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(54) **SPORTS SHOE**

(57) A sports shoe (1) comprising an upper or a shell (2), to which at least one bootleg (3) is articulated, which wrap around the foot and optionally part of the leg of the user and have a first and a second flap (4, 5) which can be closed;

the sports shoe comprises at least one lever (6), associated with the upper or shell (2), to which at the least one bootleg (3) is articulated, which is adapted to take up at least one string (7) associated with, and therefore guided on, the first and the second flap (4, 5) and/or upper or shell (2), to which the at least one bootleg (3) is articulated;

Such string (7) is keyed on a circular winding device based on strain wave gears (8).

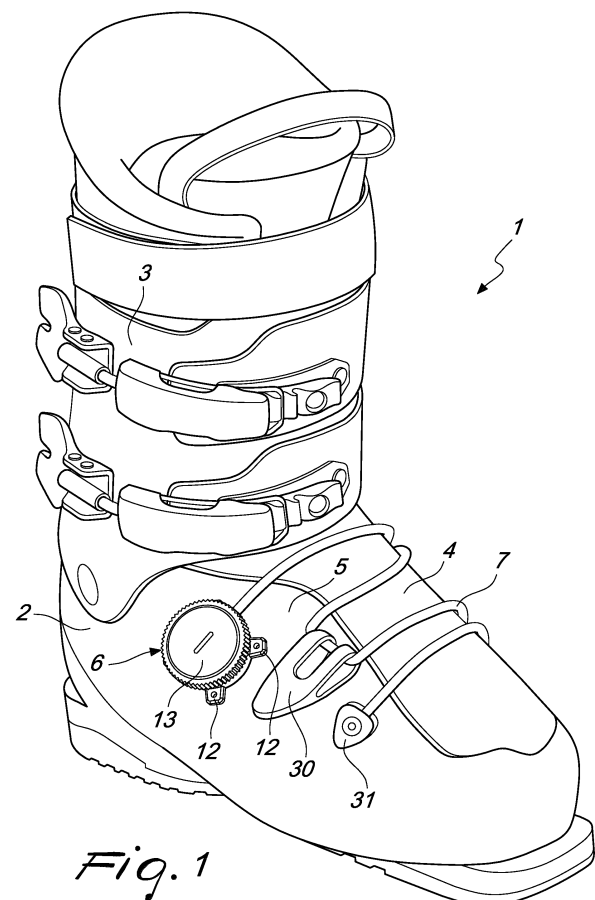


Fig. 1

Description

[0001] The present invention relates to a sports shoe.

[0002] Nowadays sports shoes usually comprise at least one shell or an upper which are provided with closeable flaps and which necessitate, once fitted over the foot of the user, the use of suitable devices to allow the upper or shell to be closed.

[0003] It is therefore known to use multiple levers to tighten the flaps of sports shoes, such as ski boots, motocross boots, cycling shoes, gym shoes etc., for example by means of a string or a band.

[0004] Therefore for example levers are known, also known as micrometric levers, which are constituted by a single arm, articulated to a first flap of the shoe, and are provided with a set of teeth with which the end of a string is associated, the other end of which in turn is associated with the second flap of the shoe.

[0005] A problem linked to the use of such levers is constituted by the fact that the extent of the take-up that is imposed on the string when the lever is closed is contained and depends on the spacing between the teeth present on the individual arm, spacing that may not be sufficient to obtain the optimal closing of the flaps given the morphological foot diversity of the various users.

[0006] As a partial solution to this drawback, it is known to use circular levers which comprise a spool onto which a string can be wound; the spool can be rotated by the user in order to take up the string by the desired amount.

[0007] This solution too presents drawbacks, in that the user can be forced to apply a high number of turns to the spool in order to take up the string by the desired amount.

[0008] This drawback is aggravated as a function of the number of circular levers associated with the sports shoe or, if there is only one, it is aggravated by the length of the string to take up if the string is to follow a path that for example wraps around several parts of the foot, such as the instep, the ankle and the shin.

[0009] US 2,906,143 is also known, which relates to mechanisms for transmitting motion and, in particular, comprises gears in which a relative motion occurs between an internal gear and a cooperating external gear.

[0010] In particular, this solution relates to a gear set in which concentric inner and outer gears are coupled in a plurality of areas that are spaced apart, with interleaved areas where they are not coupled, and the coupling areas are propagated forward in a wave which is described as a deformation wave, because it represents a wave deflection in one of the elements of the gear set.

[0011] Nowadays strain wave gears are also known which usually have a deformation wave gear set which has a pair of internally toothed gears, a cylindrical externally toothed gear which is able to flex radially, and a wave generator.

[0012] Substantially, in these strain wave gears, when the wave generator rotates, the externally toothed gear rotates slower, with a speed ratio that corresponds to the

difference in the number of teeth with respect to the internally toothed gear on the stationary side.

[0013] The rotation of the externally toothed gearing is thus increased to a speed ratio that corresponds to the difference in the number of teeth between the externally toothed gear and the internally toothed gear on the transmission side, and is transmitted by the internally toothed gear on the transmission side.

[0014] In this sense US2019203819A1 is known.

[0015] In this solution for example, in the externally toothed gear there are first teeth which can mesh with a first internally toothed gear and second teeth which can mesh with another, second internally toothed gear, which are formed on the outer peripheral surface of a radially flexible cylindrical body, the number of second teeth differing from the number of first teeth.

[0016] The aim of the present application is to resolve the abovementioned technical problems, eliminating the drawbacks in the cited known art, by providing a sports shoe, of the type comprising an upper or a shell, to which a bootleg is optionally articulated, which wrap around the foot and optionally part of the leg of the user and are provided with closeable flaps, which can be tightened in a rapid and simple manner.

[0017] Within the above aim, another important object of the invention is to make it possible at the same time to optimize the degree of tightness of the flaps based on the morphological foot shape of each individual user.

[0018] Another object is to provide an invention that is structurally simple and low cost and which can be made with the usual conventional plants and machinery.

[0019] This aim and these and other objects which will become more apparent hereinafter are achieved by a sports shoe comprising an upper or a shell, to which at least one bootleg is articulated, which wrap around the foot and optionally part of the leg of the user and are provided with a first and a second flap which can be closed, characterized in that it comprises at least one lever, associated with said upper or shell, to which at least one bootleg is articulated, which is adapted to take up at least one string associated with, and therefore guided on, said first and said second flap and/or said upper or shell, to which at least one bootleg is articulated, and keyed on a circular winding device based on strain wave gears (8).

[0020] Further characteristics and advantages of the invention will become more apparent from the detailed description of a particular, but not exclusive, embodiment, illustrated by way of non-limiting example in the accompanying drawings wherein:

Figure 1 is a perspective view of a sports shoe comprising the lever;

Figure 2 shows the lever assembled;

Figures 3 and 4 are exploded views from above and below of the lever;

Figure 5 is a view from above of the lever;

Figure 6 is a side view of the lever;

Figure 7 is a cross-sectional view taken along the line

VII-VII in Figure 5;

Figure 8 is a cross-sectional view taken along the line VIII-VIII in Figure 6;

Figure 9 is a cross-sectional view taken along the line IX-IX in Figure 6;

Figure 10 is a cross-sectional view taken along the line X-X in Figure 6;

Figure 11 shows a solution using a single string.

[0021] In the embodiments illustrated, individual characteristics shown in relation to specific examples may in reality be interchanged with other, different characteristics, existing in other embodiments.

[0022] With reference to the figures, the reference numeral 1 generally designates a sports shoe, such as a ski boot, a motocross boot, a cycling shoe or gym shoe etc., comprising an upper or a shell 2, to which at least one bootleg 3 is optionally articulated, which wrap around the foot and optionally part of the leg of the user.

[0023] The upper or the shell 2 and/or the at least one bootleg 3 have a first and a second flap 4, 5 which can be closed by way of at least one lever 6.

[0024] The latter is associated with the upper or shell 2, to which at least one bootleg 3 is optionally articulated, and is adapted to take up at least one string 7 which is associated with and, by means of conventional adapted eyelets or micrometric levers 30, therefore guided on the first and/or second flap 4, 5 and/or the upper or shell 2, to which at least one bootleg 3 is optionally articulated, and keyed at the ends on a circular winding device 8 based on strain wave gears, comprised in the lever 6, and on a retention stud 31.

[0025] Purely for the sake of non-limiting example from all the possible forms that a sports shoe can take, the sports shoe preferentially takes the form of a ski boot.

[0026] The lever 6, which is provided internally with the circular winding device 8 based on strain wave gears, comprises a cylindrical box-like body 9 which has an axial cavity 10 which is closed upwardly by the knob 13 and downwardly by a base 11 from which feet 12 for fixing to the upper or shell 2, to which at least one bootleg 3 is optionally articulated, protrude externally and radially.

[0027] The lever 6 further comprises a knob 13, which preferably has a circular plan shape with lateral knurling to increase the grip for the user, and acts as a cover for the box-like body 9.

[0028] The knob 13 is rotatably associable with the box-like body 9 because it is, in a transverse cross-section, C-shaped so as to define a first tab 14 which protrudes radially inward into the knob 13 and with which a second tab 15 engages rotatably which protrudes radially outward out from the free end 16 of the box-like body 9.

[0029] The first and the second tab 14, 15 engage each other, with the possibility for the knob 13 to rotate in both directions.

[0030] A rigid first set of teeth 17 is provided on the inner perimetric edge of the free end 16.

[0031] A protrusion 18 protrudes axially below the knob 13, has an oval shape in plan view, with axes that have smaller dimensions than the inside diameter of the knob 13, and has a height that is substantially equal to the internal depth of the knob 13.

[0032] The lever 6 also comprises the circular winding device 8 based on strain wave gears which in turn comprises a flexible sprocket 19 which positions itself inside the knob 13 and outside the oval protrusion 18.

[0033] The dimensions of the protrusion 18 and of the flexible sprocket 19 are such that the protrusion 18 forces, only at its major axis, the teeth of the flexible sprocket 19 to interact with the teeth of the rigid first set of teeth 17.

[0034] Furthermore, the number of teeth in the flexible sprocket 19 is smaller than the number of teeth in the first set of teeth 17.

[0035] In a particular, but not exclusive, embodiment the flexible sprocket 19 has thirty-four teeth while the first set of teeth 17 has thirty-six teeth.

[0036] Turning the knob 13 forces the flexible sprocket 19 to deform as the protrusion 18 passes over it, which forces part of the teeth of the flexible sprocket to interact with the teeth of the first set of teeth 17.

[0037] The protrusion 18 therefore constitutes a wave generator.

[0038] When the knob 13 makes one complete turn, it forces the flexible sprocket 19 to rotate by two teeth in the opposite direction.

[0039] For the flexible sprocket 19 to make one complete turn, it is therefore necessary for the knob 13 to turn seventeen times, with, in this particular case, a transmission ratio of 1:17.

[0040] More generally the transmission ratio can vary between 1:6 and 1:30.

[0041] Driving teeth 20 protrude downwardly from the flexible sprocket 19 and are keyed on complementarily-shaped first seats 21 which are provided on the head 22 of a spool 23 which is T-shaped in cross-section.

[0042] The spool 23 has a shank 24, which protrudes downwardly and axially from the overlying head 22 and on which a second seat 25 is provided diametrically, within which a string terminal 26 can be keyed, and the string 7 is coupled to the ends thereof.

[0043] The terminal end of the shank 24 rests and rotates at the part of the base 11 that is inside the box-like body 9.

[0044] The string 7 is made to exit from the box-like body 9 through two adapted diametrical openings 27 which are provided on the lateral surface 28 of the box-like body 9 on a plane that lies above the plane of arrangement of the feet 12.

[0045] Alternatively, there can be only one opening 27 on the box-like body 9 which can be used if a single string 7 is used, as shown in Figures 1, 2 and 11.

[0046] In this case, with the string terminal 26 accommodated in the second seat 25, only one end thereof is keyed to the corresponding end of a single string 7 which

protrudes from the box-like body 9 through a single opening 27 provided on the lateral surface 28 of the box-like body 9.

[0047] Thus it has been found that the invention fully achieves the intended aim and objects, a sports shoe being obtained that can be tightened in a rapid and simple manner while at the same time achieving an excellent degree of closure of the flaps based on the morphological foot shape of each individual user.

[0048] In fact a great advantage is obtained in terms of force ratios, given that with a small force imparted to the knob 13 the user obtains a very great force on the string.

[0049] Turning the knob 13 clockwise obtains the anticlockwise rotation of the spool 23 and vice versa.

[0050] The lever 6, in a sports shoe such as for example a ski boot, performs both a macro adjustment to cater to the various different foot sizes of users, and a very precise micrometric opening and closing adjustment even when the shoe is already closed.

[0051] The invention thus conceived is susceptible to numerous modifications and variations, all of which are within the scope of the appended claims.

[0052] Thus for example, the difference between the number of teeth on the flexible sprocket 19 and on the first set of teeth 17 can vary as a function of the specific requirements, such as the type of sports shoe with which it is possible to associate the lever 6 or as a function of the length of the string 7 to take up in order to obtain a different and desired transmission ratio.

[0053] Naturally the materials used as well as the dimensions of the individual components of the invention may be more relevant according to specific requirements.

[0054] The characteristics indicated above as advantageous, convenient or the like, may also be missing or be substituted by equivalent characteristics.

[0055] The disclosures in Italian Patent Application No. 102024000016645 from which this application claims priority are incorporated herein by reference.

[0056] Where technical features mentioned in any claim are followed by reference signs, those reference signs have been included for the sole purpose of increasing the intelligibility of the claims and accordingly, such reference signs do not have any limiting effect on the interpretation of each element identified by way of example by such reference signs.

Claims

1. A sports shoe (1) comprising an upper or a shell (2), to which at least one bootleg (3) is optionally articulated, which wrap around the foot and optionally part of the leg of the user and are provided with a first and a second flap (4, 5) which can be closed, **characterized in that** it comprises at least one lever (6), associated with said upper or shell (2), to which the at least one bootleg (3) is articulated, which is

adapted to take up at least one string (7) associated with, and therefore guided on, said first and said second flap (4, 5) and/or said upper or shell (2), to which the at least one bootleg (3) is articulated, and keyed on a circular winding device based on strain wave gears (8).

2. The sports shoe (1) according to claim 1, **characterized in that** said circular winding device based on strain wave gears (8) is adapted to impose a transmission ratio comprised between 1:6 and 1:30.

3. The sports shoe (1) according to one or more of the preceding claims, **characterized in that** said at least one lever (6) comprises a cylindrical box-like body (9) provided with an axial cavity (10) which is closed upwardly by a knob (13) and downwardly by a base (11) from which feet (12) for fixing to said upper or shell (2), to which at least one bootleg (3) is articulated, protrude externally and radially, said circular winding device based on strain wave gears (8) being present within said axial cavity (10).

4. The sports shoe (1) according to one or more of the preceding claims, **characterized in that** said knob (13) has a circular plan shape with lateral knurling to increase grip for the user, said knob (13) acting as a cover for said box-like body (9), said knob (13) being rotatably associable with said box-like body (9) and being, in a transverse cross-section, C-shaped so as to define a first tab (14) which protrudes radially inward into said knob (13) and with which a second tab (15) engages rotatably which protrudes radially outward out from the free end (16) of said box-like body (9).

5. The sports shoe (1) according to one or more of the preceding claims, **characterized in that** said first and said second tab (14, 15) engage each other, with the possibility for said knob (13) to rotate in both directions, a rigid first set of teeth (17) being provided on the inner perimetric edge of said free end (16).

6. The sports shoe (1) according to one or more of the preceding claims, **characterized in that** a protrusion (18) protrudes axially below said knob (13), which has an oval shape in plan view, with axes that have smaller dimensions than the inside diameter of said knob (13), and **in that** it has a height that is substantially equal to the internal depth of said knob (13).

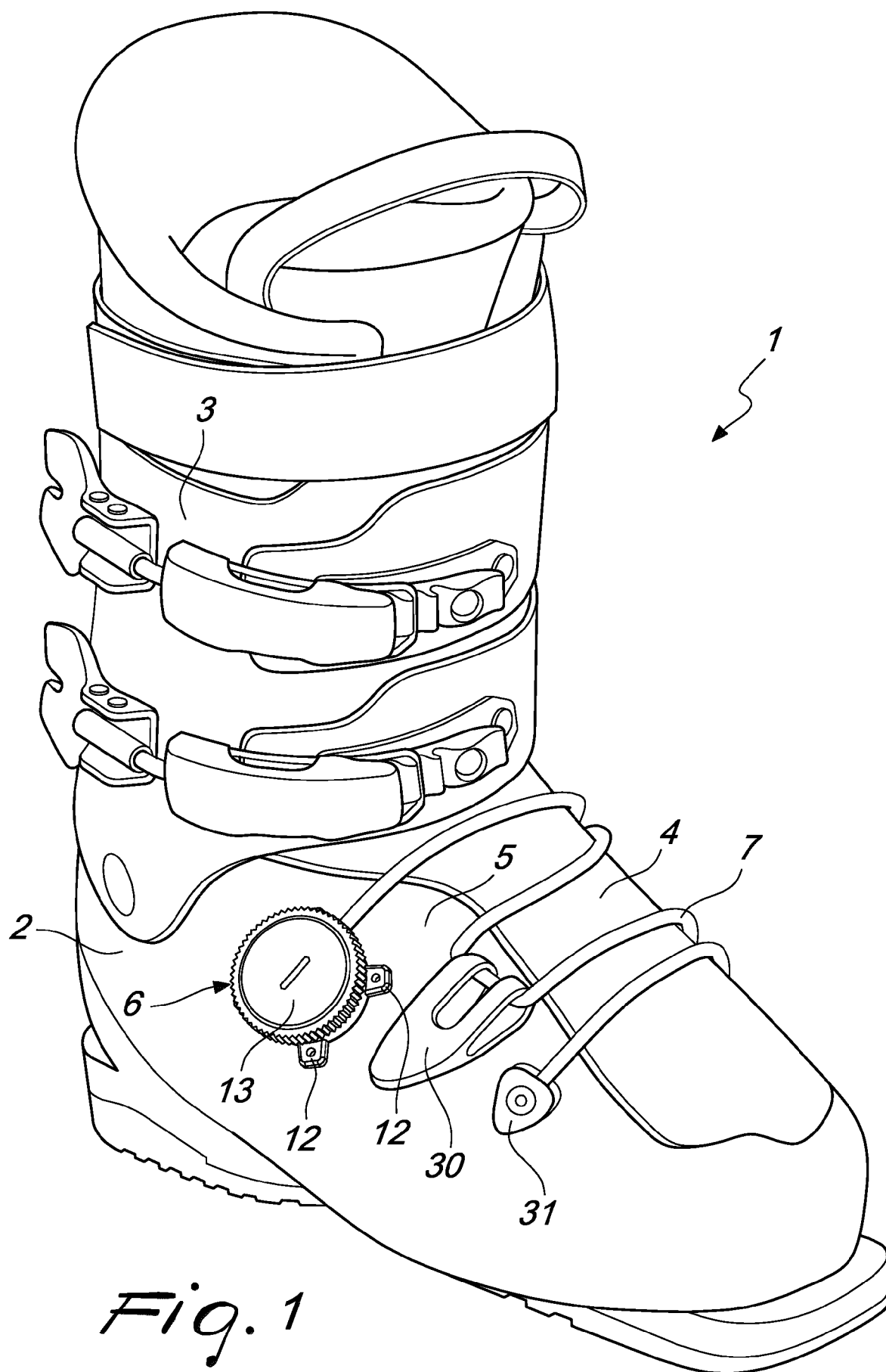
7. The sports shoe (1) according to one or more of the preceding claims, **characterized in that** said lever (6) comprises said circular winding device based on strain wave gears (8), which in turn comprises a flexible sprocket (19) which positions itself inside said knob (13) and outside said oval protrusion (18), the dimensions of said protrusion (18) and of

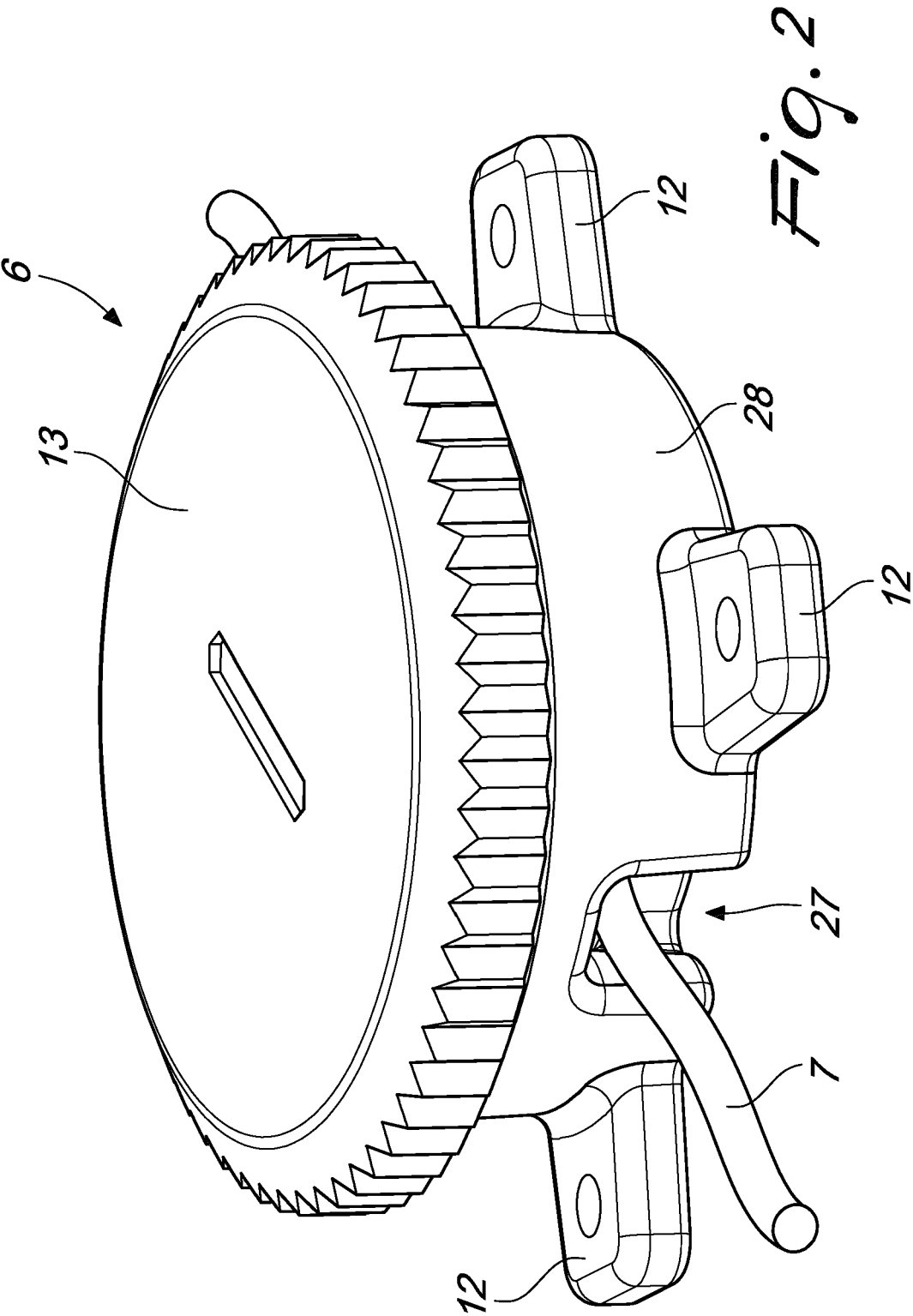
said flexible sprocket (19) being such that said protrusion (18) forces, only at its major axis, said flexible sprocket (19) to interact with the teeth of said rigid first set of teeth (17), said protrusion (18) constituting a wave generator.

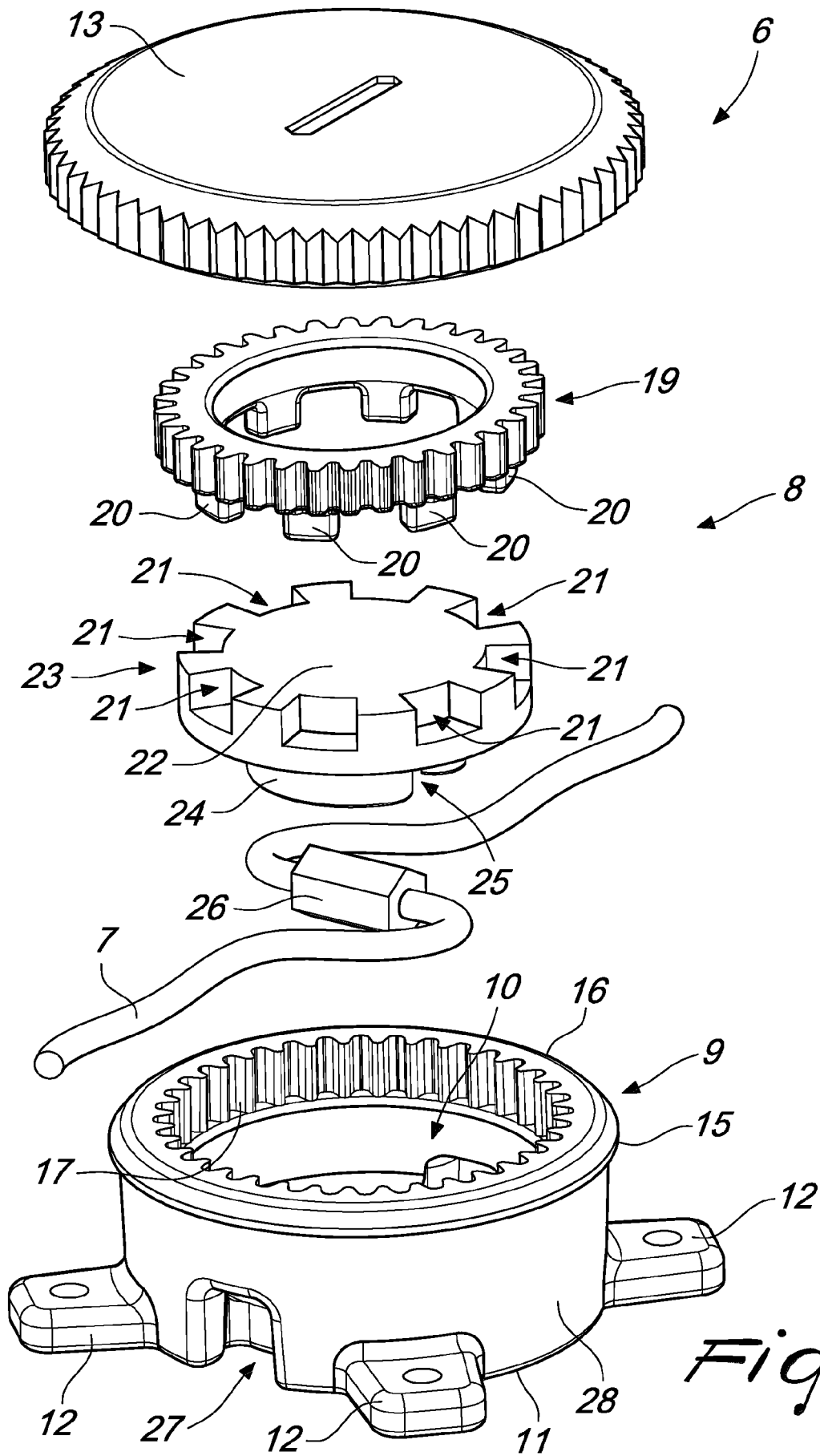
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one or more of the preceding claims, **characterized in that** the number of teeth of said flexible sprocket (19) is smaller than the number of teeth of said first set of teeth (17).

8. The sports shoe (1) according to one or more of the preceding claims, **characterized in that** said flexible sprocket (19) has a smaller number of teeth than said first set of teeth (17), the turning of said knob (13) forcing said flexible sprocket (19) to deform as said protrusion (18) passes over it, forcing part of the teeth of said flexible sprocket (19) to interact with the teeth of said rigid first set of teeth (17).
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9. The sports shoe (1) according to one or more of the preceding claims, **characterized in that** said flexible sprocket (19) has thirty-four teeth while said first set of teeth (17) has thirty-six teeth with a transmission ratio of 1:17.
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10. The sports shoe (1) according to one or more of the preceding claims, **characterized in that** driving teeth (20) protrude downwardly from said flexible sprocket (19) and are keyed on complementarily-shaped first seats (21) provided on the head (22) of a spool (23) which is T-shaped in cross-section, said spool (23) having a shank (24), which protrudes axially from said overlying head (22) and on which a second seat (25) is provided diametrically within which a string terminal (26) can be keyed, to the ends of which said at least one string (7) is coupled, which is made to exit from said box-like body (9) through an opening (27) or two diametrical openings (27) provided on the lateral surface (28) of said box-like body (9) on a plane that lies above the plane of arrangement of said feet (12), said string (7) being associated with and thus, by means of eyelets or micro-metric levers (30), guided on said first flap and/or said second flap (4, 5) and/or said upper or shell (2), to which at least one bootleg (3) is optionally articulated, and keyed at its ends to said circular winding device based on strain wave gears (8) and to a retention stud (31).
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11. A lever (6) for sports shoes (1) which comprise an upper or a shell (2), to which at least one bootleg (3) is optionally articulated, which wraps around the foot and optionally part of the leg of the user and is provided with a first flap and a second flap (4, 5) which can be closed, according to one or more of the preceding claims, **characterized in that** it comprises a circular winding device based on strain wave gears (8), to take up at least one string (7) adapted to fasten said first and said second flap (4,5) of said sports shoe (1).
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12. The sports shoe (1) and the lever (6) according to







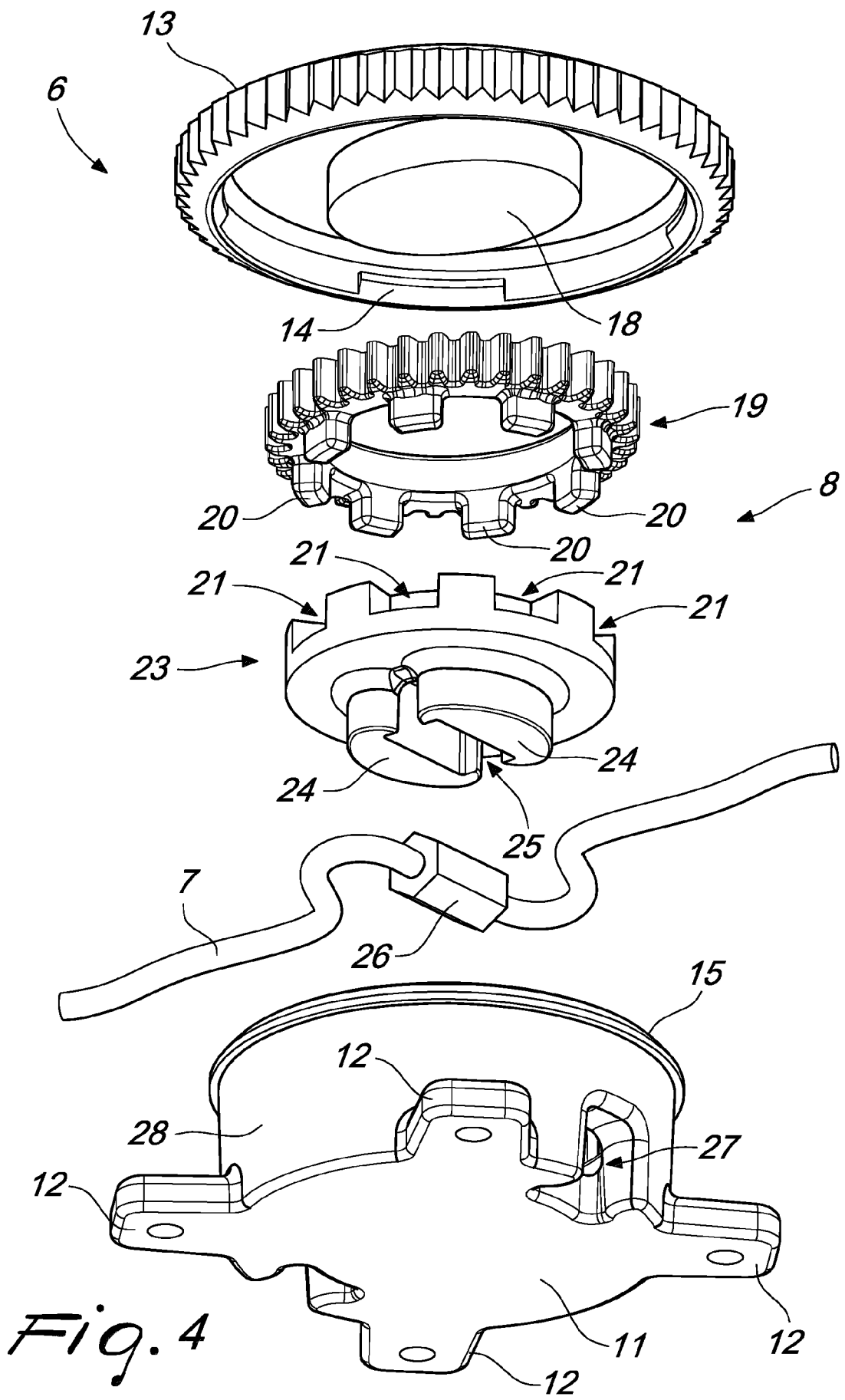
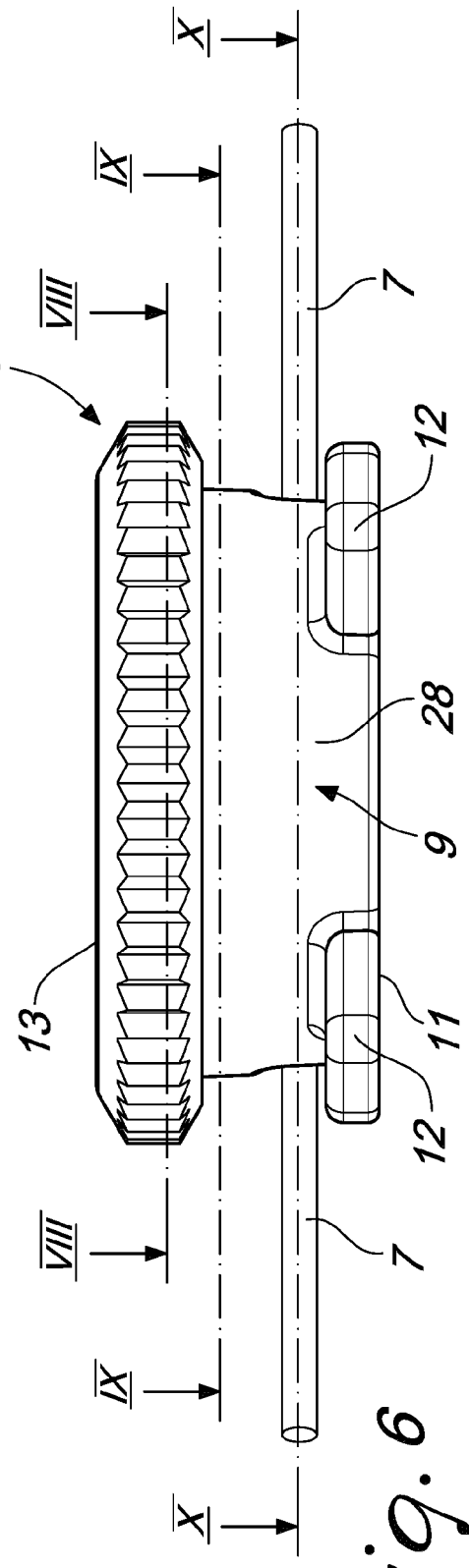
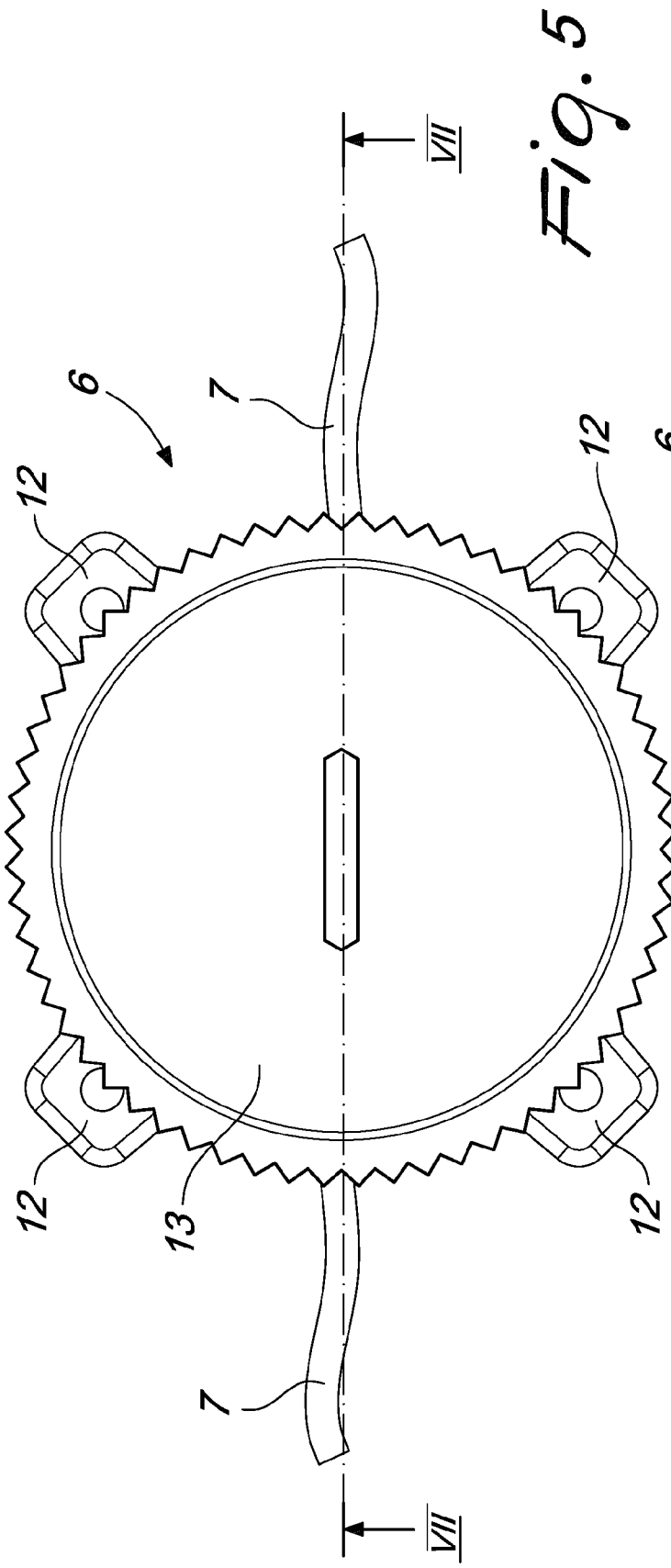


Fig. 4



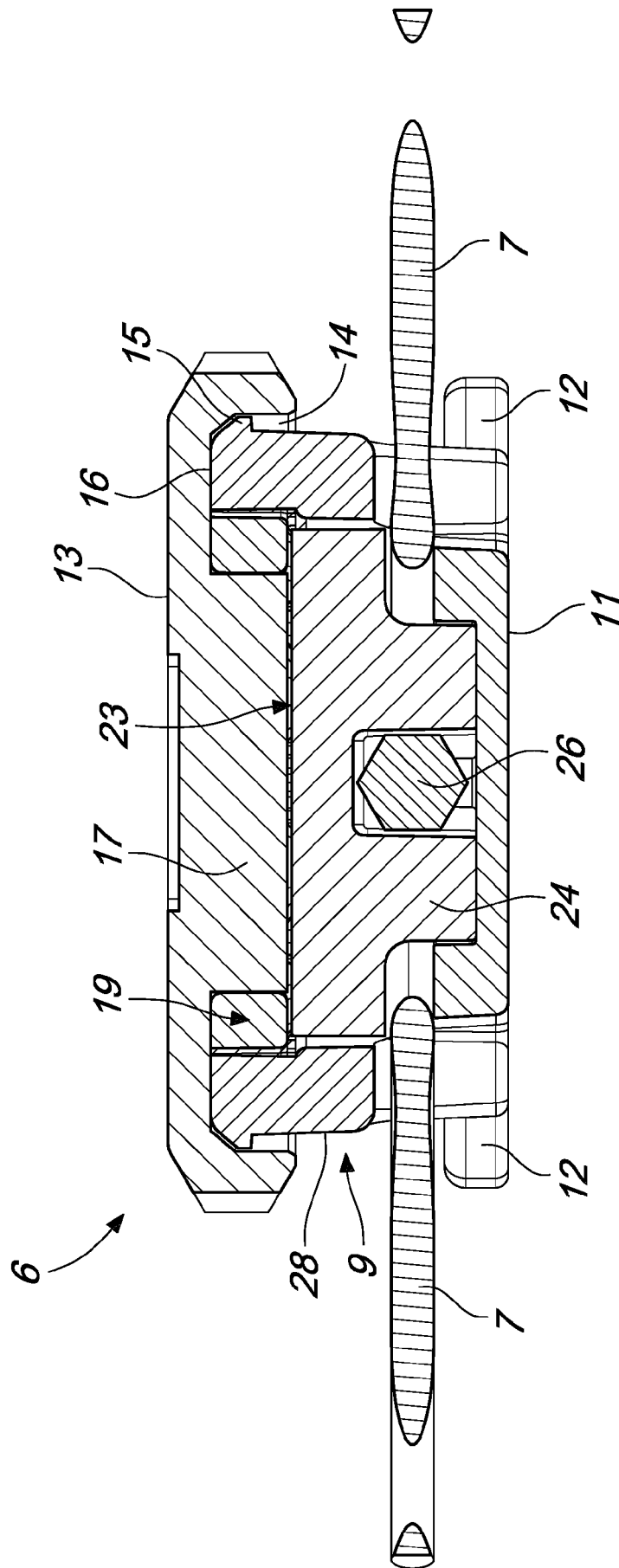
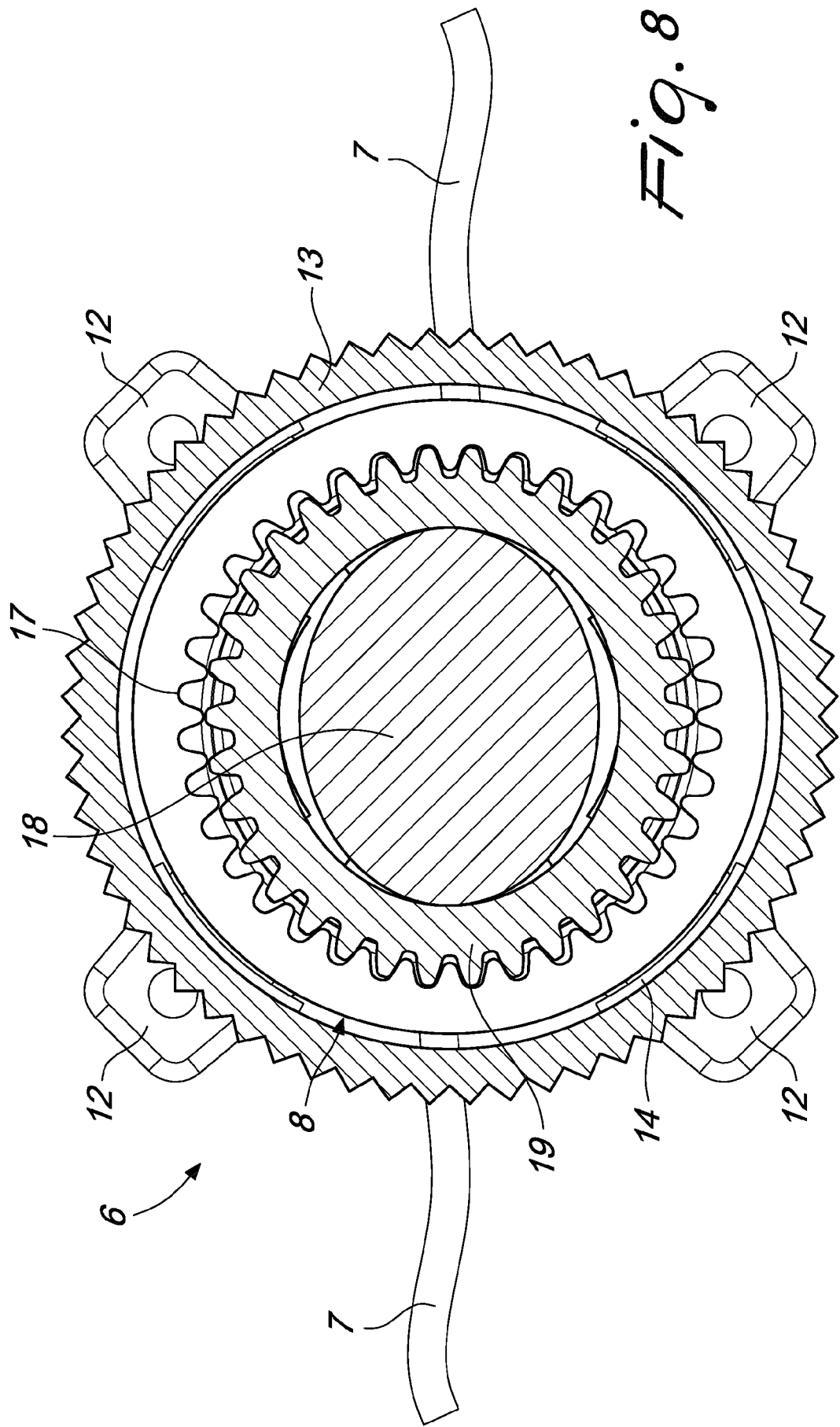


Fig. 1



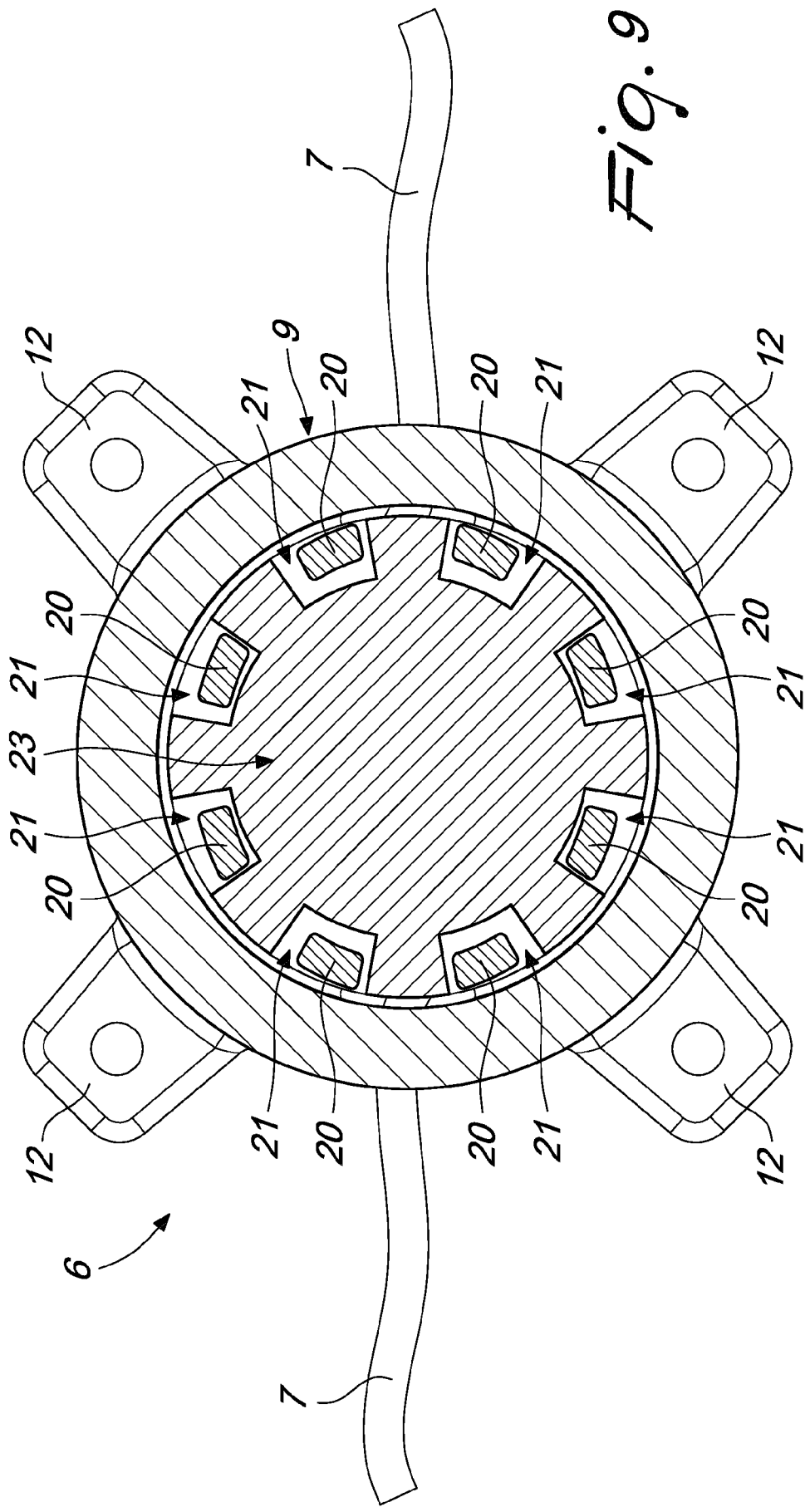
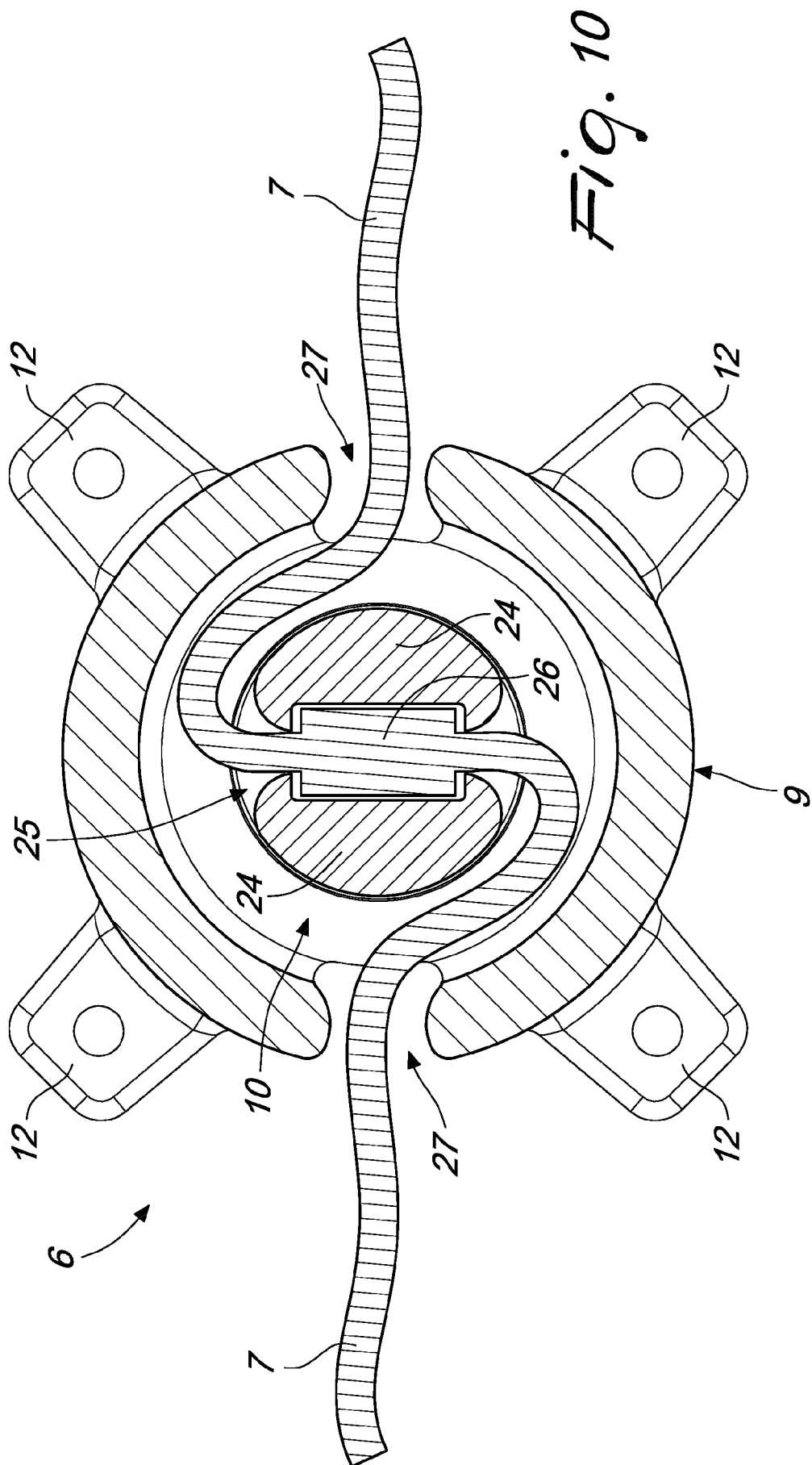
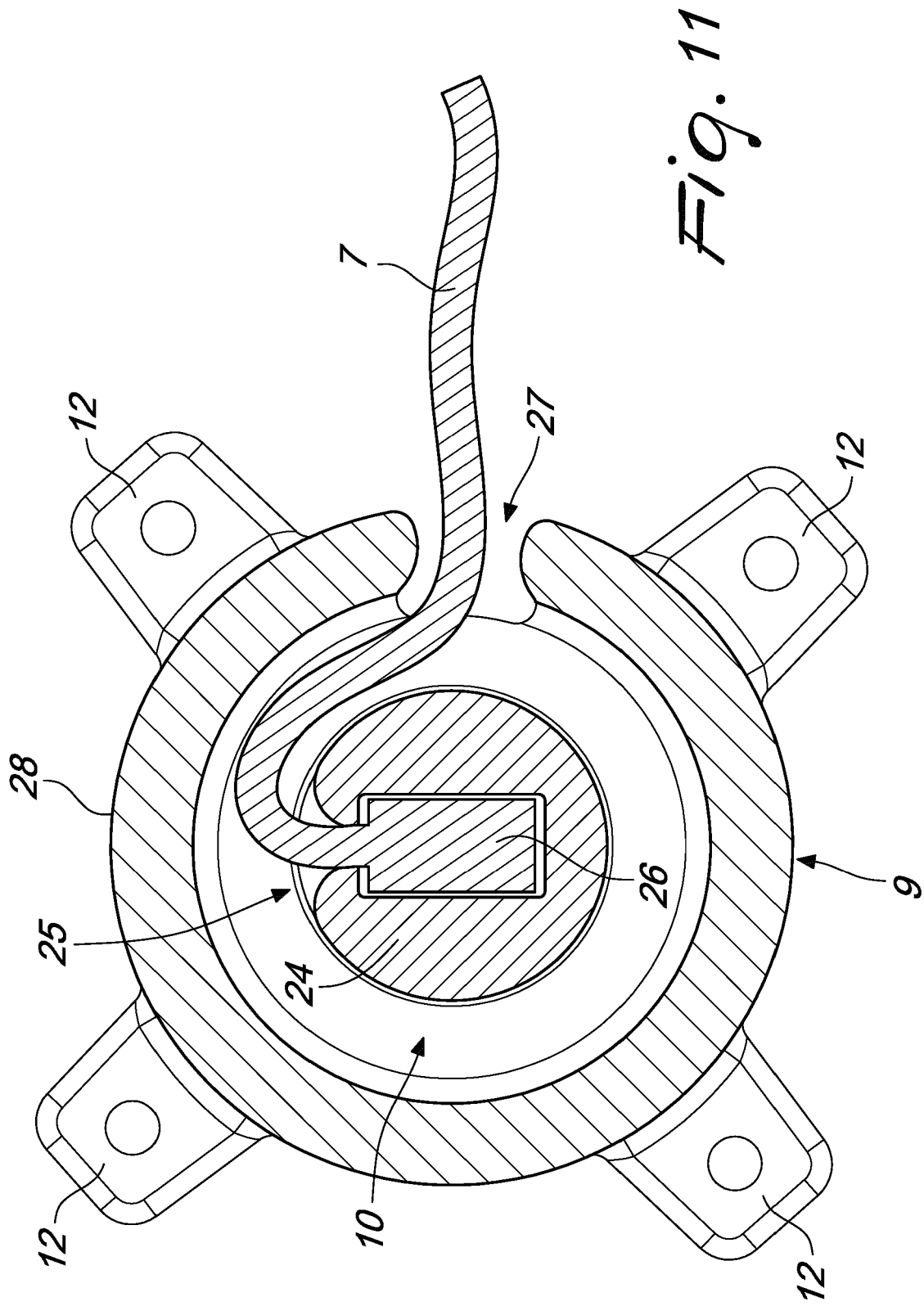


Fig. 9







EUROPEAN SEARCH REPORT

Application Number

EP 25 18 9861

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
A	IT TV20 130 036 A1 (SCARPA CALZATURIFICIO SPA) 16 September 2014 (2014-09-16) * page 5, line 4 - page 18, line 25 * * figures 1-4 *	1-12	INV. A43C11/16 A43B5/04
A	US 2024/000195 A1 (MARTIN JOHN [US] ET AL) 4 January 2024 (2024-01-04) * paragraph [0034] - paragraph [0060] * * figures 1-13 *	1-12	
A	US 9 629 417 B2 (BOA TECH INC [US]) 25 April 2017 (2017-04-25) * column 4, line 36 - column 8, line 47 * * figures 1-12E *	1-12	
The present search report has been drawn up for all claims			TECHNICAL FIELDS SEARCHED (IPC)
			A43C A43B
Place of search			Examiner
The Hague			Papatheofrastou, M
Date of completion of the search			
25 November 2025			
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Patent document cited in search report	Publication date	Patent family member(s)	Publication date
IT TV20130036 A1	16-09-2014	-----	-----
US 2024000195 A1	04-01-2024	EP 4103009 A1	21-12-2022
		US 2021251343 A1	19-08-2021
		US 2024000195 A1	04-01-2024
		US 2025311816 A1	09-10-2025
		WO 2021163578 A1	19-08-2021
		-----	-----
US 9629417 B2	25-04-2017	DE 112014003135 T5	21-04-2016
		US 2015007422 A1	08-01-2015
		US 2017303644 A1	26-10-2017
		WO 2015003079 A1	08-01-2015
		-----	-----

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Patent documents cited in the description

- US 2906143 A [0009]
- US 2019203819 A1 [0014]
- IT 102024000016645 [0055]