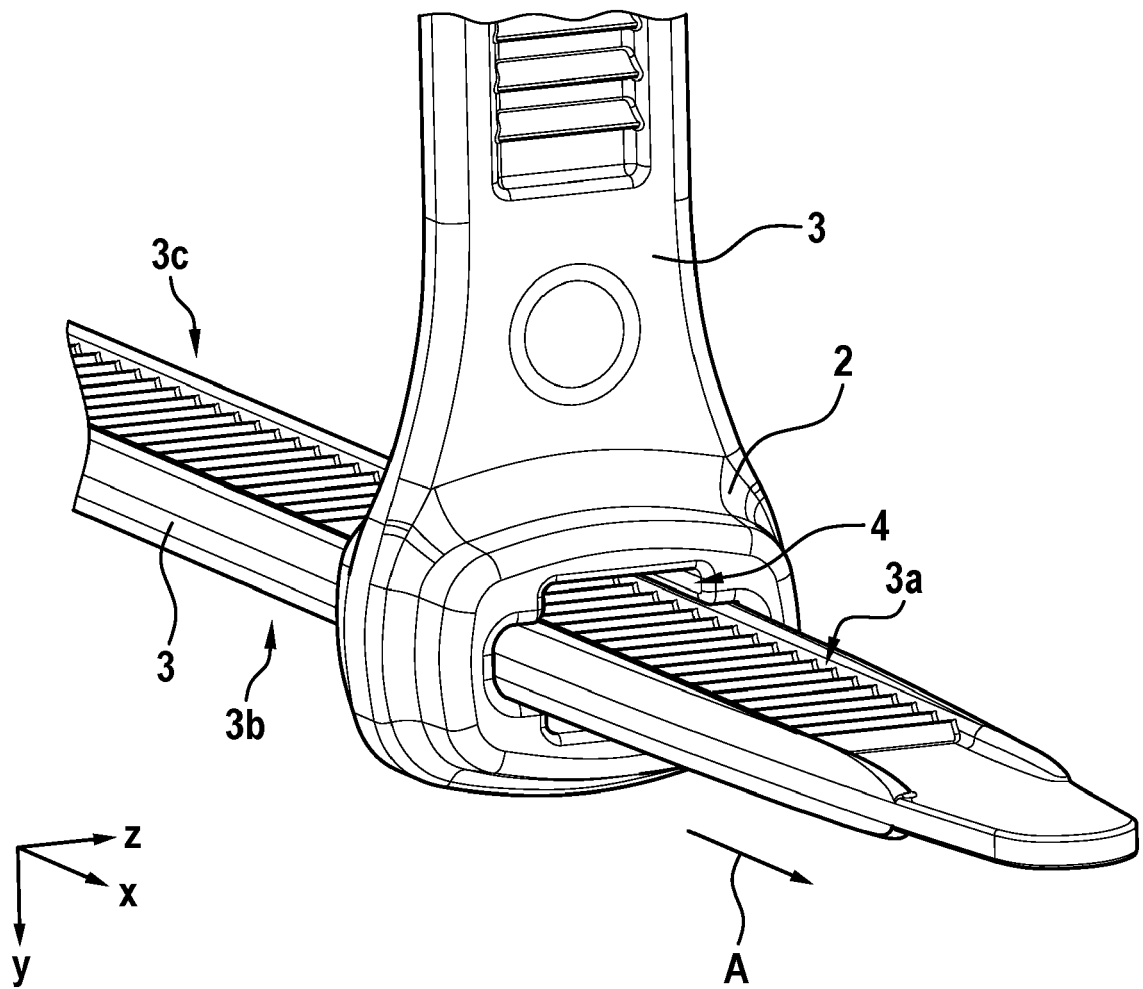


Fig. 1c

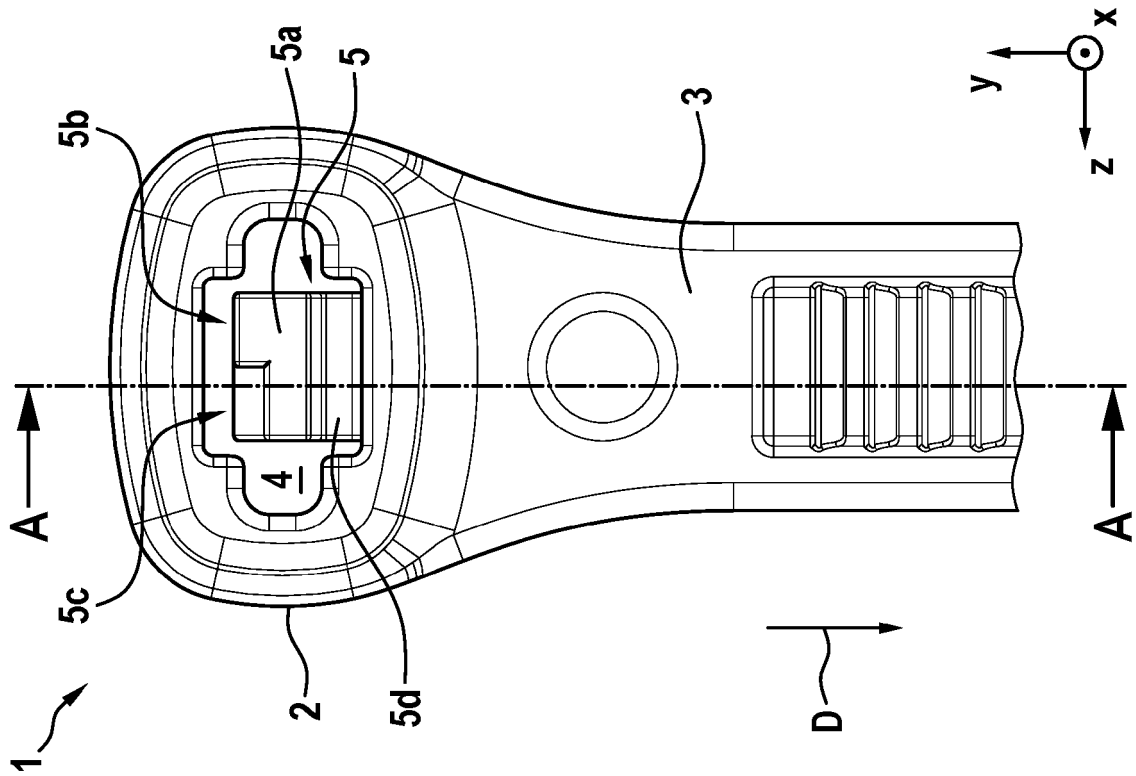


Fig. 1d

A-A 1

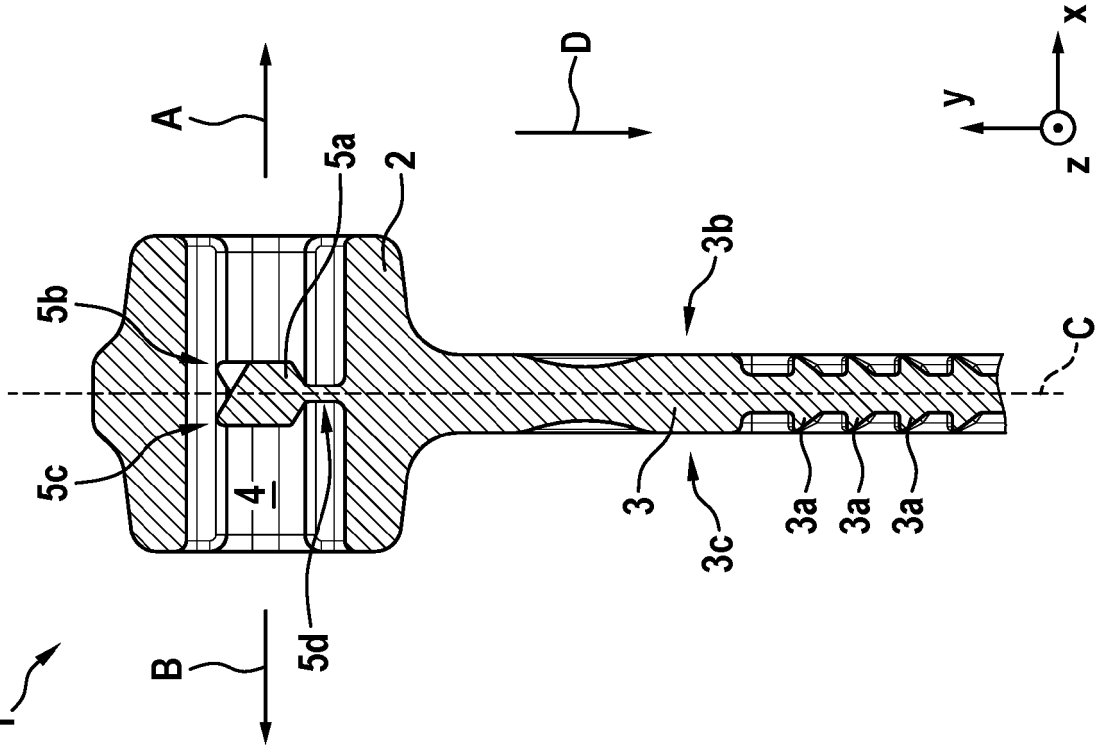


Fig. 1e

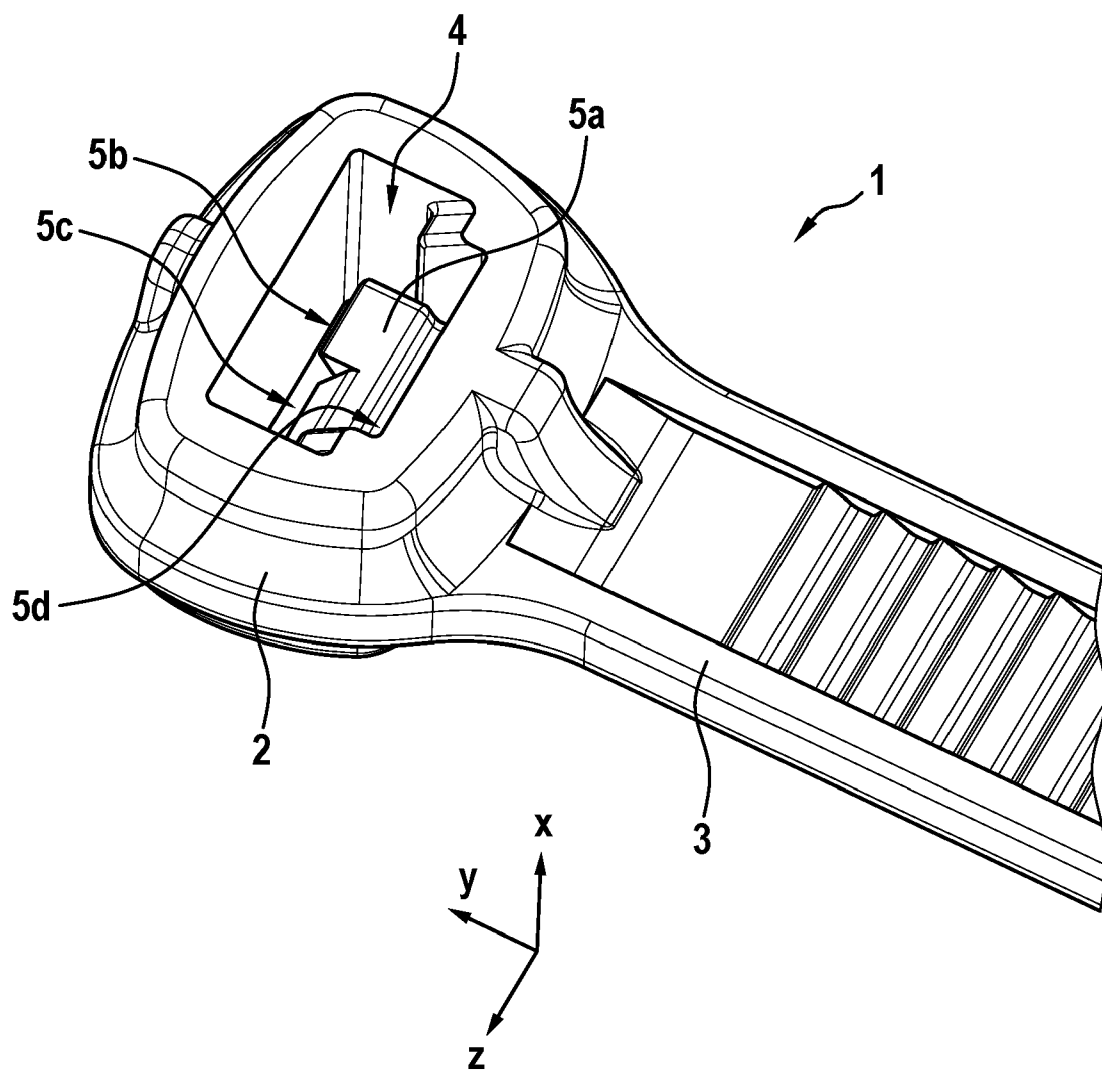


Fig. 2a

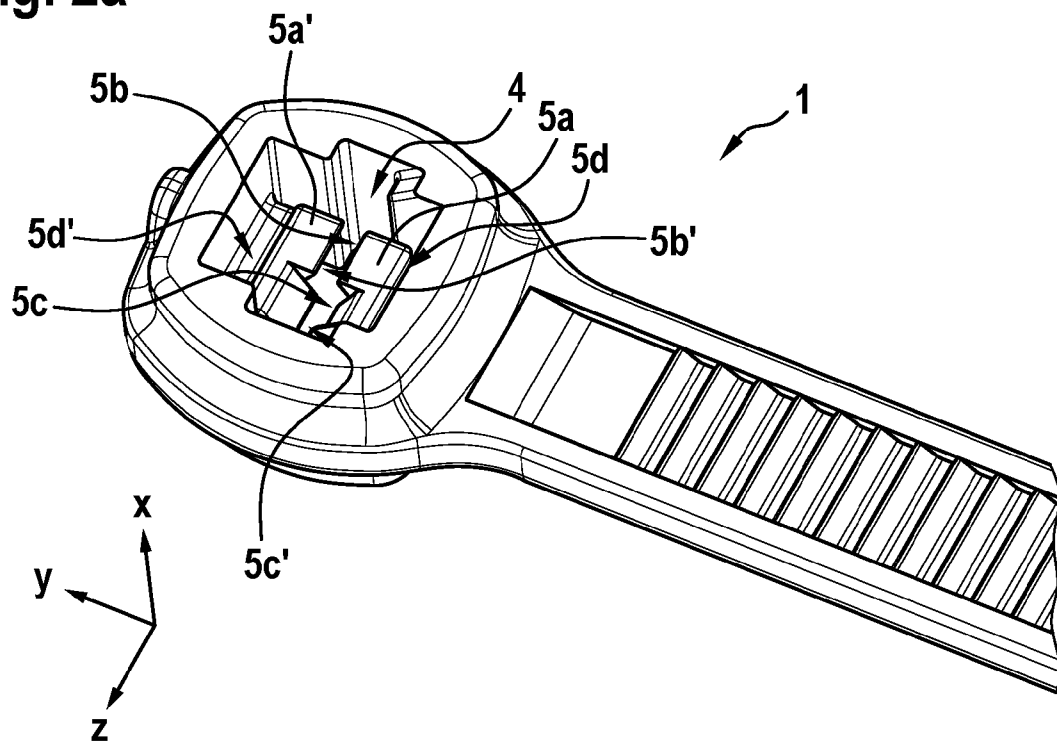


Fig. 2b

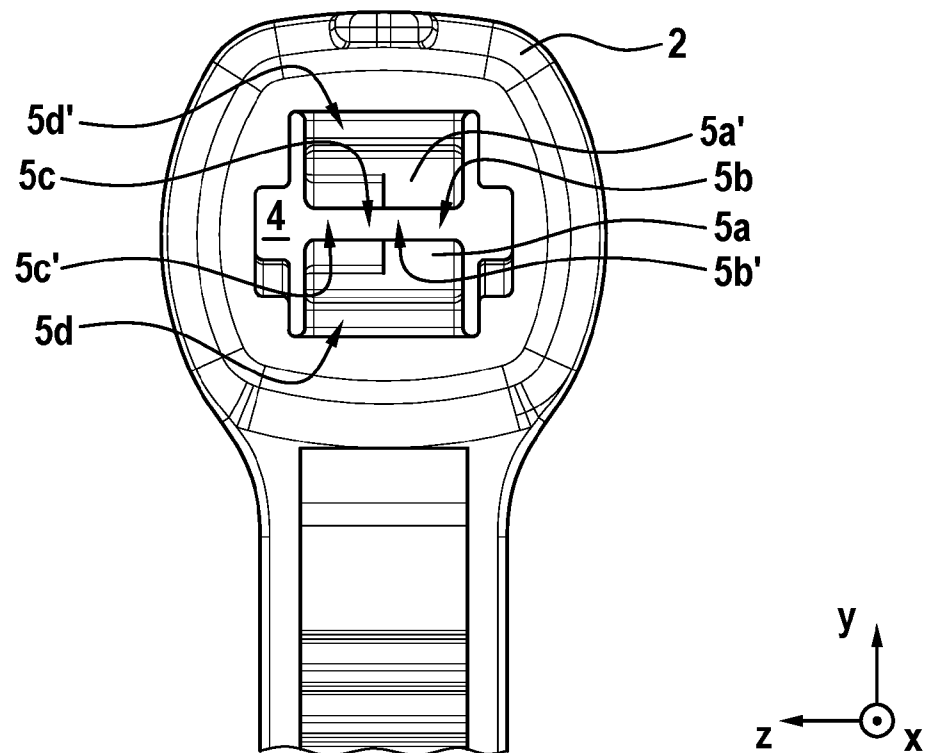


Fig. 3b
B-B 1

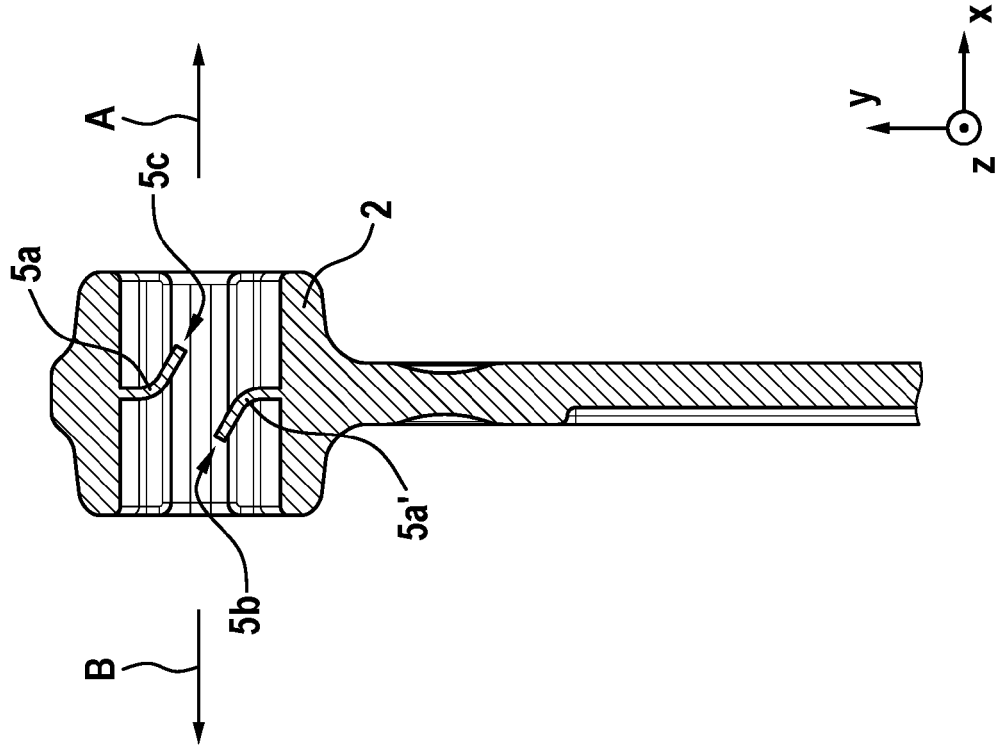


Fig. 3a
1

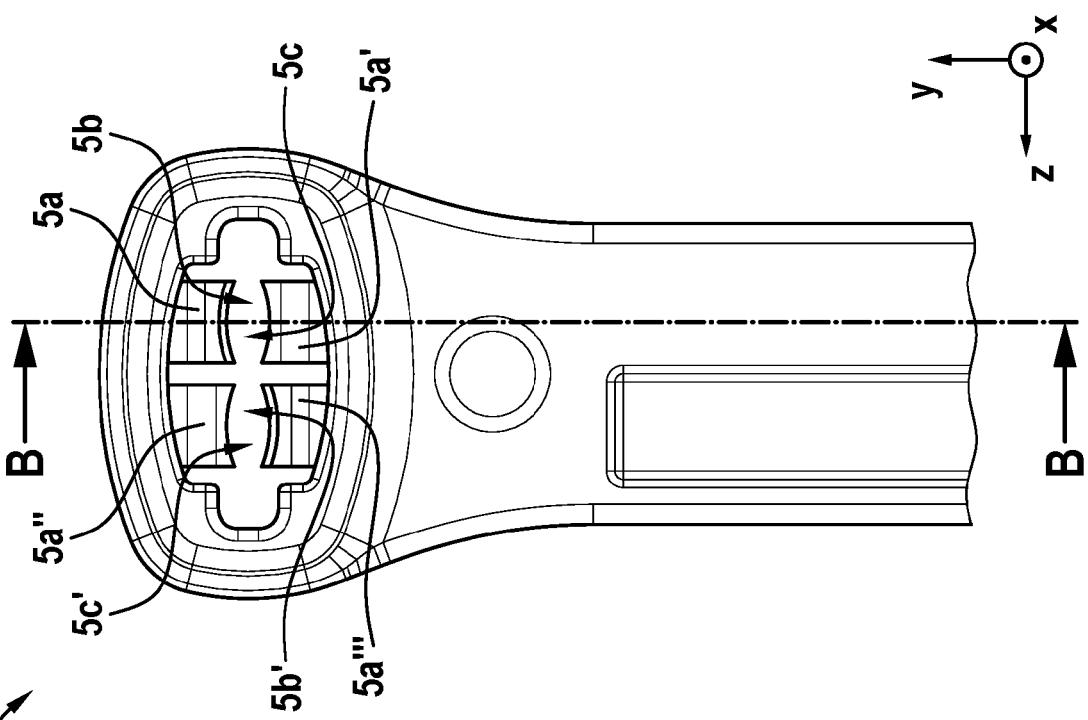


Fig. 3d

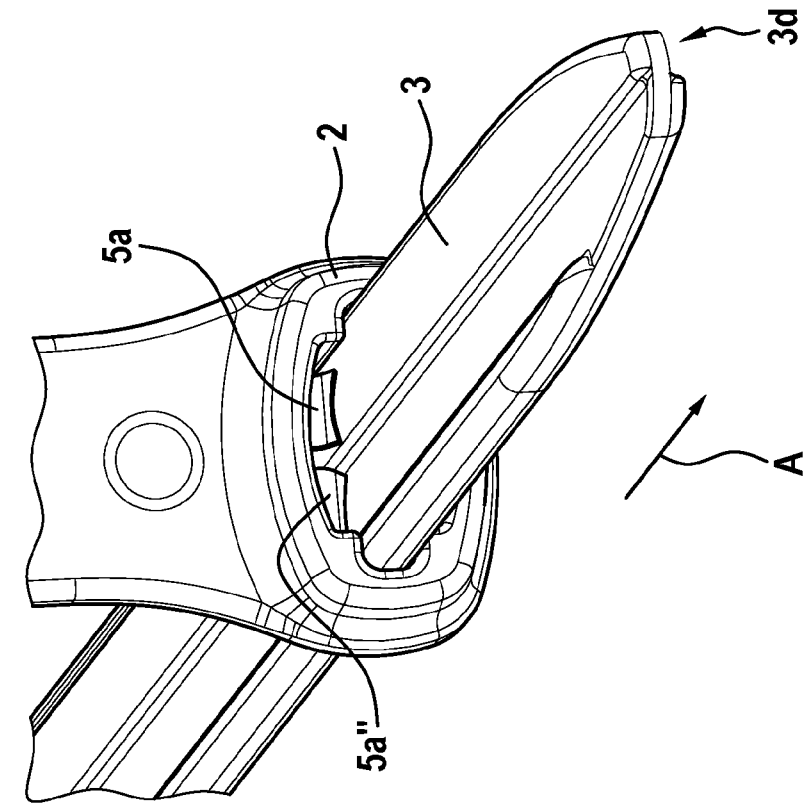


Fig. 3c

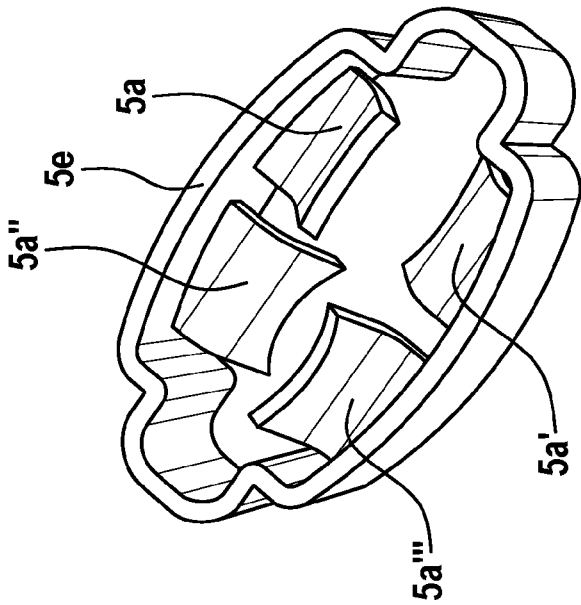


Fig. 4

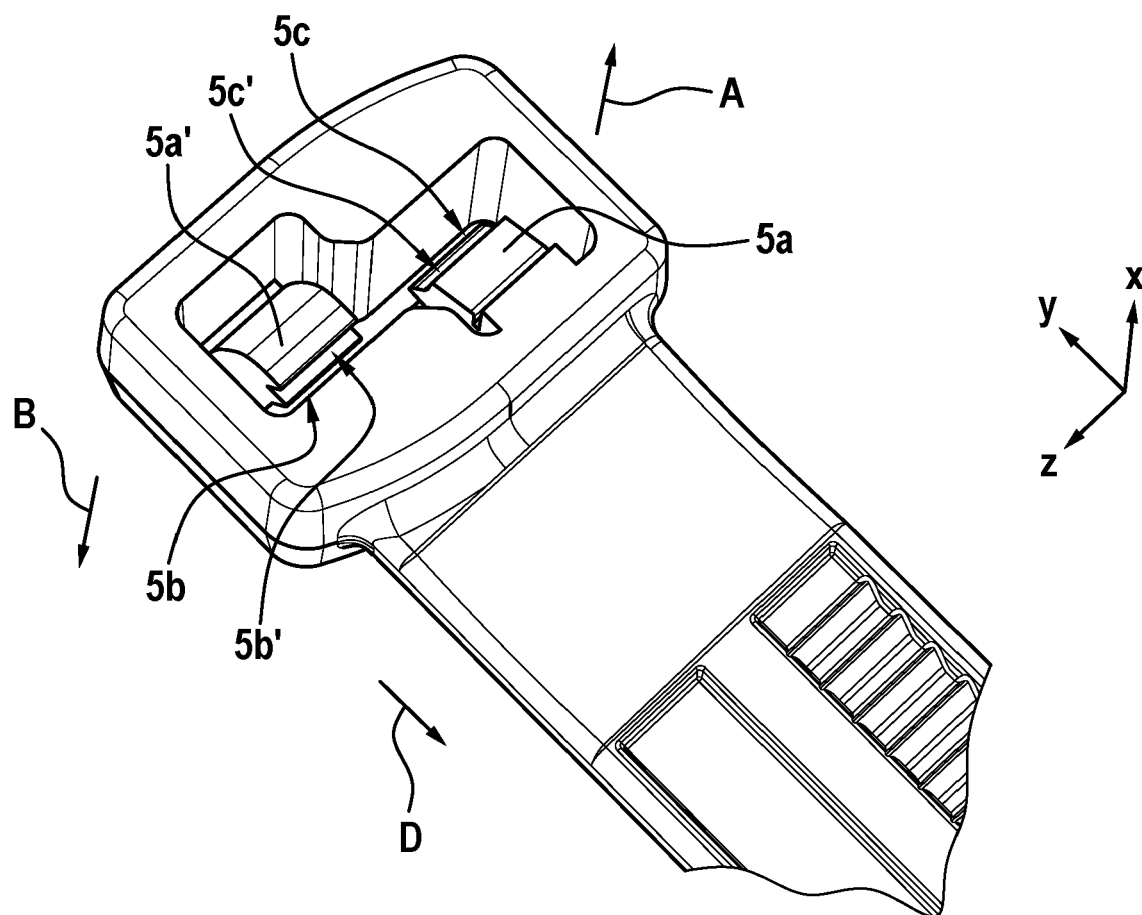


Fig. 5a

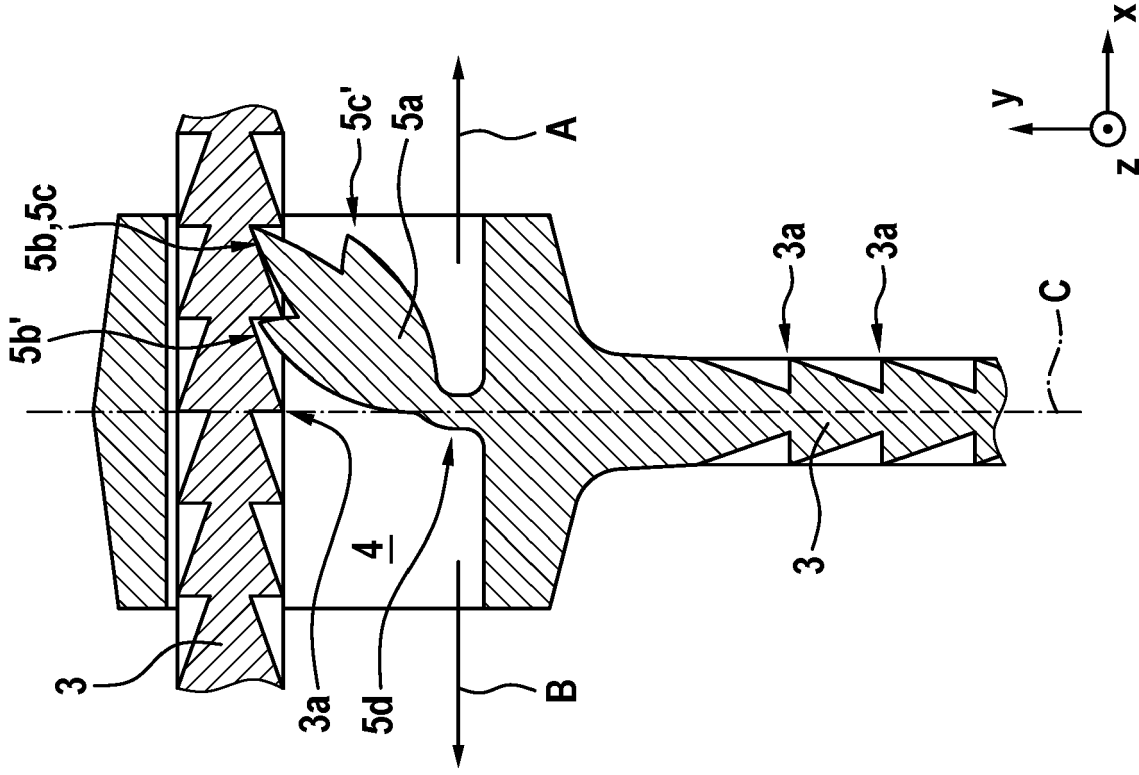
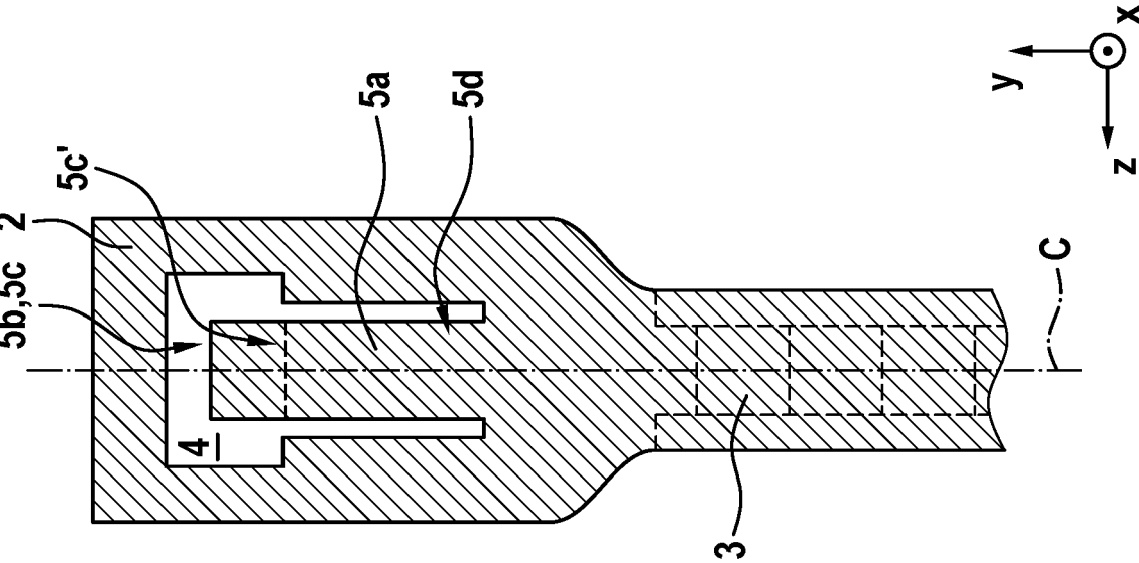


Fig. 5b





EUROPEAN SEARCH REPORT

Application Number

EP 23 18 8559

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Y	* column 4, line 43 - column 9, line 46; figures 1-19 *	7	
X	US 5 884 367 A (TEAGNO VLADIMIRO [IT] ET AL) 23 March 1999 (1999-03-23)	1-3, 5, 8-10	
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Place of search Munich		Date of completion of the search 2 February 2024	Examiner Fitterer, Johann
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