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(54) **DEVICE FOR FORMING A WEAVE**

(57) The invention relates to a device for forming a weave in a weaving machine, the device (1, 100) comprising a toothed belt (6) guided along an elongated endless path, a thread guide (7) mounted to the toothed belt (6), and a pulley (9, 10), wherein the toothed belt (6) meshes with the pulley (9, 10), wherein the thread guide (7) is adapted for guiding a binding thread (2, 3) towards a fabric (8), and wherein the thread guide (7) is provided with a support element (70) for mounting the thread guide (7) to the toothed belt (6), wherein the support element (70) has a first central segment (701) extending at an inner side of the toothed belt (6), wherein the first central segment (701) extends at an inner side of the toothed belt (6) in a gap (61) between two adjacent teeth (60) of a number of equally spaced teeth (60) of the toothed belt (6), wherein the support element (70) further has a second central segment (702) extending at an outer side of the toothed belt (6), and wherein the toothed belt (6) is clamped between the first central segment (701) and the second central segment (702). The invention further relates to a weaving machine comprising such a device and to a method for manufacturing such a device.

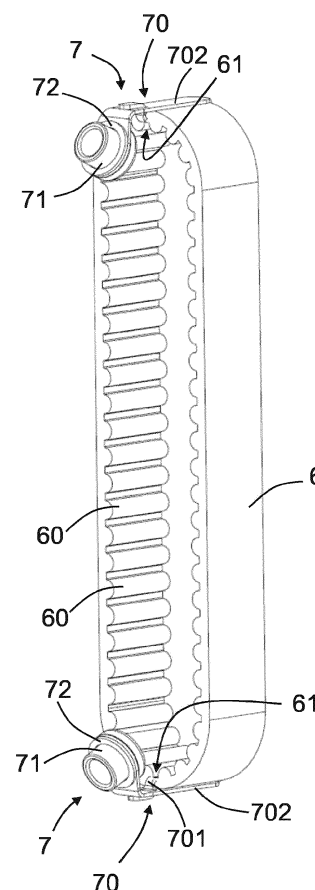


Fig. 5

Description

TECHNICAL FIELD AND PRIOR ART

[0001] The invention relates to a device for forming a weave in a weaving machine, the device comprising a toothed belt guided along an elongated endless path and a thread guide mounted to the toothed belt for moving a binding thread guided by the thread guide. The invention further relates to a weaving machine comprising such a device and to a method for manufacturing such a device.

[0002] In embodiments, the weave is a leno weave, wherein the term leno weave describes a weave in which two binding threads, also referred to as leno threads, leno binding threads or leno warp threads, are twisted around weft threads. In this case, typically a pair of thread guides is provided, wherein the thread guides are not only moved up and down, but along one or several full circulations of the elongated endless path. US3698441 shows a device for forming a leno weave, comprising at least two thread guides mounted to an endless support element guided along an elongated endless path for guiding a corresponding number of binding threads from a binding thread supply to a fixed binding point.

[0003] In other embodiments, the binding threads are moved up and down for forming a weave with weft threads and/or tucked in ends of weft threads, wherein the movement of the binding threads takes place at a different instant in the weaving cycle as shown for example in US1943662.

SUMMARY OF THE INVENTION

[0004] It is the object of the invention to provide a device for forming a weave comprising a toothed belt with a long lifetime and at least one thread guide securely mounted thereto. Further objects of the invention are to provide a weaving machine comprising such a device and to provide a method for manufacturing such a device.

[0005] According to a first aspect of the invention, a device for forming a weave in a weaving machine is provided, the device comprising a toothed belt guided along an elongated endless path, a thread guide mounted to the toothed belt, and a pulley, wherein the toothed belt meshes with the pulley, wherein the thread guide is adapted for guiding a binding thread towards a fabric, wherein the thread guide is provided with a support element for mounting the thread guide to the toothed belt, wherein the support element has a first central segment extending at an inner side of the toothed belt in a gap between two adjacent teeth of a number of equally spaced teeth of the toothed belt, wherein the support element further has a second central segment extending at an outer side of the toothed belt, and wherein the toothed belt is clamped between the first central segment and the second central segment.

[0006] Throughout this application and the claims, the indefinite article "a" or "an" means "one or more". Refer-

ence to "a first element" does not mandate presence of "a second element". Further, the expressions "first" and "second" are only used to distinguish one element from another element and not to indicate any order of the elements.

[0007] In particular, in embodiments at least two thread guides forming a pair of thread guides are provided.

[0008] Further, in embodiments the device comprises two pulleys, namely a driving pulley and a driven pulley. In the context of the application, a driving pulley is a pulley driven to rotate using an actuator, in particular an electric motor, wherein the driving pulley has teeth meshing with the teeth of the toothed belt for moving the toothed belt. The driven pulley is a passive element for guiding the toothed belt, wherein the driven pulley can be driven by the toothed belt to rotate.

[0009] For forming a leno weave, in embodiments, the toothed belt is driven by an actuator to move a number of turns in one direction, and then driven to move a number of turns in the reverse direction in order to avoid twisting the binding threads too much in the area opposite the fabric, i.e. a back area of the weaving machine. In other embodiments, the toothed belt is driven by an actuator to move to-and-fro for forming a weave without a twist, also referred to as weave binding.

[0010] When clamping the toothed belt between two segments of the support element, it is possible to fix the support element to the toothed belt while avoiding any material removal from the toothed belt, which material removal could affect a durability of the toothed belt. By arranging the first central segment in a gap between adjacent teeth, it can be avoided that the first central segment protrudes beyond the teeth to an inside of the toothed belt.

[0011] In an embodiment, the first central segment and the second central segment are forced against opposite sides of the toothed belt using only restoration forces of the support element. In other embodiments, the first central segment and the second central segment are interlinked for locking a clamp connection between the support element and the toothed belt.

[0012] In particular, in embodiments the second central segment is provided with an opening, wherein a first end of the support element, which is a free end of the first central segment, is passing through the opening for clamping the toothed belt between the first central segment and the second central segment. By passing the first end of the support element through an opening in the second central segment, the first central segment and the second central segment of the support element form a closed loop around a section of the toothed belt.

[0013] In an embodiment, the first end passing through the opening is bent so as to extend in parallel to the second central segment. By bending the first end of the support element, the support element is locked in position with the first central segment and the second central segment of the support element forming the closed loop around the section of the toothed belt. In addition, it is

avoided that the first end protrudes from the second central segment.

[0014] In an alternative embodiment, the support element has two first central segments extending at an inner side of the toothed belt, wherein in particular the two first central segments each have a fixed end, at which the first central segments are connected to the second central segment, and an opposite free end, wherein the first central segments are bent such that the free ends point towards each other.

[0015] In an embodiment, the second central segment is wider than the first central segment. A width of the first central segment is limited to a width of the gap between two adjacent teeth. Having a second central segment, which is wider than the first central segment allows the second central segment to securely abut against the outer side of the toothed belt for avoiding a tilting of the support element. Further, the second central segment can be provided with an opening, which is sufficiently large for allowing the free end of the first central segment to pass through.

[0016] In an embodiment, a protective layer is provided between the first central segment and the inner side of the toothed belt. The protective layer in embodiments is provided between side faces of the first central segment and flanks of the teeth for avoiding that the toothed belt gets damaged by edges of the first central segment. The protective layer in embodiments is a glue layer. Such a glue layer is easy to apply.

[0017] In embodiments, the thread guide further comprises a thread eyelet having a wear-resistant surface. The thread eyelet in embodiments is a hollow insert made of a wear-resistant ceramic material that is mounted to the support element. In other words, the thread eyelet and the support element are separate elements, which can be manufactured separately from different materials as per the specific requirement.

[0018] As mentioned above, in embodiments the device comprises two pulleys, namely a driving pulley and a driven pulley.

[0019] In an embodiment, the device has a driving pulley that has a number of teeth, wherein at least one tooth of the driving pulley is truncated, such that a clear space is formed in a place of the truncated tooth, and wherein the toothed belt and the driving pulley are adapted to each other such that upon a circulation of the toothed belt, the first central segment is temporarily received in the clear space.

[0020] In an embodiment, the driving pulley is provided with a number of truncated teeth forming a number of clear spaces, wherein the number and distribution of the truncated teeth is adapted to the number of teeth of the toothed belt, the number of teeth of the driving pulley including the truncated teeth, and the number and distribution of thread guides mounted to the toothed belt.

[0021] In alternative or in addition, the device comprises a driven pulley that has a number of teeth, wherein at least one tooth of the driven pulley is truncated, such that

a clear space is formed in a place of the truncated tooth, and wherein the toothed belt and the driven pulley are adapted to each other such that upon a circulation of the toothed belt, the first central segment is temporarily received in the clear space. In an embodiment, the driven pulley is provided with a number of truncated teeth forming a number of clear spaces, wherein the number and distribution of the truncated teeth is adapted to the number of teeth of the toothed belt, the number of teeth of the driven pulley including the truncated teeth, and the number and distribution of thread guides mounted to the toothed belt.

[0022] In the following, the driving pulley and the driven pulley are again conjointly referred to as pulley. In an embodiment, the pulley is provided with a pulley disc, wherein the pulley disc has a recess adapted for receiving the thread guide upon circulation of the toothed belt, wherein the recess is aligned in the circumferential direction of the pulley with an associated clear space.

[0023] In an embodiment, one pair of thread guides is mounted to the toothed belt, wherein the thread guides of said pair are distributed along the toothed belt, in particular are evenly distributed along the toothed belt. The device can be driven to form weaves using the two thread guides of said pair. In an alternative embodiment, two or more pairs of thread guides are mounted to the toothed belt, wherein the thread guides of each pair of thread guides are distributed along the toothed belt.

[0024] According to a second aspect, a weaving machine comprising such a device for forming a weave is provided.

[0025] According to a third aspect, a method for manufacturing a device for forming a weave is provided, the device comprising a toothed belt and a thread guide mounted to the toothed belt, wherein the thread guide comprises a support element, wherein the method comprises clamping the support element to the toothed belt such that a first central segment of the support element extends at an inner side of the toothed belt and a second central segment of the support element extends at an outer side of the toothed belt, wherein the first central segment extends in a gap between two adjacent teeth of a number of equally spaced teeth of the toothed belt. By clamping the support element to the toothed belt while arranging the first central segment in the gap, a mounting of the support element to the toothed belt without any material removal from the toothed belt is possible.

[0026] In an embodiment, the second central segment has an opening, wherein a first end of the support element, which is a free end of the first central segment, is passing through the opening. By passing the first end of the support element through an opening in the second central segment, the first central segment and the second central segment of the support element can be placed in a closed loop around a section of the toothed belt.

[0027] In an embodiment, the first end passing through the opening is bent so as to extend in parallel to the second central segment. Thereby, the support element is

locked in its looped state with the first central segment and the second central segment of the support element forming the closed loop around the section of the toothed belt.

[0028] In an alternative embodiment, the support element has two first central segments extending at an inner side of the toothed belt, wherein in particular the two first central segments each have a fixed end, at which the first central segments are connected to the second central segment, and an opposite free end, wherein the first central segments are bent such that the free ends point towards each other.

[0029] In an embodiment, a protective layer is provided between the first central segment and the inner side of the toothed belt, in particular between side faces of the first central segment and flanks of the teeth of the toothed belt. The protective layer in embodiments is a glue layer.

BRIEF DESCRIPTION OF THE DRAWINGS

[0030] In the following, an embodiment of the invention will be described in detail with reference to the drawings. Throughout the drawings, the same elements will be denoted by the same reference numerals. In the schematic drawings

- Fig. 1 shows in a perspective view a first embodiment of a device for forming a weave, in particular a leno weave in a weaving machine.
- Fig. 2 is a perspective view of a detail of Fig. 1 in an enlarged scale.
- Fig. 3 is a perspective view of a detail of Fig. 2 in an enlarged scale.
- Fig. 4 shows the toothed belt of the device of Fig. 1 together with thread guides mounted thereto in a front view.
- Fig. 5 shows the toothed belt of Fig. 4 in a perspective view.
- Fig. 6 shows the toothed belt of Fig. 4 in a sectional view.
- Fig. 7 shows the toothed belt of Fig. 4 in another perspective view.
- Fig. 8 shows the toothed belt of Fig. 7 in still another perspective view.
- Fig. 9 shows from a front a partial sectional view of the device of Fig. 1 showing an upper pulley, a lower pulley and a toothed belt.
- Fig. 10 shows in an enlarged scale a lower part and an upper part of the device of Fig. 9.
- Fig. 11 shows in a perspective view a housing of the device of Fig. 1 together with two pulleys mounted thereto.
- Fig. 12 shows in a perspective view a workpiece blank for forming the thread guide of Fig. 4.
- Fig. 13 shows in a perspective view the workpiece blank of Fig. 12 after bending.
- Fig. 14 shows in a perspective view another workpiece blank for forming a thread guide.

- Fig. 15 shows in a perspective view the workpiece blank of Fig. 14 after a first bending.
- Fig. 16 shows in a perspective view the workpiece blank of Fig. 14 after a second bending.
- Fig. 17 shows the toothed belt of the device of Fig. 1 together with the thread guide of Fig. 16 mounted thereto in a perspective view.
- Fig. 18 shows in a front view an arrangement comprising two toothed belts shown in Fig. 1.
- Fig. 19 shows in a back view the arrangement of Fig. 18.
- Fig. 20 shows in a perspective view another arrangement comprising two devices shown in Fig. 1 arranged next to one another.
- Fig. 21 shows in a front view a toothed belt having four thread guides mounted thereto for use in a device similar to the device shown in Fig. 1.
- Fig. 22 shows in a perspective view an alternative for the guiding element of Fig. 1.

DETAILED DESCRIPTION OF EMBODIMENTS OF THE INVENTION

[0031] Fig. 1 shows a device 1 according to the invention in which two binding threads 2, 3 are raised and lowered alternately to form a weave. In particular, the device 1 allows forming a leno weave by twisting the binding threads 2, 3 around each other for binding a weft thread 4 into the binding threads 2, 3. In other embodiments, the binding threads 2, 3 are only raised and lowered without twisting.

[0032] The device 1 is to be arranged on a weaving machine, for example a rapier weaving machine, an air jet weaving machine, or any other kind of weaving machine, wherein only a reed 5 of the weaving machine is schematically shown in Fig. 1.

[0033] Fig. 2 is a perspective view of a detail of Fig. 1 in enlarged scale without the two binding threads 2, 3 shown in Fig. 1. Fig. 3 is a perspective enlarged view of a detail of Fig. 2 together with the two binding threads 2, 3.

[0034] The device 1 in one embodiment is arranged in the region of outer edges of a fabric 8, for example on the outer edge at the weft insertion side of the fabric or at the outer edge at the opposite side of the fabric, or in a central region of the weaving machine for producing weaves, such as leno weaves between two fabrics. In one embodiment, two or more devices 1 are arranged side by side on an outer edge of the fabric as shown in Figs. 18 to 20 (which will be described further below).

[0035] As shown in Fig. 1, for moving the binding threads 2, 3, the device 1 comprises a toothed belt 6 and two thread guides 7 mounted evenly distributed to the toothed belt 6, wherein each thread guide 7 is adapted for guiding a binding thread 2, 3 between a thread supply (not shown) and a fabric 8.

[0036] The device 1 further comprises a driving pulley 9 and a driven pulley 10 having parallel axes 94, 104, wherein the driving pulley 9 and the driven pulley 10 are

conjointly referred to as pulleys 9, 10. When mounted to the weaving machine, in the embodiment shown, the axes 94, 104 of the pulleys 9, 10 are arranged in parallel to a pulling direction of the warp threads 40 (see Fig. 1) and the binding threads 2, 3, which pulling direction is also referred to as warp thread direction or binding thread direction.

[0037] The toothed belt 6, also referred to as endless support belt or endless support element, is supported by the two pulleys 9, 10 and the thread guides 7 are guided along an elongated endless path. In an embodiment, the thread guides 7 are moved in one direction, thereby twisting the binding threads 2, 3 guided by the thread guides 7 around each other for binding a weft thread 4 into the binding threads 2, 3 forming a leno weave.

[0038] In one embodiment, for forming a leno weave, the thread supply for the binding threads 2, 3 comprises fixedly arranged bobbins (not shown), wherein the toothed belt 6 is driven to move a number of turns in one direction, and then driven to move a number of turns in the reverse direction in order to avoid twisting the binding threads 2, 3 too much in the area opposite the fabric, i. e. a back area of the weaving machine.

[0039] In another embodiment, the thread supply for the binding threads 2, 3 comprises rotatably arranged bobbins (not shown), for example as known from US3698441, wherein the toothed belt 6 as shown in Fig. 1 can be driven to move in one direction only.

[0040] In other embodiments, the thread guides 7 are moved to-and-fro for forming a weave without a twist. In still another embodiment, the two movements of the thread guides 7 for forming a weave with or without a twist can be alternated using the device 1.

[0041] The driving pulley 9, which in the embodiment shown is the lower pulley, is driven by an electric motor 11. The electric motor 11 in the embodiment shown is controlled separately to a main drive of the weaving machine (not shown) and to a drive of a shedding device (not shown). The electric motor 11 in one embodiment is a stepper motor, which is electrically controlled and can be driven in both directions of rotation. In one embodiment, the stepper motor is controlled in an open loop. A synchronization of the device 1 and the weaving machine in one embodiment is set and controlled according to a program, so that the binding threads 2, 3 move - and for forming a leno weave further cross each other - at an expected moment of time within the weaving cycle. The driving pulley 9 is connected to the electric motor 11 using a shaft 24 (see Fig. 2), which shaft 24 is housed in a shaft housing 12.

[0042] The shaft housing 12 in the embodiment shown is formed integrally with a housing 13 of the pulleys 9, 10. In the embodiment shown, two fixed guiding elements 14 are mounted on the housing 13 of the pulleys 9, 10, each guiding element 14 comprising a bended wire. In an alternative embodiment, the two guiding elements are formed integrally with the housing 13. In another alternative embodiment, the two guiding elements 14 are

formed integrally by a piece 140 having borders that serve as a guide element 14 as shown in Fig. 22, for example a piece made of ceramic material.

[0043] As shown in Figs. 1 and 3, the binding threads 2, 3 pass through an opening in the housing 13 and are guided via the guiding elements 14 to the thread guides 7. By means of the guiding elements 14 it is avoided that the binding threads 2, 3 coming from the thread supplies contact the toothed belt 6 and/or the pulleys 9, 10, in particular when a thread guide 7 is in the upper position or the lower position as shown in Figs. 1 and 3. In one embodiment, additional guiding elements (not shown), such as rounded wires, are provided near the opening in the housing 13 through which the binding threads 2, 3 are threaded, to avoid that the binding threads 2, 3 come into contact with the opening in the housing 13 and could be damaged by the housing 13.

[0044] The housing 13 is further provided with a fitting 15 (see Fig. 3) for a connection with an air supply 150 via a duct 151 (see Fig. 2). The duct 151 is arranged in the shaft housing 12 and covered by a cover plate 16. The fitting 15 is connected to a blower 18 (see Fig. 3), which is adapted to blow away dust that will accumulate on the toothed belt 6 and/or near one of the pulleys 9, 10. In the embodiment shown, only one blower 18 is provided (as can be seen in Fig. 9) that blows near the teeth of the toothed belt 6. In an alternative embodiment, two blowers are provided, which are distributed in the horizontal and/or the vertical direction, for example one near the driven pulley 10, which in the embodiment shown is the upper pulley, and one near the driving pulley 9, which in the embodiment shown is the lower pulley.

[0045] On a front side of the housing 13, as best seen in Figs. 2 and 3, two at least essentially vertical bars 19 are provided in order to prevent that an operator will be caught by the moving toothed belt 6 and/or by the thread guides 7.

[0046] The toothed belt in the embodiment shown is an endless toothed belt 6, and the pulleys 9, 10 are provided with a number of teeth 95, 105 adapted for meshing with the teeth 60 of the toothed belt 6.

[0047] Figs. 4 to 8 show the toothed belt 6 of the device 1 together with two thread guides 7 mounted thereto in a front view, a first perspective view, a sectional view, a second perspective view and a third perspective view. In the state shown in the second perspective view or the third perspective view, the toothed belt 6 is rotated with respect to the state shown in the first perspective view.

[0048] As best shown in Fig. 5 to 8, the thread guide 7 comprises a support element 70 fixed to the toothed belt 6 and a thread eyelet 71 supported by the support element 70. As best seen in Fig. 6, the thread eyelet 71 is received in an aperture 705 of the support element 70 and is fixed to the support element 70 using a securing ring 72. The thread eyelet 71 in embodiments is made of ceramic.

[0049] The toothed belt 6 has a number of equally spaced teeth 60. As best seen in Figs. 7 and 8, the thread

guide 7 is fixed to the toothed belt 6 via the support element 70, wherein the support element 70 extends between two adjacent teeth 60 of the toothed belt 6. More particular, the support element 70 has a first central segment 701 and a second central segment 702, wherein the first central segment 701 is arranged at an inner side of the toothed belt 6 in a gap 61 formed between two adjacent teeth 60.

[0050] As best seen in Fig. 6, in the embodiment shown the second central segment 702 is provided with an opening 706, wherein a first end 703 of the support element 70, which is a free end of the first central segment 701, is passing through the opening 706 for clamping the support element 70 to the toothed belt 6. For securing the support element 70, in addition the first end 703 passing through the opening 706 is bent so as to extend in parallel to the second central segment 702 and abuts against an outer side of the second central segment 702.

[0051] The toothed belt 6 meshes with teeth 95 of the lower pulley 9 and with teeth 105 of the upper pulley 10.

[0052] Fig. 9 shows from a front a partial sectional view of the device 1 of Fig. 1, wherein the support element 70 is partly cut-away, and Fig. 10 shows in enlarged scale an upper part and a lower part of the device 1 as shown in Fig. 9. The device 1 shown in Figs. 9 and 10 is adapted for moving the thread guides 7 not only up and down between the pulleys 9, 10, but also along the pulleys 9, 10.

[0053] The driving pulley 9 is provided with a number of teeth 95, wherein the teeth 95 are adapted to interact with the teeth 60 of the toothed belt 6 for moving the toothed belt 6. The driven pulley 10 is provided with teeth 105, which are received between the teeth 60 of the toothed belt 6, wherein the teeth 105 have no driving function.

[0054] In order to avoid an interference of the thread guide 7 and the pulleys 9, 10, more particular an interference between the first central segment 701 of the support element 70 and the pulleys 9, 10, at least one tooth 95 of the driving pulley 9 and at least one tooth 105 of the driven pulley 10 is truncated, wherein clear spaces 91, 101 are formed in a place of the at least one truncated tooth of the pulleys 9, 10. The toothed belt 6 and the pulleys 9, 10 are adapted to each other such that upon a circulation of the toothed belt 6, the first central segment 701 is temporarily arranged in the clear space 91, 101. In the embodiment shown, four teeth 95 of the pulley 9 and four teeth 105 of the pulley 10 are truncated, which are offset by 90°. The pulleys 9, 10 have sixteen teeth 95, 105 including the truncated teeth. The toothed belt 6 has fifty-six teeth 60, wherein upon a circulation of the toothed belt 6 the first central segment 701 of each thread guide 7 can be temporarily arranged alternately in a pair of two clear spaces 91, 101 offset by 180°.

[0055] As indicated in Fig. 10, a glue layer 709 is provided as a protective layer between the first central segment 701 and the inner side of the toothed belt 6, more particular, between side faces of the first central segment 701 and adjoining flanks of the teeth 60 of the toothed

belt 6.

[0056] As shown in Fig. 11, the driving pulley 9 is provided with two pulley discs 92 arranged at opposite sides of the pulley 9. The pulley discs 92 each have four recesses 93 adapted for receiving the thread guides 7 upon circulation of the toothed belt 6. The recesses 93 of the two pulley discs 92 are aligned in the circumferential direction of the pulley 9 with the clear spaces 91.

[0057] As shown in more detail in Figs. 12 and 13, in the embodiment shown the support element 70 is made of one workpiece blank 700, in particular a punched or stamped piece, that is bent. The support element 70 has a first end 703 and an opposite second end 704. The second end 704 is provided with a receiving opening 705 for receiving the thread eyelet 71 (see Fig. 6). The second central segment 702 is provided with an opening 706. For fixing the support element 70 to the toothed belt 6, the first central segment 701 is bent around the toothed belt 6 so as to be parallel to the second central segment 702 for clamping the support element 70 to the toothed belt 6. For a fixation, the first end 703 of the support element 70 is passing through the opening 706 from a first side 707 to an opposite second side 708 of the second central segment 702. The first end 703 passing through the opening 706 and protruding from the second side 708 is bent again to be parallel to the second central segment 702. In the embodiment shown, as best seen in Fig. 6, after fixation of the support element 70 to the toothed belt 6, the first end 703 lies flat on the second side 708 of the second central segment 702. In the embodiment shown, the first end 703 is bent towards the second end 704 end and away from the toothed belt 6.

[0058] In an alternative as shown in more detail in Figs. 14 to 17, the support element 70 has two first central segments 701 extending at an inner side of the toothed belt 6. The support element 70 as shown in Figs. 14 to 17 is also made of one workpiece blank 700, in particular a punched or stamped piece, that will be bent. One of the two first central segments 701 is provided at a first end 703 of the support element 70 and connected to an end of a second central segment 702. The other first central segment 701 is formed in an area within the second central segment 702 by providing a U-shaped slit 710 with a base 711 facing towards the first end 703. The first central segments 701 can be bent out of a plane of the second central segment 702 as shown in Fig. 15.

[0059] In an alternative (not shown) of the embodiment of Figs. 14 to 17, a U-shaped slit with a base facing towards the second end 704 is provided, wherein the first central segment is bent out of a plane of the second central segment 702 towards the first end 703.

[0060] In both embodiments, the two first central segments 701 each have a fixed end, at which the first central segments 701 are connected to the second central segment 702, and an opposite free end. For fixing the support element 70 to the toothed belt 6, as shown in Figs. 16 and 17, each first central segment 701 is bent around the toothed belt 6 so as to be parallel to the second central

segment 702 for clamping the support element 70 to the toothed belt 6 using restoration forces of the support element 70, wherein the first central segments 701 are bent such that the free ends point towards each other.

[0061] Figs. 18 and 19 show in a front view an arrangement 1000 comprising two devices 1 and 100, wherein each device shown in Figs. 18 and 19 is similar to the device 1 as shown in Fig. 1 and for the same or similar elements consistent reference signs are used. The device 1 shown on the left in Fig. 18 and on the right in Fig. 19, is referred to as first device 1, and the device 100 shown on the right in Fig. 18 and on the left in Fig. 19, is referred to as second device 100.

[0062] In the embodiment shown in Figs. 18 and 19, the first device 1 and the second device 100 are driven by one common electric motor 11, wherein as shown in the back view of Fig. 19, a transmission device 1010 is provided. The transmission device 1010 comprises two pulleys 1011, 1012 and a toothed belt 1013. In the embodiment shown, for the first device 1, the lower pulley 9 is the driving pulley causing a movement of the toothed belt 6 of the first device 1. The lower pulley 9 is coupled to the electric motor 11 using the shaft 24. In contrast to the embodiment shown in Fig. 1, the upper pulley 10 of the first device 1 is equipped with a pulley disc 102. A first pulley 1011 of the transmission device 1010 is coupled to the upper pulley 10 of the first device 1 for a conjoint rotation with the upper pulley 10 of the first device 1. The first pulley 1011 of the transmission device 1010 is coupled to the second pulley 1012 of the transmission device 1010 via the toothed belt 1013 for causing a rotation of the second pulley 1012 of the transmission device 1010 that is coupled to the upper pulley 10 of the second device 100.

[0063] The upper pulley 10 of the second device 100 is coupled to the second pulley 1012 of the transmission device 1010 for a conjoint rotation. At the second device 100, the upper pulley 10 is the driving pulley adapted for causing a movement of the toothed belt 6 of the second device 100. As shown in Fig. 18, in the embodiment shown, only the upper pulley 10 of the second device 100 is equipped with a pulley disc 102.

[0064] Fig. 20 shows in a perspective view from behind another arrangement comprising two similar devices 1 arranged next to one another, wherein each device 1 is essentially identical in design to the device 1 shown in Fig. 1 and for the same or similar elements consistent reference signs are used. The two devices 1 shown in Fig. 20 each comprise an electric motor 11 drivingly coupled to the lower pulley 9 of the associated device 1.

[0065] Fig. 21 shows in a front view a toothed belt 6 having two pairs of thread guides 7 mounted thereto for use in a device 1 similar to the device 1 shown in Fig. 1. The support element 70 of each of the thread guides 7 is mounted to the toothed belt 6 in a way similar as explained in Figs. 1 to 13. Each pair of thread guides 7 comprises two thread guides 7, which are evenly distributed along the toothed belt 6. The thread guides 7 are

each adapted for guiding a binding thread (not shown in Fig. 21) towards a fabric (not shown in Fig. 21).

[0066] It will be understood by the person skilled in the art, that each pair of thread guides 7 could be used for forming weaves even in the absence of binding threads threaded to both thread guides 7 of each pair of thread guides 7. When using four binding threads, a stronger binding or weave can be obtained. The four thread guides 7 are arranged in two sets 73, 74, each set 73, 74 comprising one thread guide 7 of each pair of thread guides 7, wherein in Fig. 22 a first set 73 is shown in a top position and a second set 74 is shown in a bottom position. For each set 73, 74, the two thread guides 7 are arranged at a distance along the toothed belt 6, wherein the distance is adapted to allow that the thread guides 7 move along the pulleys 9 and 10 without contacting each other.

[0067] The embodiments described above are provided by way of illustration only and should not be construed to limit the invention. Those skilled in the art will readily recognize various modifications and changes that may be made to the present invention without following the example embodiments and applications illustrated and described herein, and without departing from the scope of the present disclosure.

Claims

1. Device for forming a weave in a weaving machine, the device comprising a toothed belt (6) guided along an elongated endless path, a thread guide (7) mounted to the toothed belt (6), and a pulley (9, 10), wherein the toothed belt (6) meshes with the pulley (9, 10), wherein the thread guide (7) is adapted for guiding a binding thread (2, 3) towards a fabric (8), and wherein the thread guide (7) is provided with a support element (70) for mounting the thread guide (7) to the toothed belt (6), wherein the support element (70) has a first central segment (701) extending at an inner side of the toothed belt (6), **characterized in that** the first central segment (701) extends at an inner side of the toothed belt (6) in a gap (61) between two adjacent teeth (60) of a number of equally spaced teeth (60) of the toothed belt (6), wherein the support element (70) further has a second central segment (702) extending at an outer side of the toothed belt (6), and wherein the toothed belt (6) is clamped between the first central segment (701) and the second central segment (702).
2. The device according to claim 1, **characterized in that** the second central segment (702) is provided with an opening (706), wherein a first end (703) of the support element (70), which is a free end of the first central segment (701), is passing through the opening (706) for clamping the toothed belt (6) between the first central segment (701) and the second central segment (702), wherein in particular the first

end (703) passing through the opening (706) is bent so as to extend in parallel to the second central segment (702).

3. The device according to claim 1, **characterized in that** the support element (70) has two first central segments (701) extending at an inner side of the toothed belt (6), wherein in particular the two first central segments (701) each have a fixed end, at which the first central segments (701) are connected to the second central segment (702), and an opposite free end, wherein the first central segments (701) are bent such that the free ends point towards each other. 5
4. The device according to any one of claims 1 to 3, **characterized in that** the second central segment (702) is wider than the first central segment (701). 10
5. The device according to any one of claims 1 to 4, **characterized in that** a protective layer is provided between the first central segment (701) and the inner side of the toothed belt (6), wherein in particular the protective layer is a glue layer (709). 20
6. The device according to any one of claims 1 to 5, **characterized in that** the thread guide (7) further comprises a thread eyelet (71) having a wear-resistant surface, wherein in particular the thread eyelet (71) is a hollow insert made of a wear-resistant ceramic material that is mounted to the support element (70). 25
7. The device according to any of claims 1 to 6, **characterized in that** the pulley (9, 10) has a number of teeth (95, 105), wherein at least one tooth of the pulley (9, 10) is truncated, such that a clear space (91, 101) is formed in a place of the truncated tooth, and wherein the toothed belt (6) and the pulley (9, 10) are adapted to each other such that upon a circulation of the toothed belt (6), the first central segment (701) is temporarily received in the clear space (91, 101). 30
8. The device according claim 7, **characterized in that** the pulley (9, 10) is provided with a number of truncated teeth forming a number of clear spaces (91, 101), wherein the number and distribution of the truncated teeth is adapted to the number of teeth (60) of the toothed belt (6), the number of teeth (95, 105) of the pulley (9, 10) including the truncated teeth, and the number and distribution of thread guides (7) mounted to the toothed belt (6). 35
9. The device according to claim 7 or 8, **characterized in that** the pulley (9, 10) is provided with a pulley disc (92, 102), wherein the pulley disc (92, 102) has a recess (93) adapted for receiving the thread guide 40

(7) upon circulation of the toothed belt (6), wherein the recess (93) is aligned in the circumferential direction of the pulley (9) with an associated clear space (91, 101).

10. The device according to any one of claims 1 to 9, **characterized in that** one pair of thread guides (7) is mounted to the toothed belt (6) or two or more pairs of thread guides (7) are mounted to the toothed belt (6), wherein the thread guides (7) of each pair of thread guides are distributed along the toothed belt (6). 45
11. Weaving machine comprising a device (1) for forming a weave according to any one of claims 1 to 10. 50
12. Method for manufacturing a device (1) for forming a weave, the device (1) comprising a toothed belt (6) and a thread guide (7) mounted to the toothed belt (6), wherein the thread guide (7) comprises a support element (70), **characterized in that** the method comprises clamping the support element (70) to the toothed belt (6) such that a first central segment (701) of the support element (70) extends at an inner side of the toothed belt (6) and a second central segment (702) of the support element (70) extends at an outer side of the toothed belt (6), wherein the first central segment (701) extends in a gap (61) between two adjacent teeth (60) of a number of equally spaced teeth (60) of the toothed belt (6). 55
13. The method according to claim 12, **characterized in that** the second central segment (702) has an opening (706), wherein a first end (703) of the support element (70), which is a free end of the first central segment (701), is passing through the opening (706), wherein in particular the first end (703) passing through the opening (706) is bent so as to extend in parallel to the second central segment (702).
14. The method according to claim 12, **characterized in that** the support element (70) has two first central segments (701) extending at an inner side of the toothed belt (6), wherein in particular the two first central segments (701) each have a fixed end, at which the first central segments (701) are connected to the second central segment (702), and an opposite free end, wherein the first central segments (701) are bent such that the free ends point towards each other.
15. The method according to any one of claims 12 to 14, **characterized in that** a protective layer is provided between the first central segment (701) and the inner side of the toothed belt (6), wherein in particular the protective layer is a glue layer (709).

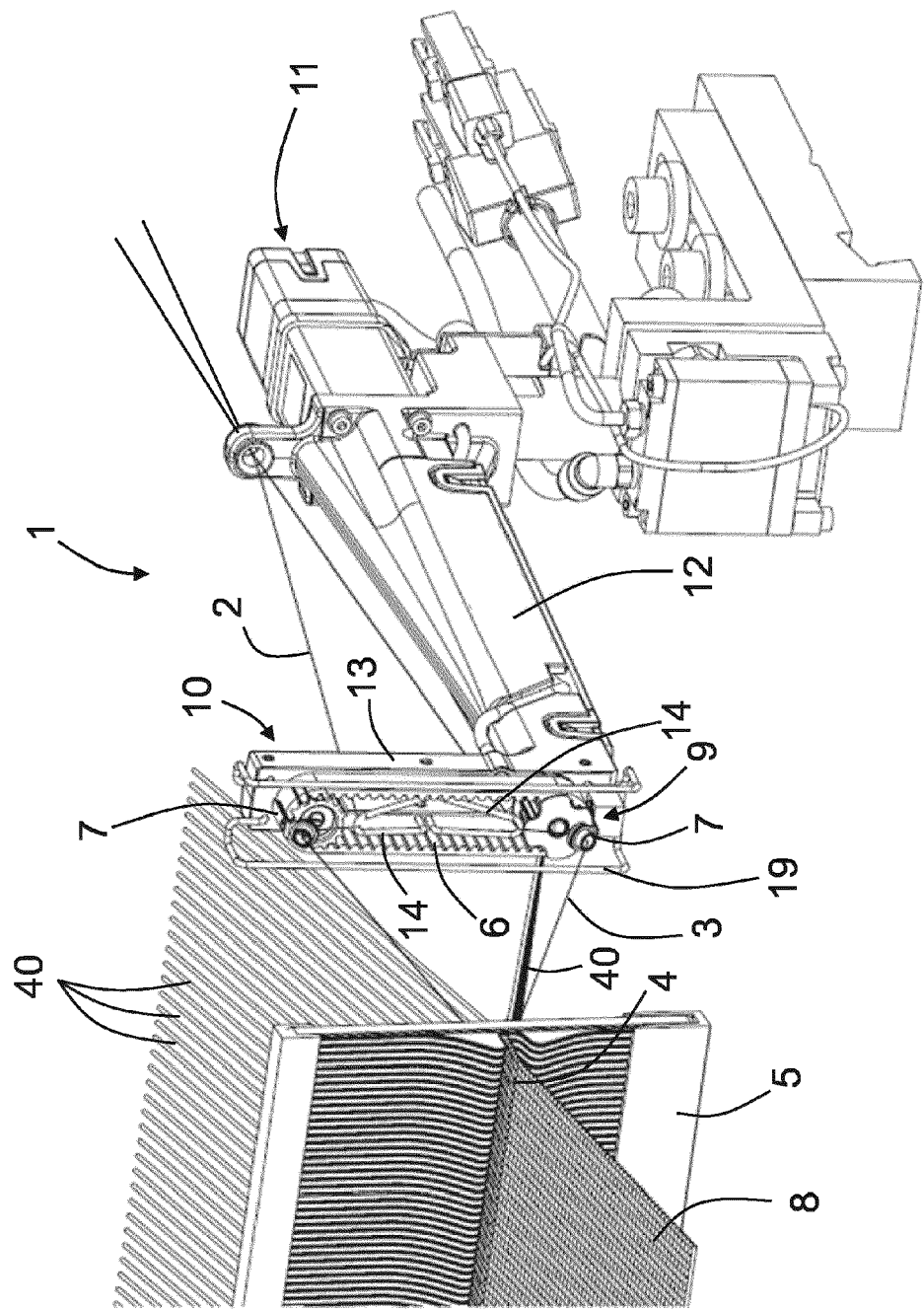


Fig. 1

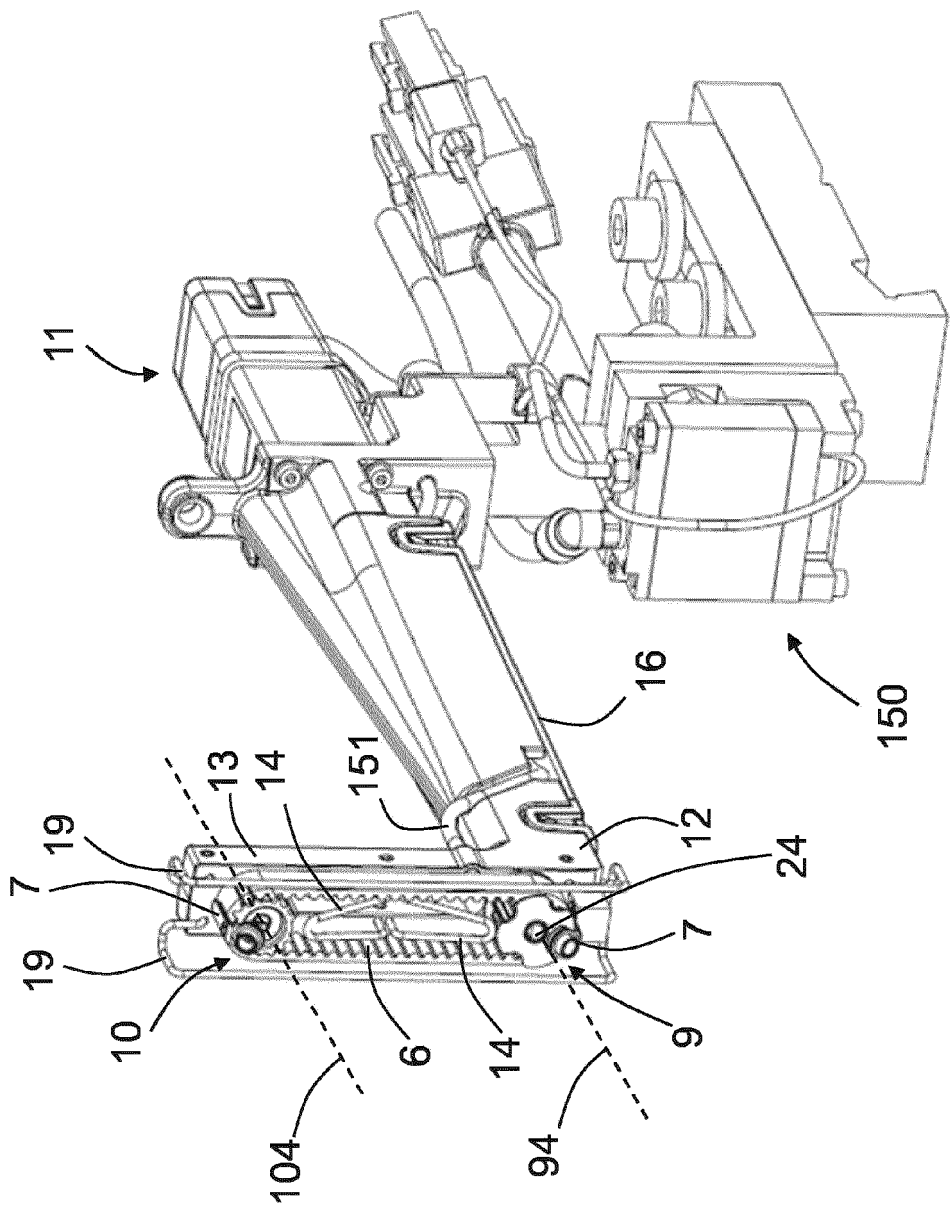


Fig. 2

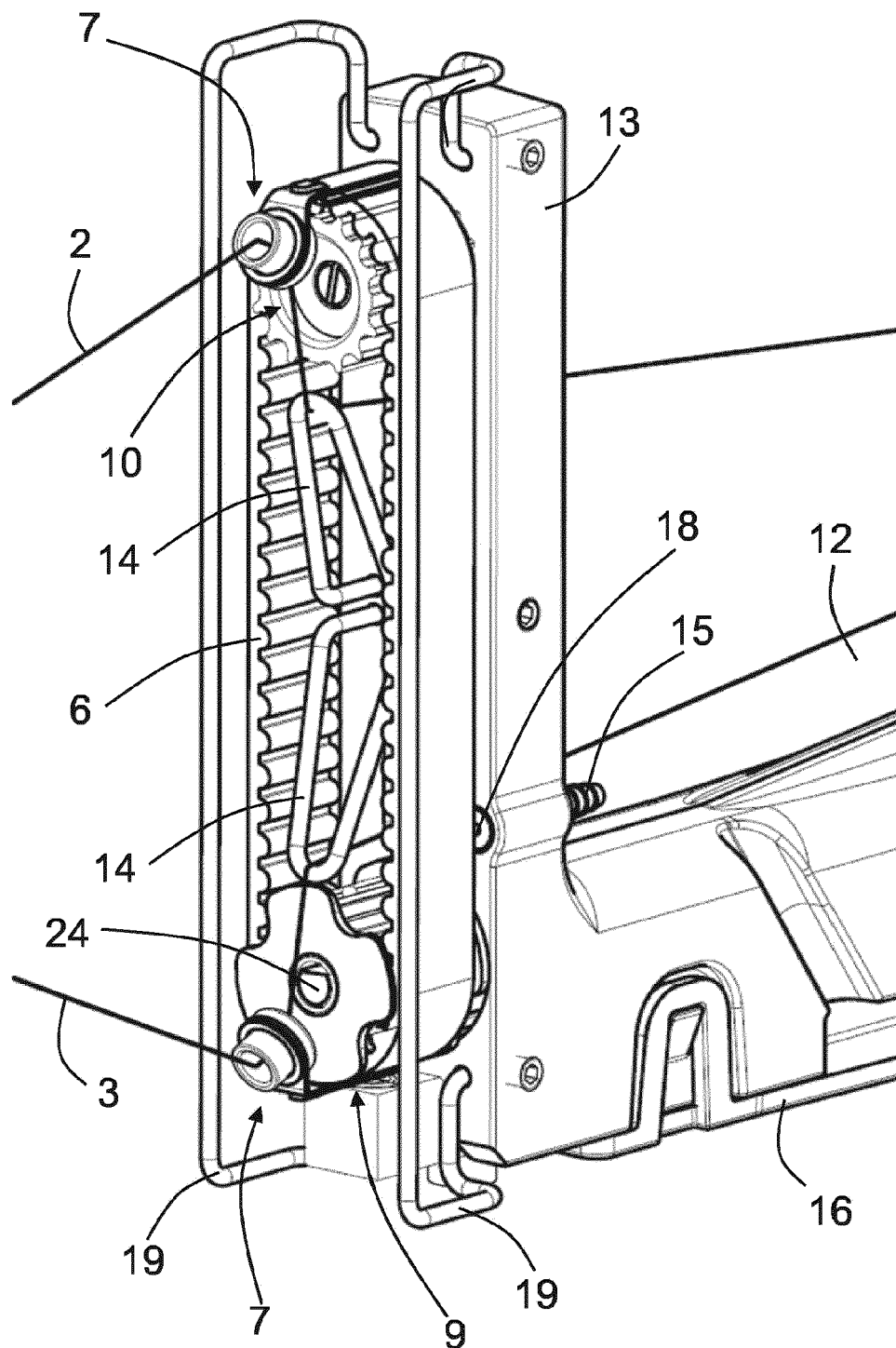


Fig. 3

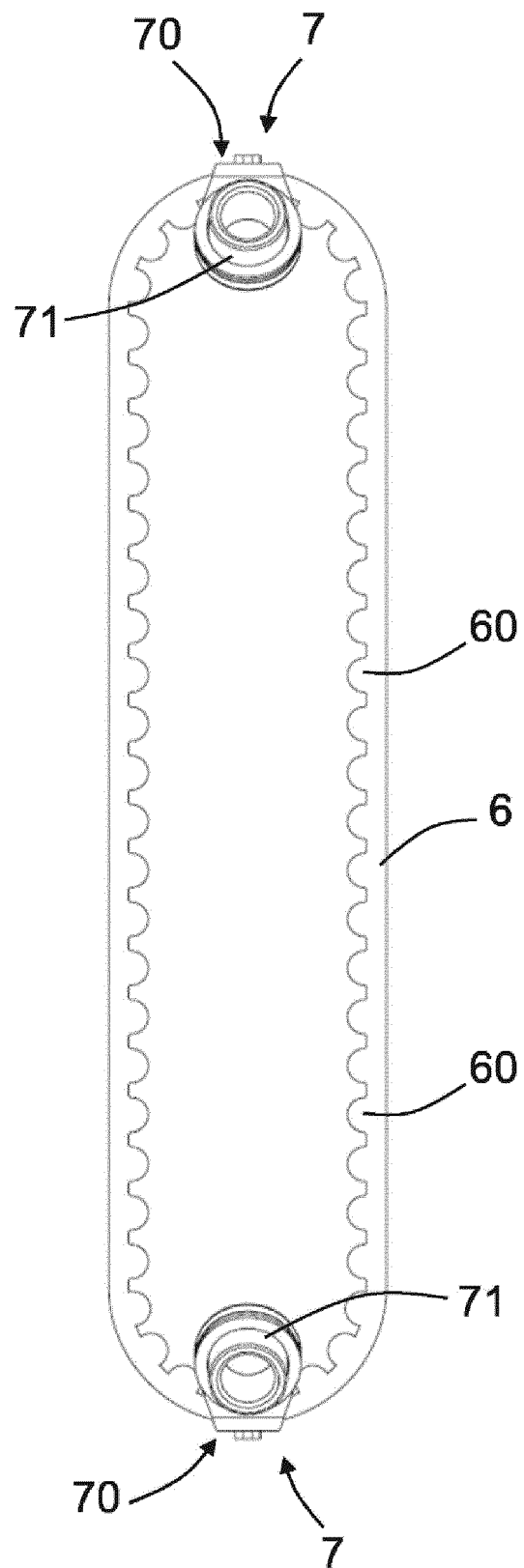


Fig. 4

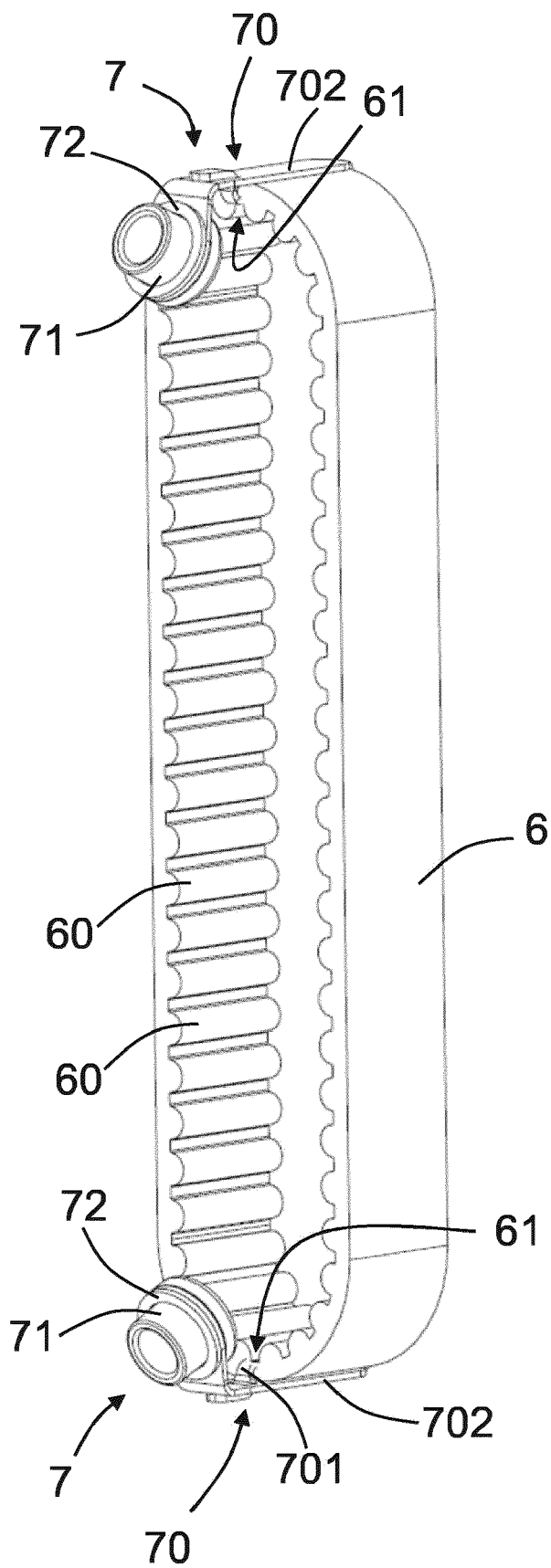


Fig. 5

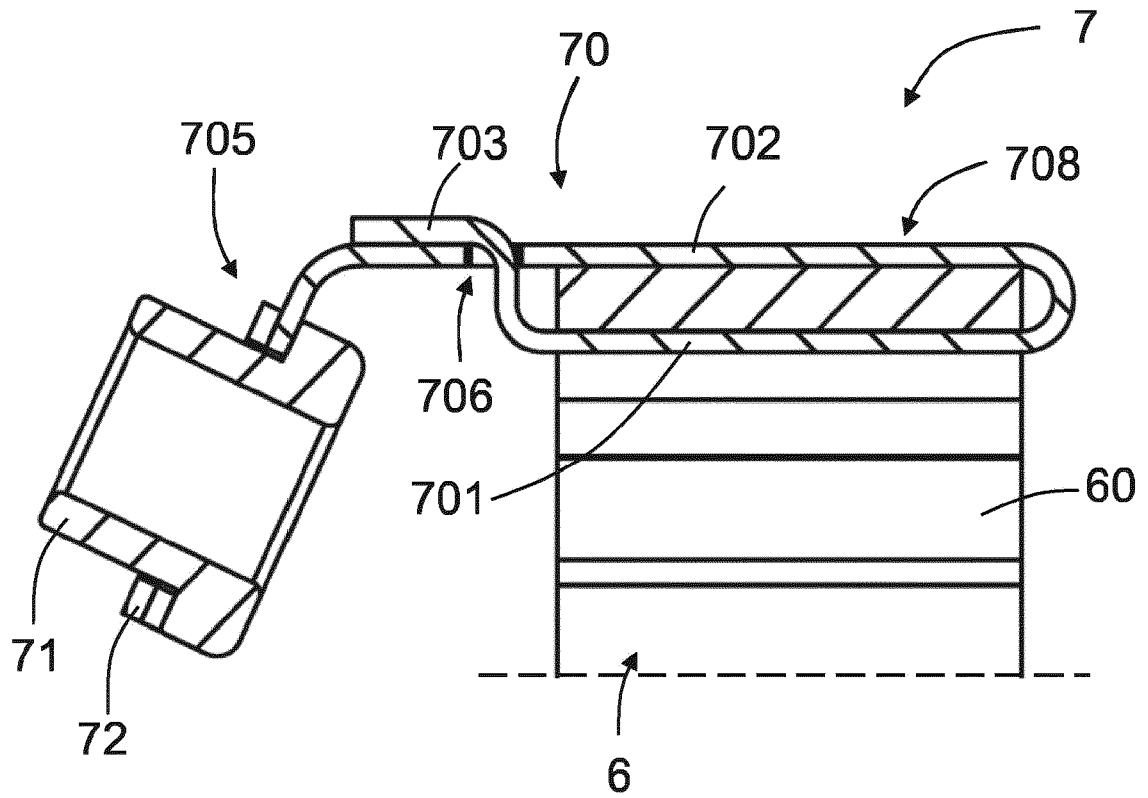


Fig. 6

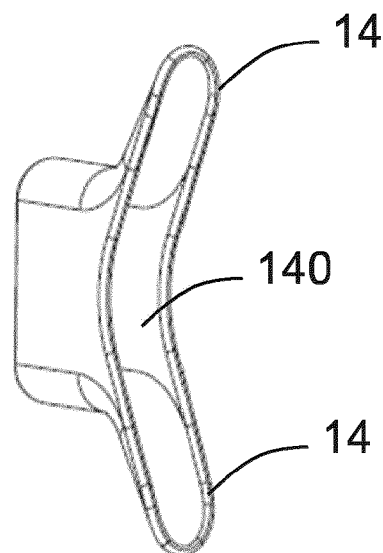


Fig. 22

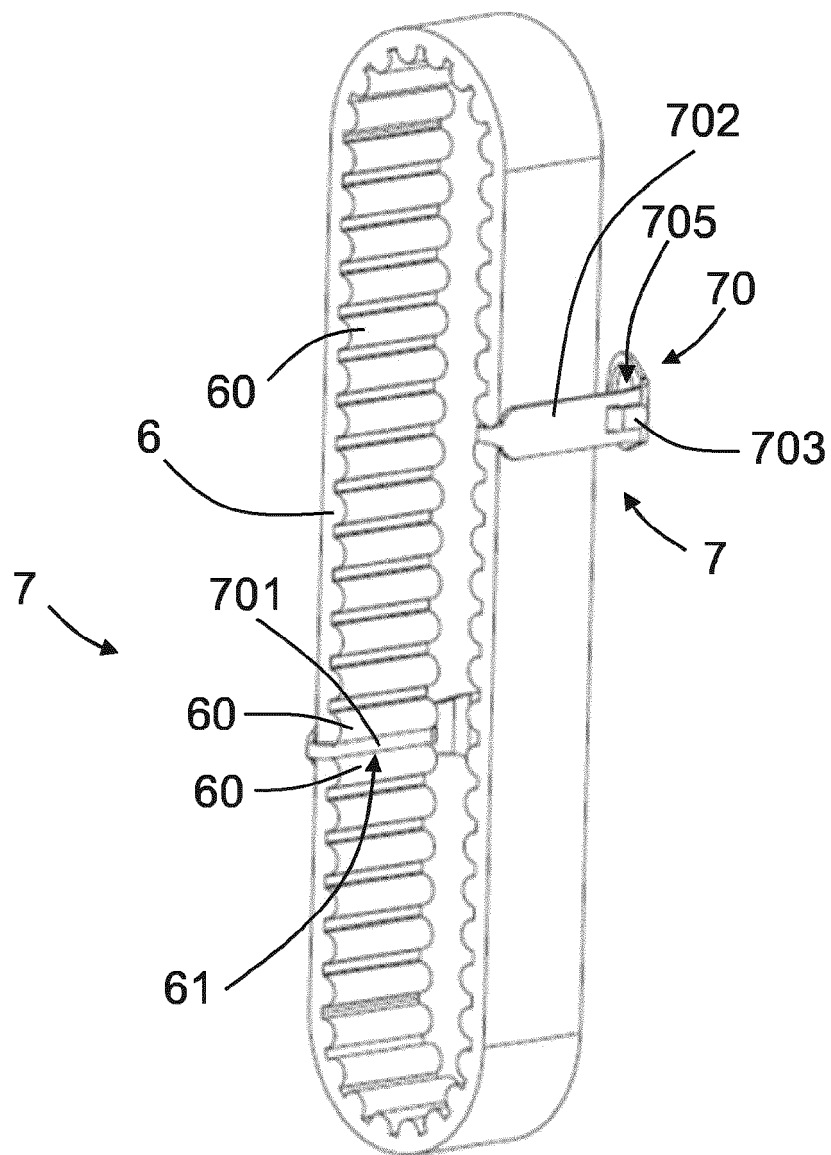


Fig. 7

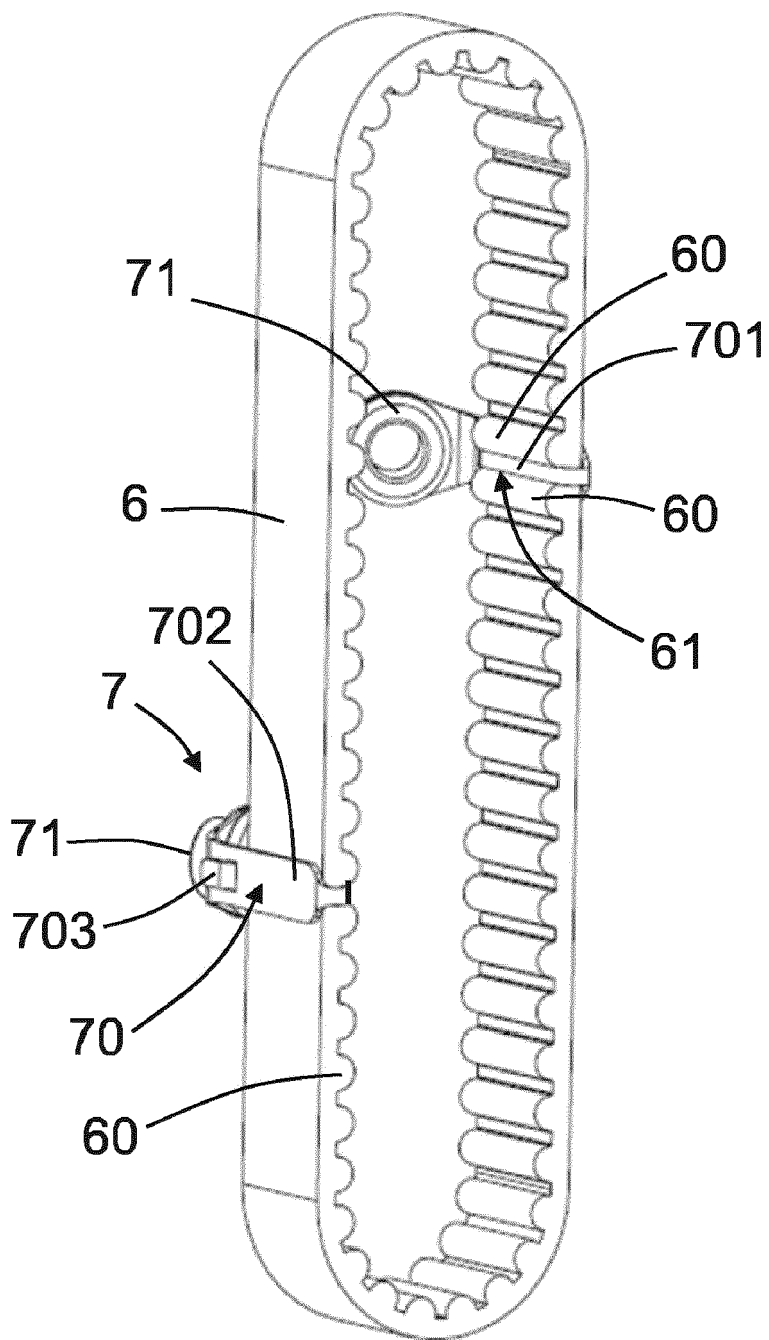


Fig. 8

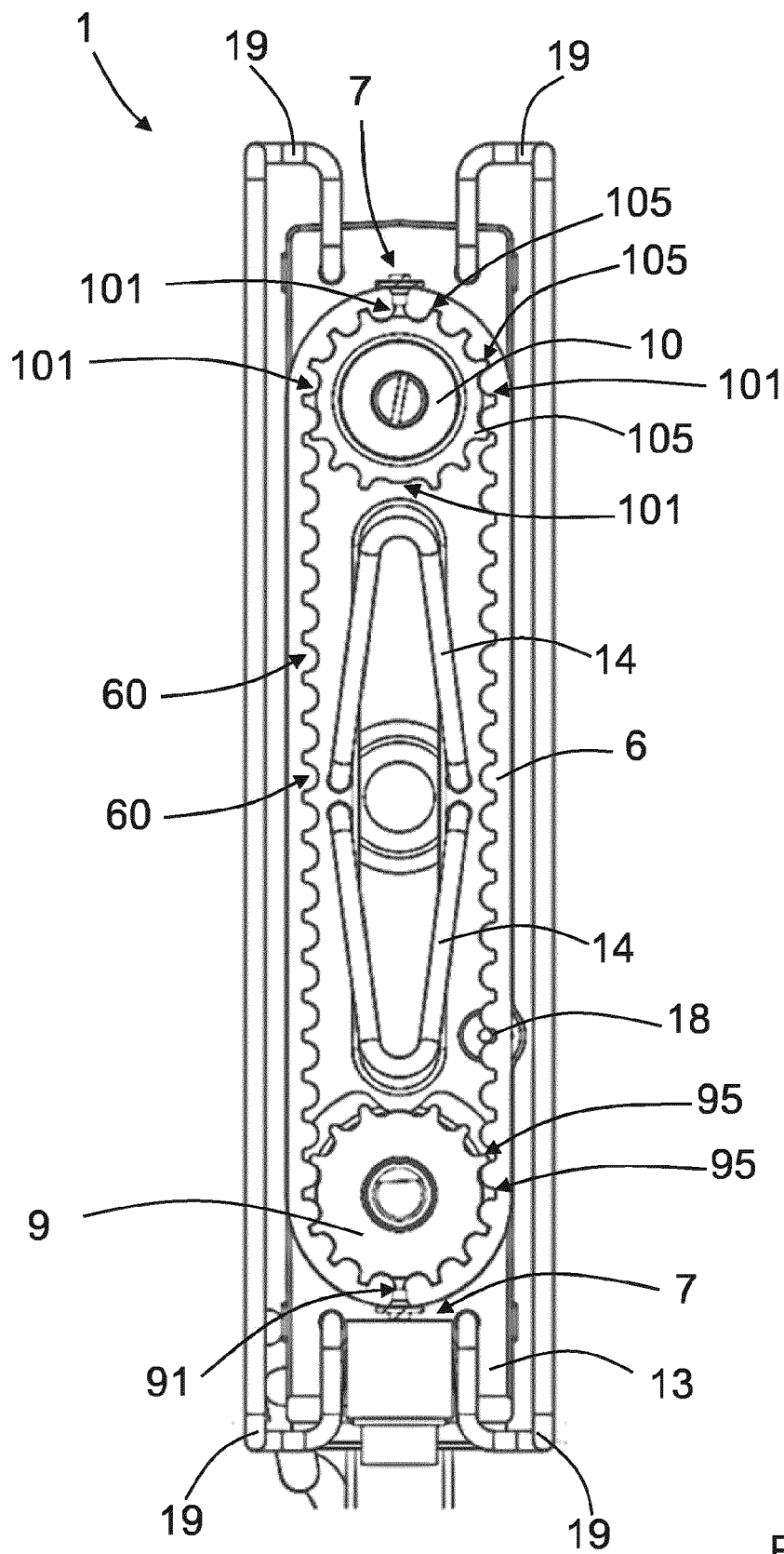


Fig. 9

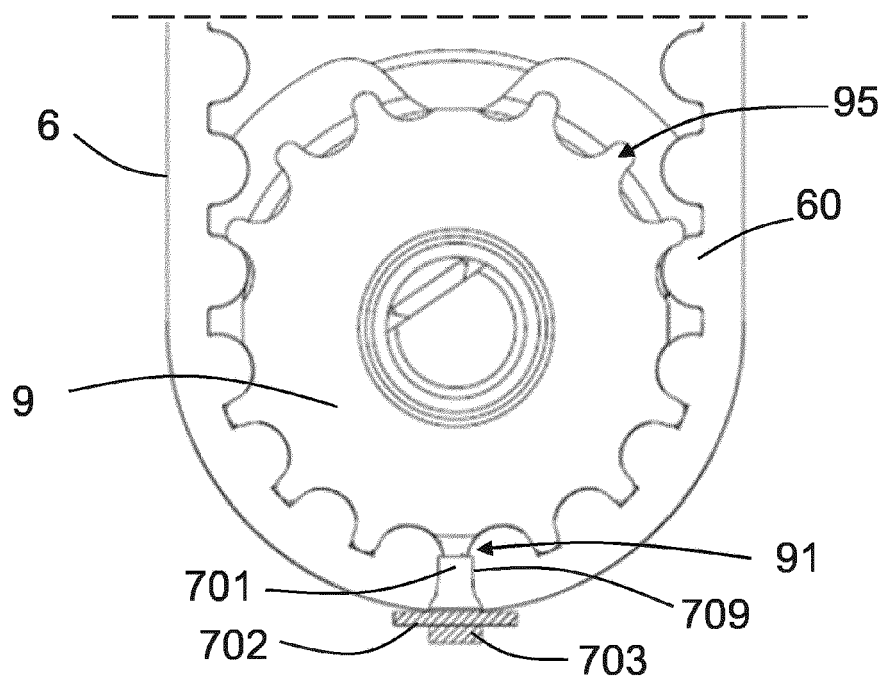
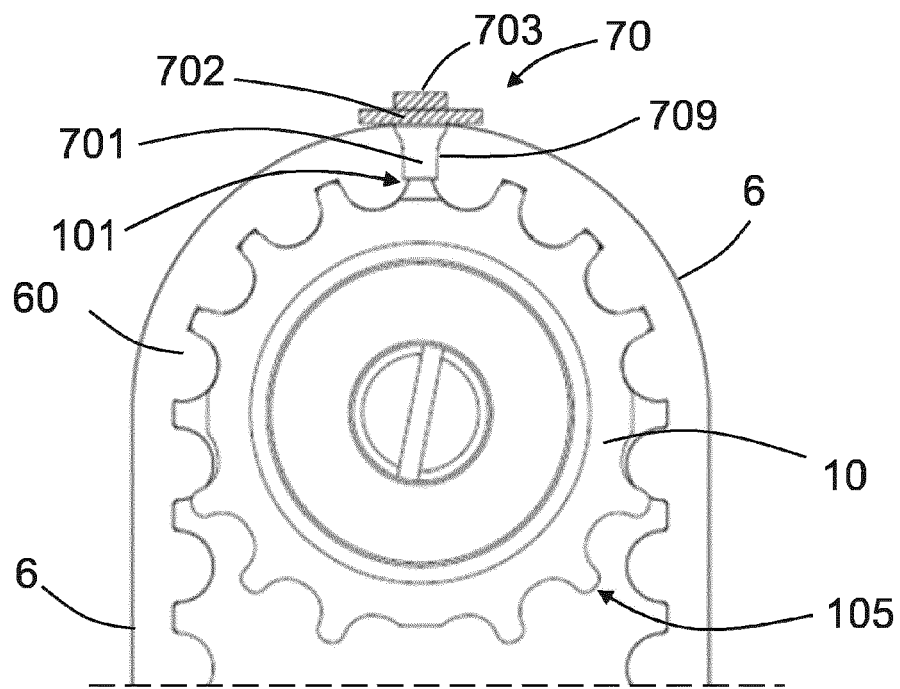


Fig. 10

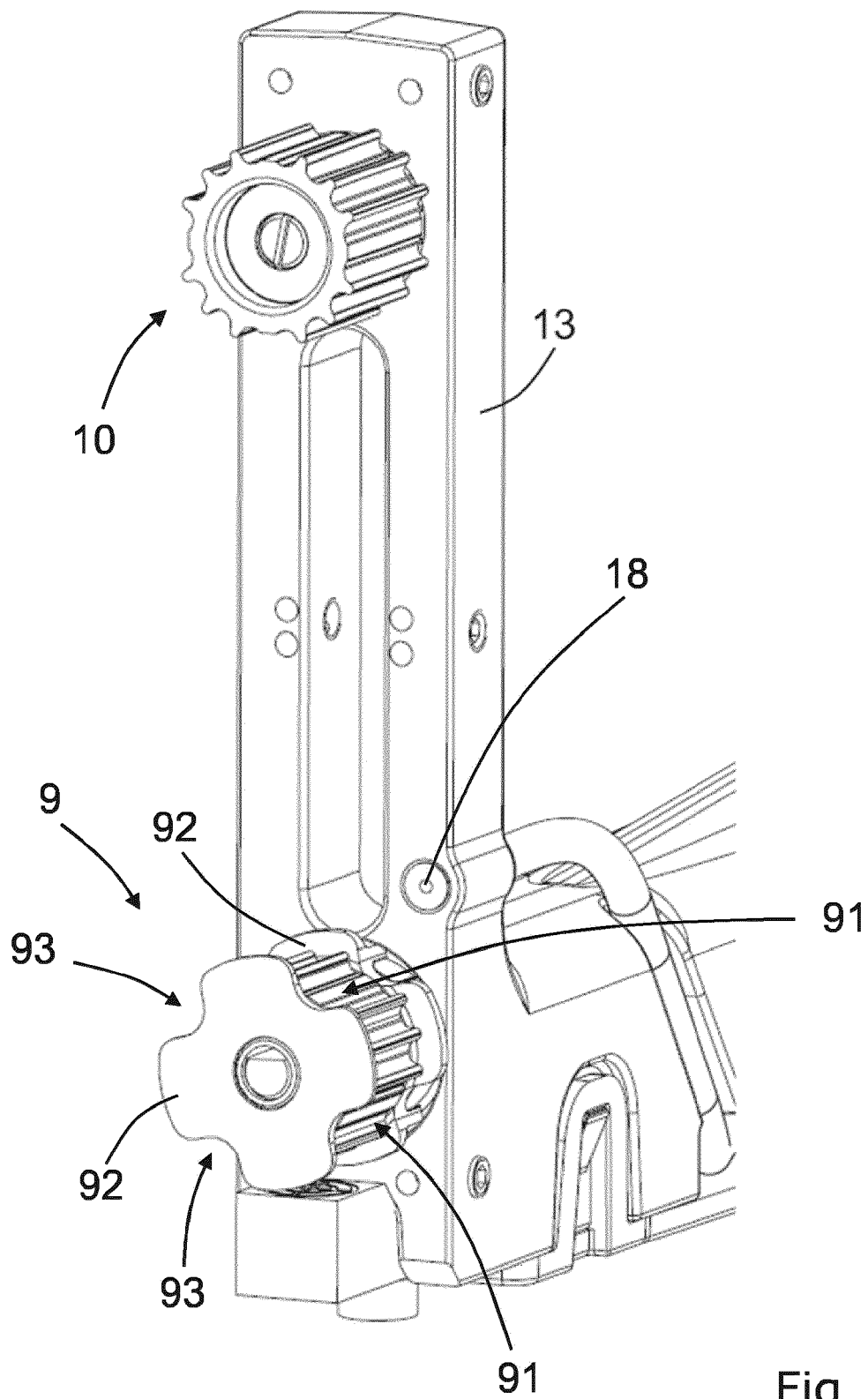
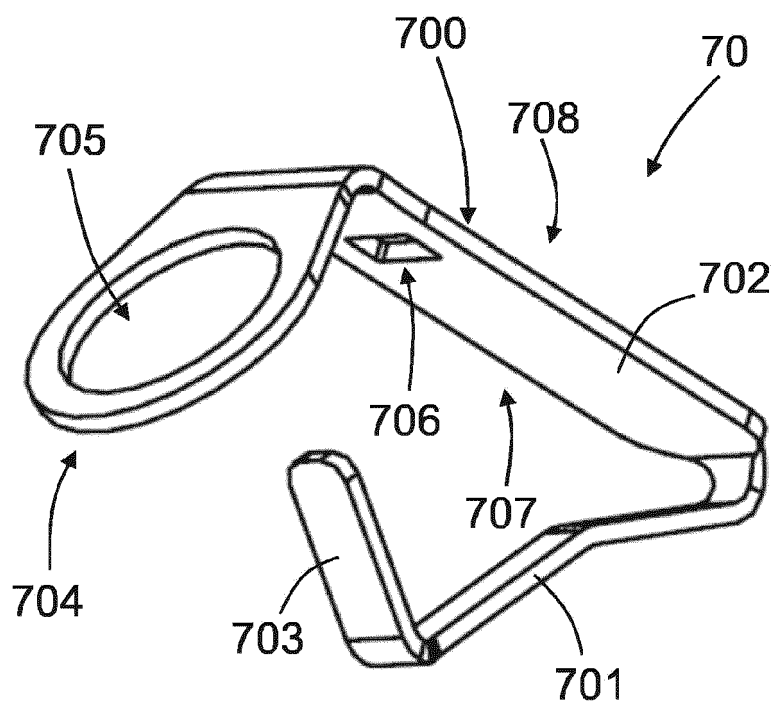
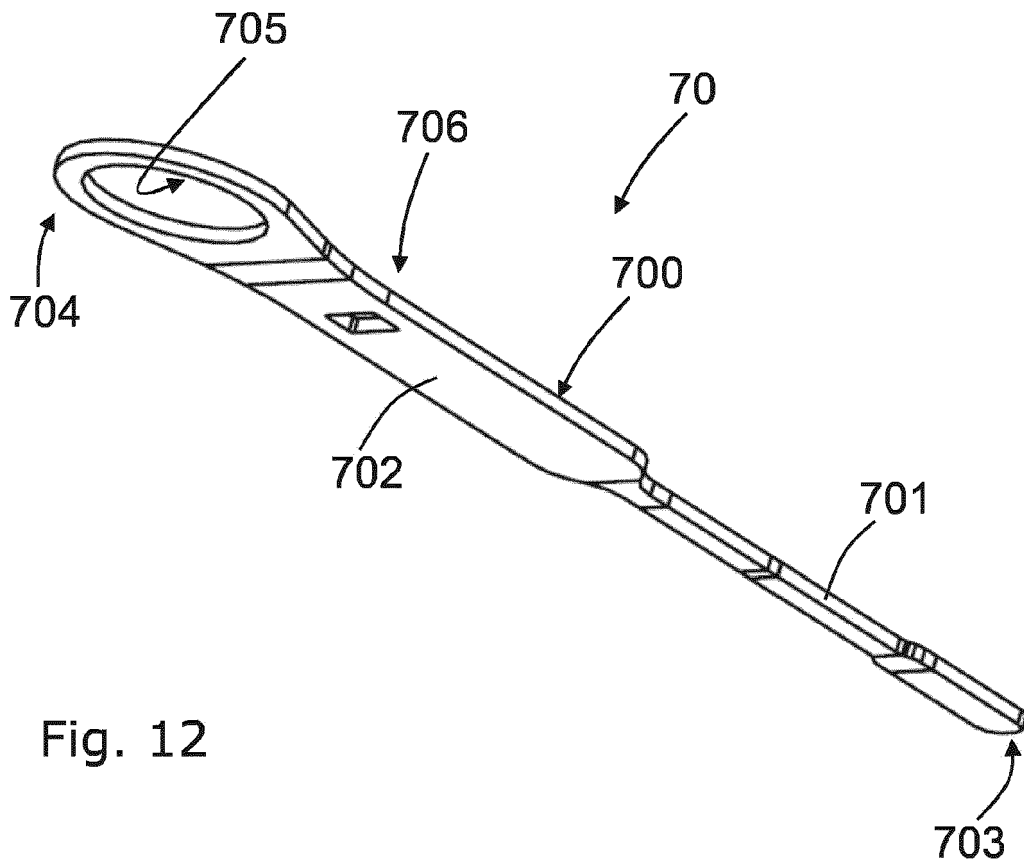


Fig. 11



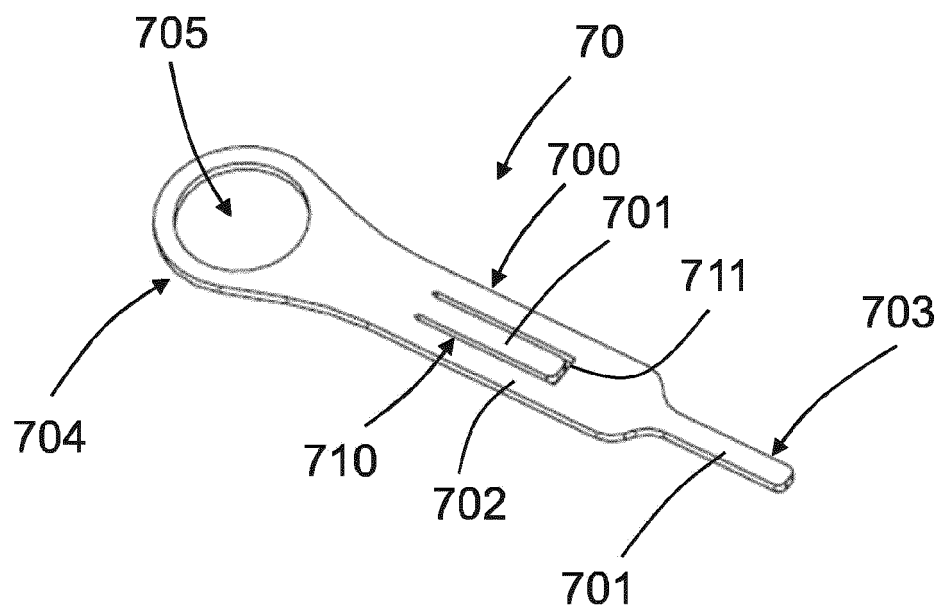


Fig. 14

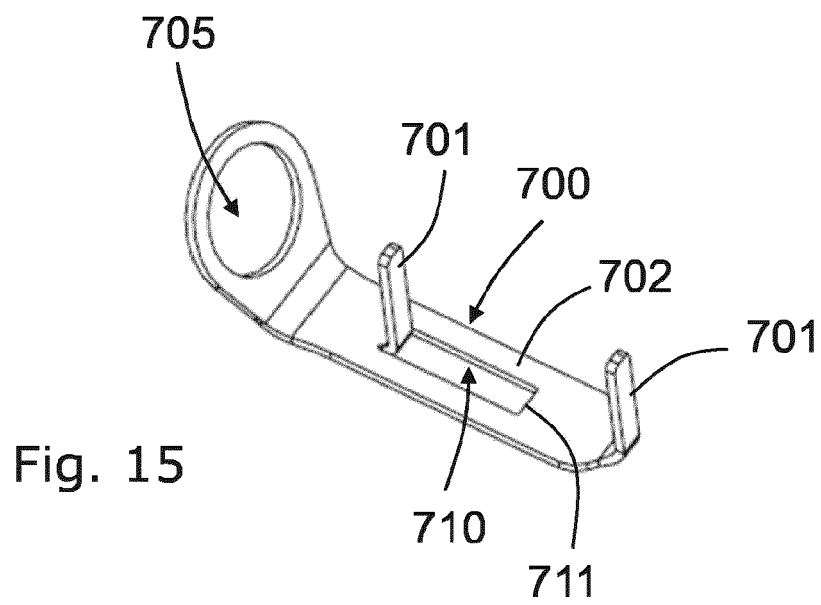
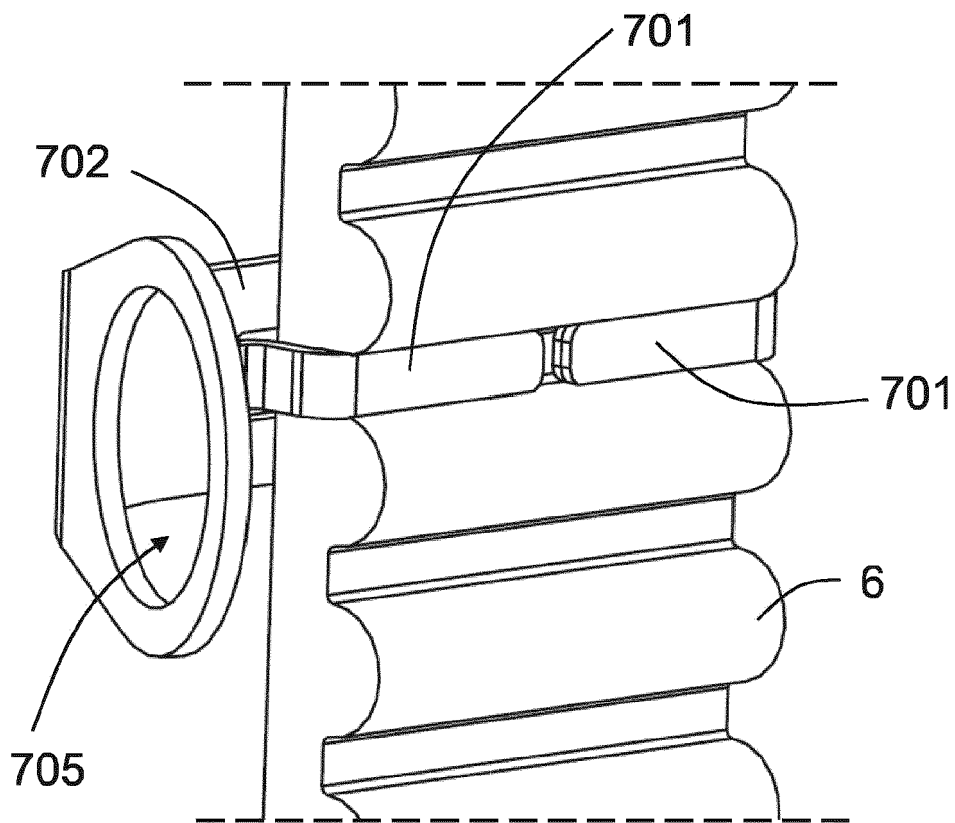
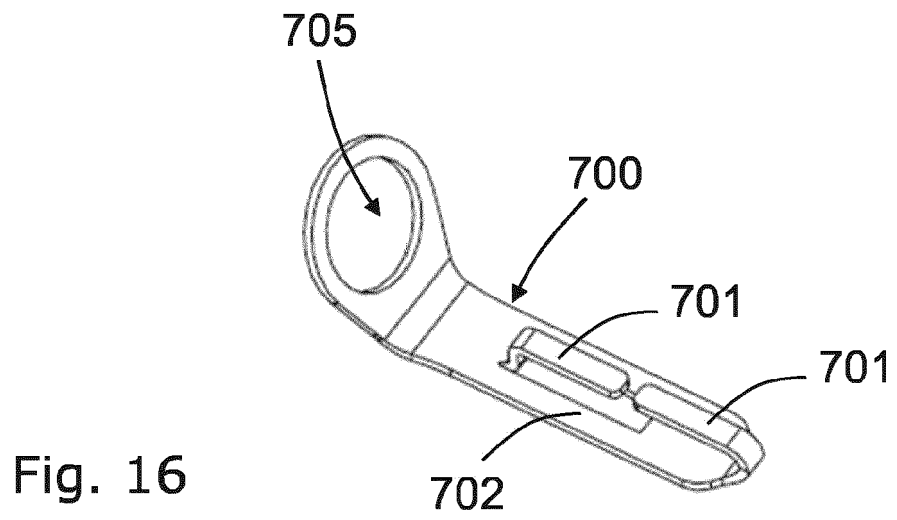


Fig. 15



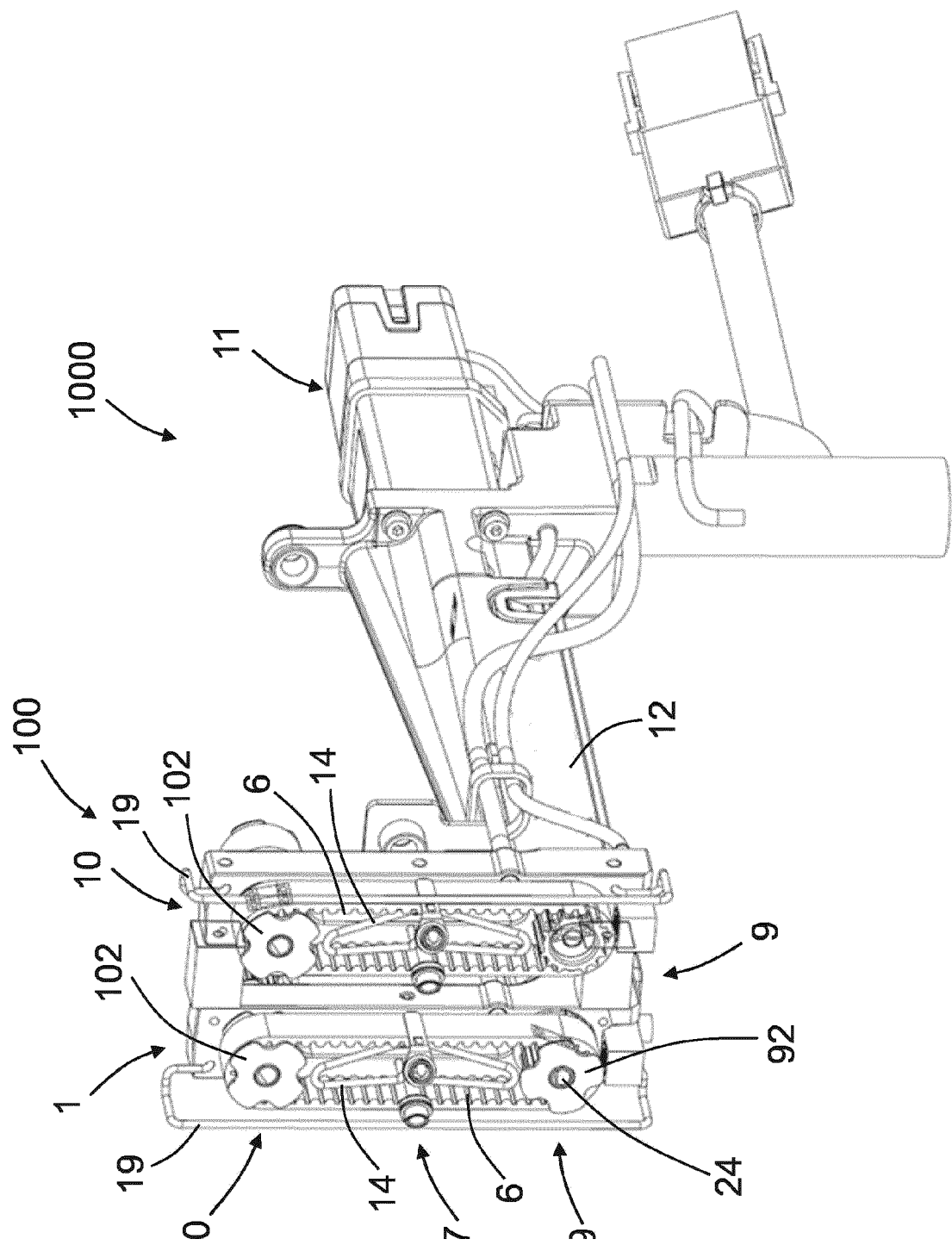


Fig. 18

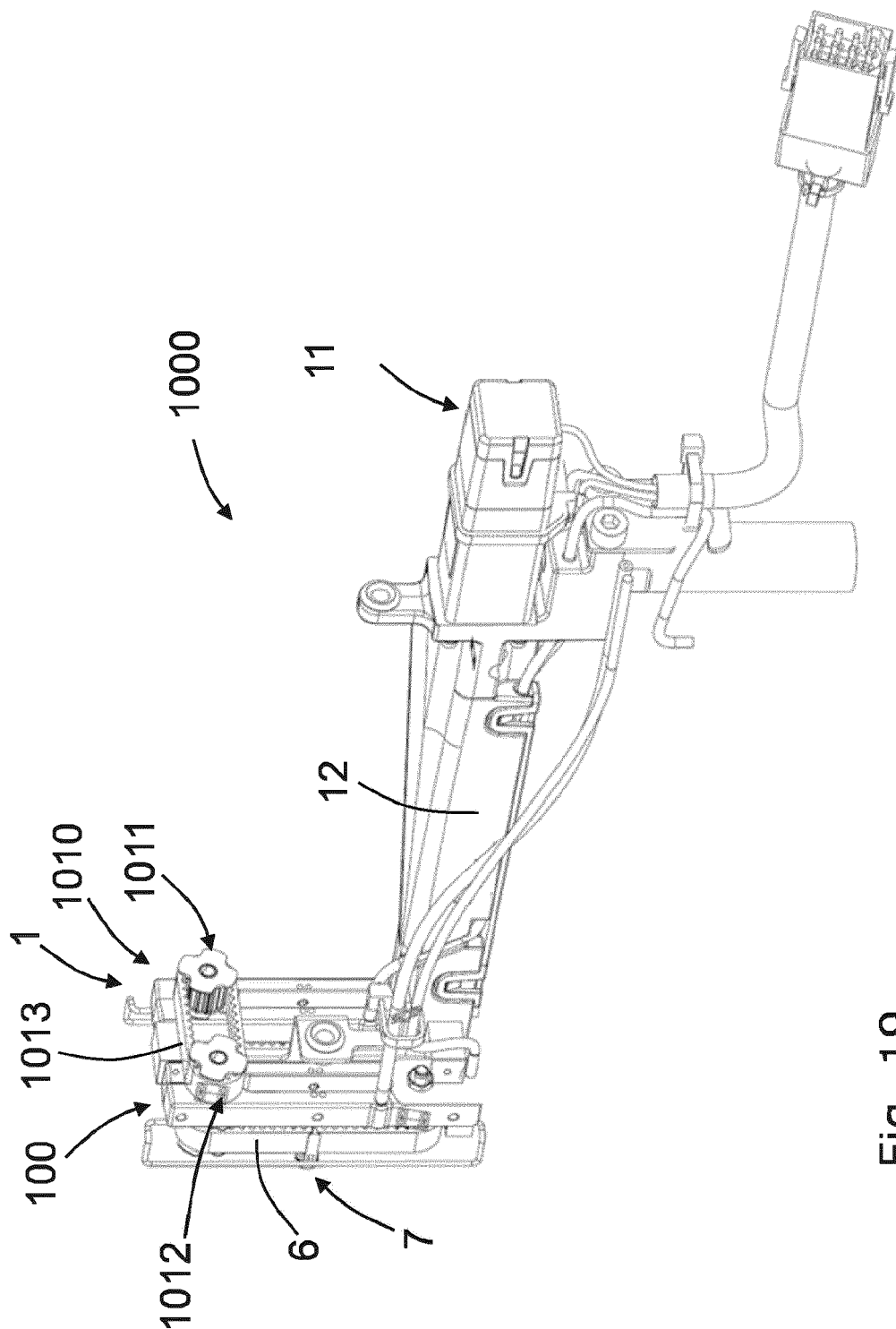


Fig. 19

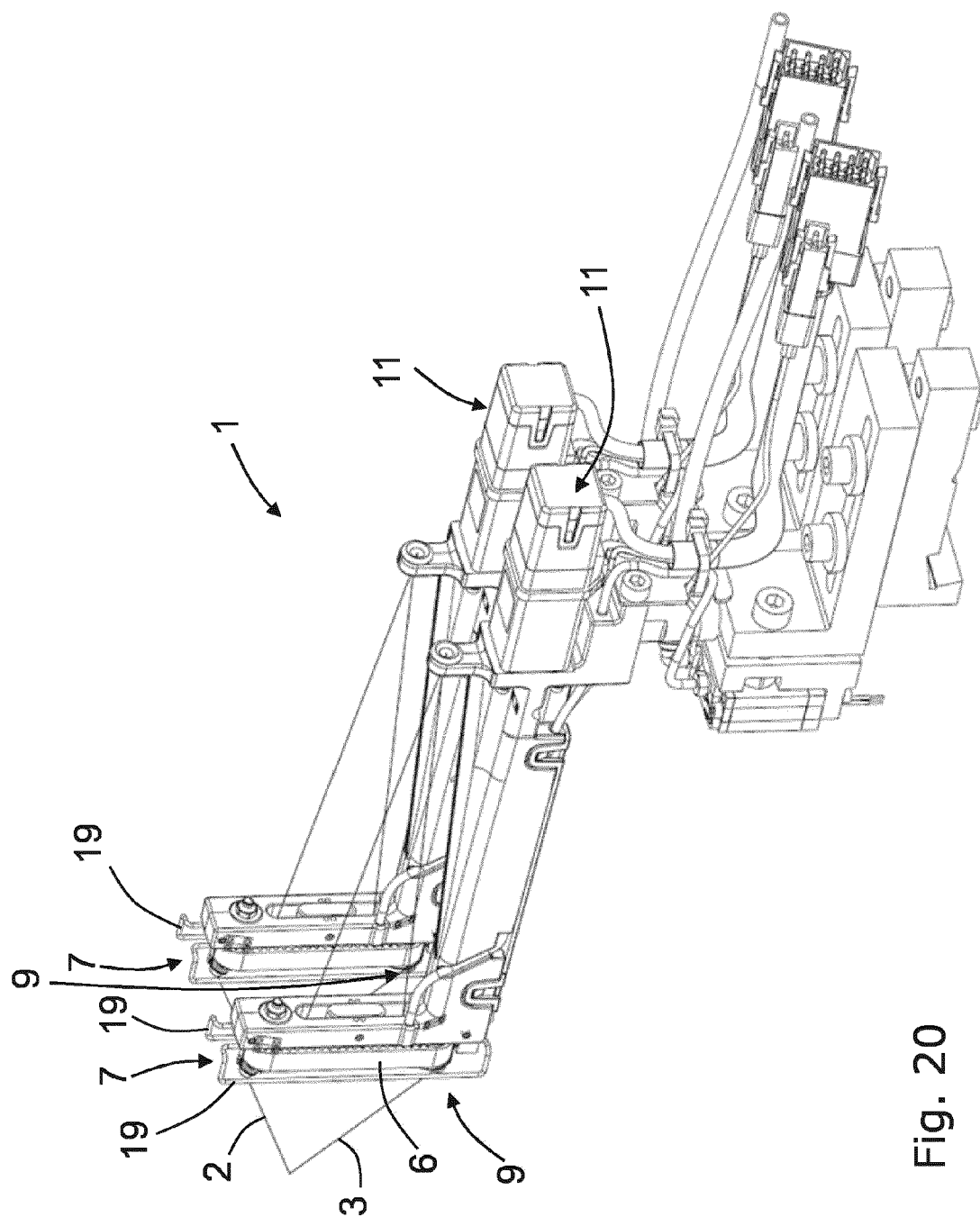
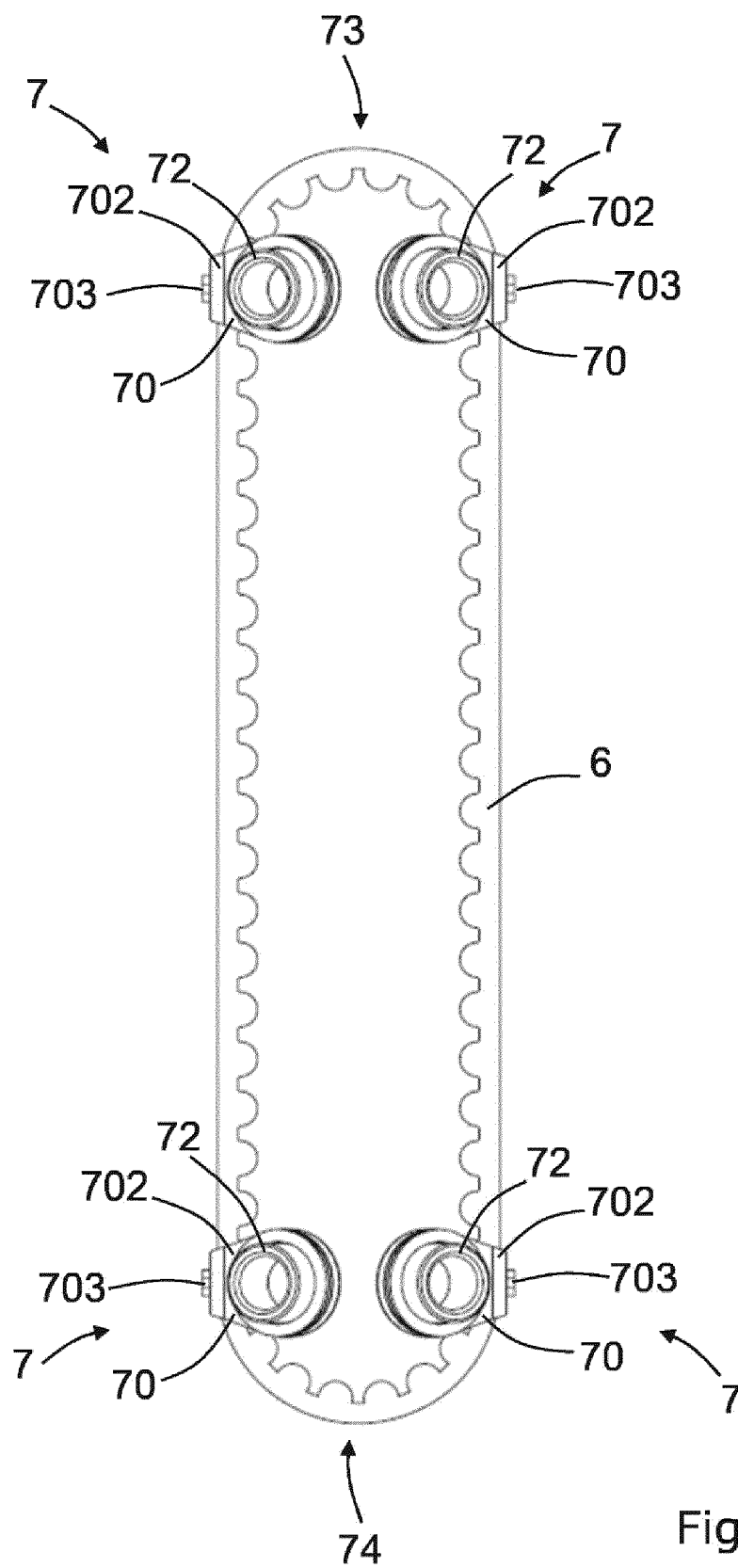


Fig. 20





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Application Number

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The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 11 September 2023	Examiner Hausding, Jan
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document		T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document	

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