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(54) **LEVER TIGHTENING DEVICE FOR SPORTS FOOTWEAR**

(57) The present invention relates to a lever tightening device adapted to be applied to a sports footwear for tightening the latter about the foot of the user by tensioning a traction element. The lever tightening device comprises a lever arm which is connected or can be connected to an abutment base in a rotatable manner about a first articulation axis between an opening position and a closing position in which the traction element is tensioned. The lever arm comprises a redirecting guide element which provides for a redirecting guide seat con-

figured to slidably receive a redirecting curved section of the traction element. Specifically, the lever tightening device comprises connection means which are configured to connect the redirecting guide element to the lever arm in a rotatable manner about a second articulation axis distinct from the first articulation axis, so as to allow the relative rotation of the redirecting guide element with respect to the lever arm when the latter is moved between said opening and closing positions.

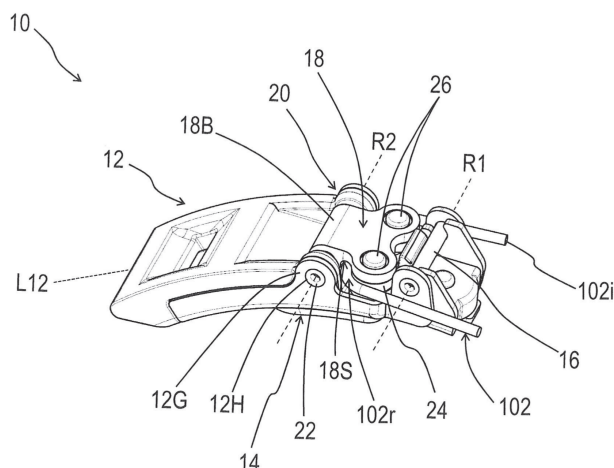


Fig. 13

Description

TECHNICAL FIELD OF THE INVENTION

[0001] The present invention relates to a lever tightening device adapted to be associated to the upper and to the shell of sports footwear, such as for example ski or snowboard boots, skates, hiking boots, cycling shoes or the like, which are provided with a pair of flaps which can be overlapped or approached to obtain the releasable tightening about the foot of the user.

[0002] Generally, a lever tightening device according to the present invention is used where there arises the need to control approach/release a pair of flaps of the sports footwear by tensioning and releasing a traction element, such as a traction cable.

[0003] In particular, a lever tightening device according to the present invention may be synergistically used with further tightening devices provided for closing the sports footwear, such as for example a reel-based tightening device.

STATE OF THE PRIOR ART

[0004] Fastening assemblies which allow the releasable tightening of a traction cable have long been known and applied in the sports footwear industry.

[0005] The Italian patent application n. 102023000012099 describes an example of a possible tightening assembly for the releasable tensioning of a traction cable to obtain the releasing tightening of a pair of flaps of a ski boot.

[0006] Such an example of a tightening assembly comprises a traction cable, which can be fixed with a first end portion to a flap and which can be associated with the other flap to be tightened with at least one portion by means of a reel-based tightening device adapted to tension by winding a second end portion of the cable, a lever tightening device, and possibly one or more redirecting members suitably associated with the flaps of the footwear.

[0007] In particular, with reference to Figs. 1 to 3, the prior art lever tightening device LD acts as a traction element adapted to obtain a high degree of tightening of the flaps (not shown in Figs. 1 to 3) of the footwear when moved from an opening position (see Fig. 1), in which the traction cable TC is not substantially tensioned, to a closing position (see Fig. 3), in which the traction cable TC is tensioned to obtain the closure of the footwear. While the reel-based tightening device (not shown in Figs. 1 to 3) allows a fine adjustment of the degree of tightening of the flaps through the fine variation of the tensioning degree of the traction cable TC.

[0008] In order to obtain tensioning by means of the lever tightening device LD, the latter is arranged so as to engage and cooperate with an intermediate portion of the traction cable TC. In particular, the lever tightening device provides for a redirecting body EB which is adapted to be

engaged passing through and slidable to the traction cable TC suitably diverting the sliding direction thereof and, in particular in the closing position, by applying a suitable closing tensioning to obtain the tightening of the flaps of the footwear.

[0009] Although such known tightening assembly works appropriately in many cases, it does have drawbacks.

[0010] In particular, the construction of the prior art lever tightening device LD generally operates adequately in the case where the traction cable TC is coated with a low friction coefficient material and/or in the case where the redirecting body EB is formed with a wear-resistant material, a low friction coefficient material, or a material having a hardness greater than or equal to that of the material with which the traction cable is formed.

[0011] As a matter of fact, should the redirecting body EB be formed of plastic material and should there be used a traction cable TC made of uncoated metal material, the repeated opening/closing movement of lever tightening device LD causes a repeated rubbing between the traction cable TC and the lateral edge portions of the redirecting body EB, resulting in high wear of the plastic material as it has a lower hardness than that of the metal material.

[0012] In order to at least partially overcoming this drawback, there may be provided for a selection of the materials with which the traction cable TC and the redirecting body EB are formed, so as to reduce the friction and the resulting wear of the components. For example, there may be provided for the use of the same material for both components, use low friction coefficient materials for at least one of the components, and further solutions or combinations thereof. However, in this case the choice of materials that can be used to obtain the lever tightening device LD and the traction cable TC is significantly limited, with resulting risk of failing to meet other mechanical requirements of the components, such as traction strength, impact strength, tensile strength, density and the like, aesthetic requirements such as surface appearance, colour and the like, or other production requirements such as cost/availability of materials, ease of manufacture of components and the like.

[0013] Typically, the traction cable TC is formed with metal material, such as steel, so as to ensure high tensile strength, and it is preferably uncoated so as to reduce the cost thereof and simplify the construction thereof. Whereas the redirecting body EB is typically made of plastic material to simplify production steps, for example by means of injection moulding, while ensuring reduction in weight and adequate mechanical and aesthetic features.

[0014] In addition, in the prior art lever tightening devices LD, the redirecting body EB provides for a redirecting guide seat, suitable for receiving the traction cable TC, which is shaped to suitably distribute the loads induced by the tensioning of the traction cable TC only in the closing position (see Fig. 3), but not in the inter-

mediate positions (see Fig. 2) between the opening (see Fig. 1) and closing positions (see Fig. 3). In particular, Figs. 1 to 3 show with a two-dot-dash line an optimal plane or direction SP of the seat for the traction cable CT that is adapted to suitably distribute the tensioning loads of the traction cable CT. In particular, only in the closing position (see Fig. 3) the plane on which tension is applied by the traction cable CT is aligned with said optimal plane or direction SP of the seat of the redirecting body EB.

[0015] Therefore, the repeated opening/closing movement of the lever tightening device LD induces a repeated non-optimal distribution of the loads which increases the probability of breakage of the redirecting body EB, in particular when the latter is formed with plastic material, thereby degrading its durability.

[0016] Furthermore, in order to ensure the durability and reliability of the traction cable TC, the latter must provide for at the redirecting regions, such as the redirecting body EB, a degree of bending having a radius of curvature greater than a given minimum radius of curvature, which is defined by the latter depending on the diameter and type of construction of the cable. This is particularly important in the case of traction cables TC, preferably of the stranded type, which are formed with metal material.

[0017] However, in the prior art lever tightening devices LD, said redirecting guide seat of the redirecting body EB is shaped to ensure an appropriate degree of bending of the traction cable only in the closing position (see Fig. 3), but not in the intermediate positions (see Fig. 2) between the opening (see Fig. 1) and closing positions (see Fig. 3) wherein, on the other hand, the traction cable CT may take degrees of bending having a radius of curvature smaller than said minimum-radius of curvature.

[0018] Therefore, the repeated opening/closing movement of the lever tightening device LD induces a repeated non-optimal degree of bending of the traction cable TC, which increases the likelihood of breakage thereof, thereby degrading the durability thereof.

[0019] As a result, there arises the need to develop a lever tightening device for sports footwear, and a sports footwear comprising it, which overcome at least one of the above-mentioned drawbacks.

SUMMARY OF THE INVENTION

[0020] The task of the present invention is to provide a lever tightening device adapted to be applied to a sports footwear provided with a pair of flaps to be moved mutually towards/away, which is configured to ensure operating reliability and durability.

[0021] In the context of the task outlined above, an object of the present invention is to obtain a lever tightening device that allows a reliable degree of tightening of the sports footwear even after multiple opening/closing steps.

[0022] A further object is to obtain a lever tightening device that ensures the durability of its components and

their operation. Furthermore, it would be advantageous to obtain a lever tightening device that ensures the durability of the traction cable of the tightening assembly with which it is associated.

[0023] A further object is to obtain a lever tightening device that provides for an even distribution of the loads induced by tensioning the traction cable in the closing position and in intermediate positions between the opening and closing positions.

[0024] A further object is to obtain a lever tightening device that provides for a construction that can be easily and extensively adapted at the design stage, depending on the needs.

[0025] A further object is to obtain a lever tightening device that provides for components whose materials, constructions and combinations thereof can be widely chosen, depending on the needs.

[0026] A further object is to obtain a lever tightening device that provides for a construction that can be achieved by using means and components that are easy to find and which can be obtained with conventional plants, machinery and equipment.

[0027] A further object is to obtain a lever tightening device adapted to make the tightening process gradual and convenient.

[0028] A further object is to obtain a lever tightening device adapted to allow convenient steps for introducing and/or removing the foot into/from the sports footwear.

[0029] A further object is to obtain a sports footwear comprising said lever tightening device, as a result providing for the advantages of the latter.

[0030] These and other tasks, objects and advantages outlined above which will be more apparent in the description below, are attained through a lever tightening device and a sports footwear as defined in the independent claim. Preferred embodiments are defined in the dependent claims.

BRIEF DESCRIPTION OF THE FIGURES

[0031] The further characteristics and advantages of the lever tightening device and of the sports footwear comprising it, will become more apparent in the following description relating to embodiments provided purely by way of non-limiting example, with reference to the figures below, wherein:

- Fig. 1 shows a lateral view of a lever tightening device according to the state of the art, in an opening position,
- Fig. 2 shows a lateral view of the lever tightening device of Fig. 1, in an intermediate position between the opening position and a closing position,
- Fig. 3 shows a lateral view of the lever tightening device of Figs. 1 and 2, in the closing position,
- Fig. 4 shows a lateral view of a sports footwear provided with a tightening assembly comprising the lever tightening device according to a first em-

- bodiment of the present invention,
- Fig. 5 shows a top view of the tightening assembly of Fig. 4, wherein the tightening device is in an opening position,
 - Fig. 6 shows a top view of the tightening assembly of Fig. 4, wherein the tightening device is in a closing position,
 - Fig. 7 shows a perspective view of the lever tightening device of Fig. 4 according to the first embodiment of the present invention, wherein the lever tightening device is in a closing position,
 - Fig. 8 shows a cross-sectional view along a horizontal plane of the lever tightening device of Fig. 7,
 - Fig. 9 shows an exploded view of the lever tightening device of Fig. 7,
 - Fig. 10 shows a lateral view of the lever tightening device of Fig. 7, in an opening position,
 - Fig. 11 shows a lateral view of the lever tightening device of Fig. 7, in an intermediate position between the opening position and a closing position,
 - Fig. 12 shows a lateral view of the lever tightening device of Fig. 7, in the closing position,
 - Fig. 13 shows a perspective view of a lever tightening device according to a second embodiment of the present invention, wherein the lever tightening device is in a closing position,
 - Fig. 14 shows a lateral view of the lever tightening device of Fig. 13, in the closing position,
 - Fig. 15 shows an exploded view of the lever tightening device of Fig. 13.

DETAILED DESCRIPTION OF THE INVENTION

[0032] In the present description, there may be used expressions such as expressions such as "upper", "lower", "horizontal", "vertical", "inner", "outer" or the like; the person skilled in the art will have no difficulty understanding that these expressions relate to the sports footwear, to the tightening assembly and to the lever tightening device, in their normal condition of use, as shown in the attached figures.

[0033] With reference to Fig. 4, the present invention relates to a lever tightening device 10 which may be comprised in a tightening assembly 100 in particular adapted to be associated with a sports footwear 1000 provided with a pair of flaps, first F1 and second F2, which can be superimposed or approached to attain the releasable tightening of the sports footwear 1000 around the foot of the user.

[0034] In the present embodiment, the sports footwear 1000 is preferably a ski boot. However, such sports footwear 1000 may be any type of footwear provided with a pair of flaps which can be superimposed or approached to each other, and possibly associated with a tab-like element, to obtain the releasable tightening thereof around the foot of the user, such as for example ski boots, snowboard boots, skates, hiking boots, cycling shoes or the like.

[0035] Fig. 4 shows a possible embodiment of said ski boot 1000, as a sports footwear, which is provided with the tightening assembly 100 comprising the lever tightening device 10 according to the present invention.

[0036] The ski boot 1000 comprises a shell 1002 adapted to receive the foot of a user and it is provided with a sole S1, essentially defining a plane for supporting the foot, from which there depart, on opposite longitudinal sides, a first lateral flap F1 and a second lateral flap F2, which are adapted to be arranged respectively on the outer part and on the inner part of the foot, extending between a tip T1, located in an area proximal to the tip of the foot, and a heel B1, located at an area proximal to the heel, involving the lateral regions of the foot up to about the area of the malleoli area, and being faced or superimposed preferably in the upper area of the foot.

[0037] The tightening of the boot 1000 can be obtained by means of a tightening assembly 100 which may entail the approaching of the interface edges of said first F1 and second F2 flaps, between which there may be possibly positioned a tab-like element, or it may entail the slidable superimposition of one flap with respect to the other.

[0038] The boot 1000 may further comprise a bootleg 1004 adapted to wrap around at least at the rear part the lower part of the leg of the user. Preferably, the bootleg 1004 is articulated to the shell 1002 being able to rotate around suitable hinge devices 1006 of the known type.

[0039] In the present embodiment of the boot 1000, in particular as shown in Fig. 4, the tightening assembly 100 is shown applied to the pair of flaps, first F1 and second F2, which essentially form the shell 1002 of boot 1000. It is clear that the tightening assembly 100 can also be equally applied to a pair of flaps for example arranged at the cuff 1004, or to any other portion of the cuff or of the shell of a footwear in which there arises the need to releasably tighten a pair of flaps facing each other.

[0040] With reference to Figs. 4, 5 and 6 there is shown a preferred embodiment of the tightening assembly 100 in turn comprising the tightening device 10 according to the present invention.

[0041] The tightening assembly 100 comprises a traction element 102, such as a traction cable 102, which can be fixed to a flap of the boot 1000 through a first end portion 102a thereof preferably by means of a cable lug device 104, a reel-based tightening device 106 configured to act on a second end portion 102b, and the lever tightening device 10 configured to act on an intermediate portion 102i (which is intermediate between said first 102a and second 102b end portions) of the traction element 102 for releasably tightening the boot 1000 around the foot of the user by tensioning the traction element 102.

[0042] The traction element 102, such as traction cable 102, is substantially formed by a cable, rope or the like, preferably of the stranded type which is flexible and generally substantially inextensible. In a most preferred embodiment, the traction element 102, such as traction cable 102, is formed with a metal material, such as for

example steel, and even more preferably uncoated, such as for example sheath, film, layer material or the like made of polymeric material.

[0043] In the present embodiment, said reel-based tightening device 106 can be associated with the same flap to which there can be fixed the cable lug device 104 and said lever tightening device 10, that is the first flap F1 in the present embodiment Fig. 4.

[0044] Preferably, the tightening assembly 100 further provides for redirecting means 108, comprising one or more redirecting members (not numbered in the figures) adapted to be engaged passing through and freely slidable by the traction cable 102 so as to suitably divert the sliding direction thereof.

[0045] In particular, said redirecting members of the redirecting means 108 each comprise a fixing body which can be fixed to a flap of the footwear 1000, that is to the second flap F2 in the present embodiment of Fig. 4. On said fixing body (not numbered in the figures) there is idly mounted a respective pulley. Alternatively, said redirecting members may be formed by conventional cable gland portions.

[0046] Said redirecting means 108 are suitably positioned on one flap or on both flaps to be approached, for example with a quincunx arrangement, so as to evenly distribute the tightening action conferred by the tensioning of the traction cable 102.

[0047] In the present embodiment, as shown in Figs. 4, 5 and 6, the tightening assembly 100 comprises redirecting means 108 all of which are fixed to the same flap of said pair of flaps, such as the second flap F2. Whereas the lever tightening device 10, the reel-based tightening device 106 and the cable lug device 104 are fixed to the other flap of said pair of flaps, such as the first flap F1.

[0048] However, this arrangement shall not be deemed as limiting. For example, there may be provided for further embodiments in which there are provided for redirecting means 108, and the tightening assembly 100 comprises the reel-based tightening device 106 and the cable lug device 104 fixed to said pair of flaps, such as the first flap F1. Whereas the lever tightening device 10 is fixed to the other flap of said pair of flaps, such as the second flap F2.

[0049] In particular, the tightening assembly 100, according to various possible embodiments, generally comprises at least one traction element 102 which can be fixed with a first end portion 102a to a flap of said pair of flaps, first F1 and second F2, of the shell 1002 of the boot 1000, and which can be associated with at least one intermediate portion 102i to the other flap of said pair of flaps, first F1 and second F2, and on which there acts the lever tightening device 10 according to the present invention.

[0050] In the present preferred embodiment shown in Figs. 4, 5 and 6, wherein the tightening assembly 100 comprises the reel-based tightening device 106, the latter is of the known type and it substantially comprises a casing in which there is housed a winding mechanism

provided with a reel with which there is associated said second end portion 102b of the traction cable 102. In particular, the winding mechanism is operatively connected to a knob which can be used by the user to drive in rotation the reel in a winding direction, so that said traction cable 102 is wound around the reel, therefore obtaining a gradual tensioning of the traction cable 102 and a progressive approaching of the first F1 and second F2 flaps, and therefore the tightening action thereof, or in the unwinding direction, to obtain a release and unwinding of the traction cable 102 from the reel and therefore allow the two flaps F1, F2 to be moved away.

[0051] Whereas the lever tightening device 10 is adapted to allow a quick tightening/loosening of the boot 1000, without possibly losing a tightening condition previously set for example by means of the reel-based tightening device 106, when the latter is provided for in the tightening assembly 100. In particular, Fig. 5 shows the lever tightening device 10 in the opening position in which said traction element 102 is not tensioned, and Fig. 6 shows the lever tightening device 10 in the closing position in which said traction element 102 is tensioned by the action of the lever.

[0052] With reference to Figs. 7 to 12, described below is a first preferred embodiment of the lever tightening device 10, according to the present invention.

[0053] As mentioned above, said lever tightening device 10 can be associated with one of the first F1 or second F2 flaps of the boot 1000 and it comprises a lever arm 12 and an abutment base 14 connected to each other, or which can be removably connected to each other, as better explained below. The lever arm 12 and the abutment base 14 can be formed with materials identical or different from each other and suitably preferably selected from metal materials, such as steel, aluminium or the like, and plastic materials, such as thermoplastics, thermosetting or the like, and combinations thereof. For example, in a possible preferred embodiment, the lever arm 12 is formed with a combination of plastic and steel material, while the abutment base 14 is formed with steel, as explained below.

[0054] In the present first embodiment, the lever arm 12 is connected to the abutment base 14 so as to be rotatably movable, that is movable in a rotating manner, around a first articulation axis R1, substantially parallel to the surface of the flap with which it is associated and preferably defined by a first articulation pin 16, at least between a first position, or opening position (see Fig. 10), in which it is moved away and substantially disengaged from the abutment base 14, and a second position, or closing position (see Fig. 12), in which it is lowered and abuts against the abutment base 14, passing through an intermediate position (see Fig. 11) which is intermediate between said opening and closing positions.

[0055] The operation of the lever devices in a tightening assembly is generally substantially known. When the lever arm 12 is in the opening position, the traction cable 102 is not tensioned by said lever arm 12. Whereas when

the lever arm 12 is in the closing position, said traction cable 102 is tensioned by the said lever arm 12 due to the exceeding of the dead centre of the articulation of the lever.

[0056] In particular, the abutment base 14 comprises a base articulation portion 14A, formed for example by a copy of fins extending from a plate-shaped base element 14B, in which the fins are drilled transversely with circular shaped holes. The base articulation portion 14A is configured to be connected by means of the first articulation pin 16 to the lever arm 12, so as to allow the rotation of the latter around said first articulation pin 16, that is to the first articulation axis R1.

[0057] In turn, the base element 14B comprises mutually opposite main surfaces, such as an upper abutment surface 14U and a lower connection surface 14D. The abutment surface 14U is configured to receive the lever arm 12 in abutment when the latter is in the closing position. Whereas the connection surface 14D is configured to be coupled with the surface of the flap of the boot 1000 to which the lever tightening device 10 is fixed, using suitable and known fixing means.

[0058] The lever arm 12 comprises a lever articulation portion 12A, formed for example by a body provided with a transversely through opening, through which it is mounted by means of the first articulation pin 16 on the abutment base 14, at the base articulation portion 14A, rotatable around said first articulation pin 16, that is to the first articulation pin R1.

[0059] Furthermore, the lever arm 12 comprises a lever gripping portion 12B arranged substantially distal from said lever articulation portion 12A along a longitudinal extension direction L12 of the lever arm 12. The lever gripping portion 12B is adapted to be grasped manually by the user in order to move the lever arm 12 between the closing and opening positions in order to apply and release the tensioning of the traction cable 102 respectively.

[0060] To this end, the lever arm 12 further comprises a redirecting guide element 18 configured to allow the slidable coupling of the traction cable 102 to the lever arm 12 so that, when the latter is rotatably moved from the opening position to the closing position, it induces the traction action on the traction cable 102.

[0061] Said redirecting guide element 18 is configured to define, that is provide for, a redirecting guide seat 18S substantially shaped to form a groove or conduit and having a possibly at least partially curved shape. The redirecting guide seat 18S extends substantially at least partially transversely to a longitudinal axis L18 of the redirecting guide element 18, that is, with respect to the longitudinal extension direction L12 of the lever arm 12, and it is configured to receive and allow the sliding of a redirecting curved section 102r of the intermediate section 102i of the traction cable 102, diverting its sliding direction (the redirecting curved section 102r is better visible in Figs. 8 and 9).

[0062] Preferably, the redirecting guide element 18 is

obtained as a separate piece with respect to the lever arm 12, and it is preferably formed with plastic material by means of injection moulding, simultaneously ensuring decrease in weight, appropriate mechanical characteristics and ease of manufacture of the component.

[0063] According to the present invention, the lever tightening device 10 further comprises connection means 20 which are configured to connect the redirecting guide element 18 to the lever arm 12 in a rotatable fashion around a second articulation axis R2, which is distinct from said first articulation axis R1 and preferably substantially parallel to the latter, so as to allow the relative rotation of the redirecting guide element 18 and of the redirecting guide seat 18S thereof with respect to the lever arm 12 when the latter is moved between said opening and closing positions (that is when moved from the opening position to the closing position and vice versa).

[0064] In this manner, the longitudinal axis L18 of the redirecting guide element 18, transversal to said second articulation axis R2, is adapted to follow remaining substantially parallel to, or coplanar with, a plane P1 defined by the redirecting curved section 102r of the traction element 102 (the plane P1 is better visible in Fig. 9, it is substantially the plane of the sheet in Fig. 8, and it is substantially orthogonal to the plane of the sheet in Figs. 10 to 12). In particular, the plane P1 defined by the redirecting curved section 102r is the plane on which the tension is applied by the traction element 102 when moving the lever element 12 between the opening and closing positions, passing through the intermediate position.

[0065] In this condition, the redirecting guide element 18 follows, by rotating freely and substantially independently and not integrally joined with the lever arm 12, the orientation changes of the plane P1 at all times during the movement of the lever arm 12 between said opening and closing positions, substantially maintaining the longitudinal axis L18 parallel to or aligned with the plane P1, as shown in Figs. 10 to 12.

[0066] Therefore, advantageously, the lever tightening device 10 is adapted to ensure operating reliability and durability after multiple opening/closing steps.

[0067] As a matter of fact, by changing the orientation of the redirecting guide element 18 with respect to the lever arm 12 so as to follow the changes in orientation of the plane P1 during the opening/closing movement, the redirecting curved section 102r of the intermediate portion 102i of the traction cable 102 remains, in operating conditions, substantially in the same position in the redirecting guide seat 18S, unless there is any sliding along the longitudinal extension of the cable.

[0068] Therefore, during the opening/closing steps, the likelihood of a repeated rubbing between the traction cable 102 and the lateral edge portions of the redirecting guide element 18 is reduced or eliminated, therefore avoiding the excessive wear of the material with which the latter and/or the traction cable 102 is made. Such

condition is particularly advantageous when the redirecting guide element 18 is formed with plastic material and the traction cable 102 is formed with metal material, especially should the latter be uncoated.

[0069] Furthermore, by changing the orientation of the redirecting guide element 18 with respect to the lever arm 12 so as to follow the changes in orientation of the plane P1 during the opening/closing movement, the redirecting curved section 102r of the intermediate portion 102i of the traction cable 102 maintains, in operating conditions, a substantially constant degree of bending.

[0070] Therefore, during the opening/closing steps, the likelihood of a change in the degree of bending of the traction cable 102 which maintains a constant degree of bending induced by the conformation of the redirecting guide seat 18S which in turn is configured and/or shaped, so as to have a radius of curvature that is greater than or equal to a given minimum-radius of curvature, the latter depending on the diameter and type of construction of the traction cable, is reduced or eliminated. Such condition is particularly advantageous when the traction cable 102 is of the stranded type and it is formed metal material.

[0071] As a result, for the advantages mentioned above, the lever tightening device 10 ensures durability of its components, in particular of the redirecting guide element 18 and of the traction cable 102, besides their reliable operation after multiple opening/closing steps.

[0072] Furthermore, changing the orientation of the redirecting guide element 18 with respect to the lever arm 12 so as to follow the changes in orientation of the plane P1 during the opening/closing movement, the lever tightening device 10 provide for an even distribution of the loads on the components induced by the tensioning of the traction cable 102 in the closing position, and in the intermediate positions between the opening and closing positions during the movement of the lever arm 12.

[0073] Therefore, during the opening/closing steps, there is ensured a releasable tightening process which is gradual and convenient.

[0074] The redirecting guide element 18 comprises an engaging and redirecting portion 18A which is connected to an element articulation portion 18B. The engaging and redirecting portion 18A and the element articulation portion 18B are arranged on opposite ends of the redirecting guide element 18 along the longitudinal axis L18.

[0075] The engaging and redirecting portion 18A defines, that is comprises, said redirecting guide seat 18S which, as mentioned above, is configured to receive and allow the sliding of the redirecting curved section 102r of the intermediate portion 102i of the traction cable 102, diverting the sliding direction thereof. Whereas the element articulation portion 18B is substantially formed by first hole element 18H preferably formed passing through and extending transversely to the longitudinal axis L18 of the redirecting guide element 18.

[0076] Furthermore, the lever arm 12 comprises a protruding portion 12G which is shaped protruding from the top part of the lever arm 12. The protruding portion

12G in turn comprises second hole elements 12H preferably formed passing through and extending transversely to the longitudinal extension direction L12 of the lever arm 12.

[0077] In particular, in the present embodiment, the connection means 20 comprise said first hole element 18H of the redirecting guide element 18, said second hole elements 12H of the lever arm 12, and a second articulation pin 22. In particular, said articulation pin 22, defining said second articulation axis R2, is configured to engage said first 18H and second 12H hole elements, so as to connect the redirecting guide element 18 to the lever arm 12 in a rotatable fashion around said second articulation axis R2.

[0078] However, this configuration shall not be deemed as limiting and there can be provided for further constructions adapted to obtain a rotatable connection of the redirecting guide element 18 to the lever arm 12, such as for example through a flexible/foldable connection portion, or through a pair of pins instead of a single pin, or other similar constructions. The embodiments which provide for a second articulation pin 22, or a plurality of pins, advantageously ensure ease of construction, reliability and durability of the components.

[0079] Preferably, the lever tightening device 10 is configured so that the lever arm 12 is substantially arranged between, that is interposed between, the abutment base 14 and the redirecting guide seat 18S of the redirecting guide element 18, when said lever arm 12 is in the closing position. In other words, when said lever arm 12 is in the closing position, the abutment base 14, the lever arm 12 and the redirecting guide seat 18S are arranged in this order in a superimposition relationship with respect to each other along a direction which goes from the abutment base 14 to the lever arm 12, as seen in a lateral view from a direction parallel to the first articulation axis R1.

[0080] In this condition, the redirecting guide element 18 and its redirecting guide seat 18S, the latter configured to receive the redirecting curved section 102r of the traction cable 102, are arranged above the lever arm 12, that is arranged on an upper surface thereof opposite to that facing towards the abutment surface 14U of the abutment base 14, and substantially having no obstacles, it can rotate with respect to the latter with high angle values. Preferably, the redirecting guide element 18 and its redirecting guide seat 18S are adapted to rotate, around the second articulation axis R2, with respect to the lever arm 12 by an angle greater than 90 degrees, more preferably greater than 120 degrees, even more preferably by 180 degrees or greater than 180 degrees.

[0081] Therefore, a high amount of the traction cable 102 can be released during the opening step, as shown in Figs. 5 and 6 together with Fig. 10, substantially obtaining the approaching of the redirecting guide element 18 and of its redirecting guide seat 18S to the redirecting means 108 of the tightening assembly 100.

[0082] Such condition is particularly advantageous

when there arises the need to release a high amount of traction cable 102 to extensively separate the pair of flaps, first F1 and second F2, so as to allow, for example, convenient steps for introducing and/or removing the foot into/from the boot 1000. Furthermore, this condition is even more advantageous when the tightening assembly 100, including the present lever tightening device 10, provides for the reel-based tightening device 106 given that the latter requires relatively long time to release the cable and/or to regain previous tightening conditions once the cable has been released.

[0083] Particularly with reference to Figs. 9 and 12, preferably the lever tightening device 10 is configured so that, when the lever arm 12 is in the closing position, a first distance D1 of the first articulation axis R1 from the abutment surface 14U of the abutment base 14 is greater than or equal to a second distance D2 of the redirecting guide seat 18S from said abutment surface 14U.

[0084] In this condition, the redirecting guide seat 18S, configured to receive the redirecting curved section 102r of the traction cable 102, is arranged closer to the base element 14B with respect to the first articulation axis R1, around which the lever arm 12 rotates operatively.

[0085] Therefore, when the lever arm 12 is in the closing position in which the tensioning to the traction cable 102 is applied, this construction allows to maintain the position in a particularly reliable manner given that, after exceeding the articulation dead centre of the lever, a lever closing holding force is greater than the tightening force of the cable, and a relatively high opening force has to be applied to overcome the lever articulation dead centre in order to obtain the opening position of the lever arm 12.

[0086] As a result, this construction is particularly advantageous given that it prevents or reduces the likelihood of an unwanted opening of the lever tightening device 10 in the operating conditions, for example due to an impact or foot movement that could apply an increase in tension to the traction cable 102.

[0087] Particularly with reference to Figs. 9 and 12, in the present preferred embodiment, the lever arm 12 is substantially formed by or comprises a frame element 12M and a covering element 12P. The frame element 12M is configured to preferably extend from said lever articulation portion 12A to said lever gripping portion 12B of the lever arm 12, along its longitudinal extension direction L12. Whereas the covering element 12P is configured to coat the upper part of the frame element 12M. The frame element 12M and the covering element 12P are formed separately and subsequently fixed together by means of suitable coupling and/or fixing means 12F, such as for example a fitting system, mechanical fixing system, gluing system or the like.

[0088] The frame element 12M serves as a structural base frame, preferably formed with a first material of high rigidity and strength (for example metal and in particular steel), which is adapted to provide adequate mechanical characteristics, such as high rigidity, high tensile strength or the like, to ensure the functionality of the lever arm 12 to

obtain the tensioning of the traction cable 102. Whereas the covering element 12P, preferably formed with a second material other than the first (for example plastic material), is adapted to provide desired further aesthetic or functional characteristics, such as colour, appearance/surface pattern, conformation or the like, so as to ensure a desired appearance and/or ergonomics of the lever arm 12.

[0089] In particular, since the frame element 12M can be formed with a first material of high rigidity and strength such as steel, due to its forming, there can be used a low thickness element, such as for example a plate measuring 1-1.5mm in thickness, so as to ensure adequate mechanical characteristics for the functionality of the lever arm 12 and, at the same time, low thickness to allow the positioning of the redirecting guide seat 18S of the engaging and redirecting element 18 and a small distance D2 from the abutment surface 14U of the abutment base 14, when the lever arm 12 is in the closing position.

[0090] As a result, this construction is particularly advantageous given that it ensures adequate mechanical and aesthetic characteristics of the lever arm 12 and, at the same time, it prevents or reduces the likelihood of an unwanted opening of the lever tightening device 10 in the operating conditions, as mentioned above.

[0091] Furthermore, the lever tightening device 10 is preferably configured so that when said lever arm 12 is in the closing position, the redirecting guide seat 18S of the redirecting guide element 18 is substantially arranged between, that is interposed between the second articulation axis R2 and the first articulation axis R1, that is between the second articulation pin 22 and the first articulation pin 16. In other words, when said lever arm 12 is in the closing position, the second articulation axis R2, the redirecting guide seat 18S and the first articulation axis R1 are arranged in that order along a direction substantially parallel to the longitudinal extension direction L12 of the lever arm 12 and which goes from the lever gripping portion 12B to the lever articulation portion 12A.

[0092] In this condition, the redirecting guide seat 18S, configured to receive the redirecting curved section 102r of the traction cable 102, is arranged closer to the first articulation axis R1, around which the lever arm 12 rotated operatively, with respect to the second articulation axis R2.

[0093] Therefore, when the lever arm 12 is in the closing position in which the tensioning is applied to the traction cable 102, this construction allows to maintain the position in a particularly reliable manner given that a relatively high opening force is required to overcome the lever articulation dead centre given that the redirecting guide seat 18S, which receives the redirecting curved section 102r, arranged at a short distance from the first articulation axis R1, around which the lever arm 12 rotates operatively.

[0094] As a result, this construction is particularly advantageous given that it further prevents or reduces the

likelihood of an unwanted opening of the lever tightening device 10 in the operating conditions, for example due to an impact or foot movement that could apply an increase in tension to the traction cable 102.

[0095] In the present preferred first embodiment shown in Figs. 7 to 12, the lever tightening device 10 is preferably configured so that said connection means 20 are further configured to connect the redirecting guide element 18 to the lever arm 12 substantially slidably along the longitudinal extension direction L12 of the lever arm 12, that is along a direction substantially parallel to the longitudinal extension direction L12, besides being configured to connect said redirecting guide element 18 to said lever arm 12 rotatably around the second articulation axis R2 as mentioned above.

[0096] In this condition, the redirecting guide element 18 and its redirecting guide seat 18S, the latter being configured to receive the redirecting curved section 102r of the traction cable 102, are adapted to follow the changes in the orientation of the plane P1 of the redirecting curved section 102r at all times during the movement of the lever arm 12 between said opening and closing positions and, at the same time, provide for a further degree of freedom of movement along the longitudinal extension direction L12 of the lever arm 12, substantially obtaining a roto-translation movement.

[0097] Therefore, a high amount of the traction cable 102, can be released during the opening step, as shown in Figs. 5 and 6 together with Fig. 10, substantially obtaining the approaching of the redirecting guide element 18 and of its redirecting guide seat 18S to the redirecting means 108 of the tightening assembly 100 by rotating them around the second articulation axis R2 and sliding towards the lever gripping portion 12B of the lever arm 12.

[0098] Such condition is particularly advantageous when there arises the need to release a high amount of traction cable 102 to extensively separate the pair of flaps, first F1 and second F2, so as to allow, for example, convenient steps for introducing and/or removing the foot into/from the boot 1000. Furthermore, this condition is even more advantageous when the tightening assembly 100, including the present lever tightening device 10, provides for the reel-based tightening device 106 given that the latter requires relatively long time to release the cable and/or to regain previous tightening conditions once the cable has been released.

[0099] To this end, there may be provided for different constructions of the connection means 20 adapted to connect the redirecting guide element 18 to the lever arm 12 in a rotatable fashion around the second articulation axis R2 and slidably along the longitudinal extension direction L12.

[0100] In the present preferred first embodiment, as mentioned above, the connection means 20 comprise the first hole 18H of the redirecting guide element 18, the second articulation pin 22, and the second hole 12H of the lever arm 12. In particular, said second hole elements

12H are, in the present first embodiment, shaped to form a slot or straight and/or curved slit which extends substantially along the longitudinal extension direction L12 of the lever arm 12. Therefore, in the present first embodiment, said second hole elements 12H form slit-shaped guide means 12H which are engaged in a rotatable and sliding manner by said second articulation pin 22, to connect the redirecting guide element 18 to the lever arm 12 in a rotatable manner, around the second articulation axis R2, and in a slidable manner, along the longitudinal extension direction L12.

[0101] Hereinafter, with reference to Figs. 13 to 15, described below is a second preferred embodiment of the lever tightening device 10, according to the present invention. Said second preferred embodiment provides for modifications relating to the lever tightening device 10 of the first embodiment described above. Therefore, the components which are substantially unchanged with respect to those described above will not be described again specifically, and the same reference numerals will be used.

[0102] In the second embodiment, the lever tightening device 10 is substantially identical to the first embodiment, except for the construction of the redirecting guide element 18 and the type of connection between the lever arm 12 and the abutment base 14.

[0103] In particular, the redirecting guide element 18 comprises at least one pulley element 24 which is adapted to at least partially define said redirecting guide seat 18S. Furthermore, it is adapted to slidably receive the redirecting curved section 102r of the intermediate portion 102i of the traction cable 102, diverting its sliding direction (the redirecting curved section 102r is better visible in Fig. 15).

[0104] The radius of each of said at least one pulley element 24 is preferably selected so as to be greater than or equal to a given minimum-radius of curvature, the latter being defined depending on the diameter and type of construction of the traction cable 102.

[0105] Said redirecting guide element 18, similarly to the first embodiment, comprises an engaging and redirecting portion 18A which is connected to an articulation portion of element 18B. The engaging and redirecting portion 18A and the element articulation portion 18B are arranged on opposite ends of the redirecting guide element 18 along the longitudinal axis L18.

[0106] At the engaging and redirecting portion 18A there is formed a surface recess on the edge opposite to the articulation portion of element 18B, and extending along the longitudinal axis L18 forming a pair of upper and lower walls, so as to at least partially define the redirecting guide seat 18S.

[0107] Said at least one pulley element 24 is mounted in such surface recess, between the pair of upper and lower walls, so as to further at least partially define said redirecting guide seat 18S. Said at least one pulley element 24 is mounted so as to preferably freely rotatable, that is idly, around a respective pin element or hub ele-

ment 26 having axis substantially orthogonal to the pair of upper and lower walls and to the longitudinal axis L18.

[0108] Possibly, said at least one pulley element 24 has a circumferential groove adapted to receive the redirecting curved section 102r of the intermediate portion 102i of the traction cable 102.

[0109] In this condition, unlike the first embodiment in which the redirecting guide seat 18S is substantially defined as a whole by surfaces obtained in the engaging and redirecting portion 18A operatively generating sliding friction with the traction cable 102, in the present embodiment the redirecting guide seat 18S is at least partially defined by said at least one pulley element 24 operatively generating rolling friction with the traction cable 102.

[0110] Therefore, during the opening/closing steps and the tensioning steps for example by actuating the reel-based tightening device 106 of the tightening assembly 100, the likelihood of repeated rubbing between the traction cable 102 and the portions of the redirecting guide element 18 is reduced or eliminated, therefore avoiding excessive wear of the material with which the latter and/or the traction cable 102 is made. This condition is particularly advantageous when the redirecting guide element 18 and its components, such as the pulley element 24, are formed with plastic material and the traction cable 102 is formed with metal material, especially should the latter be uncoated.

[0111] Furthermore, suitably selecting the radius of each of said at least one pulley element 24 so that it is greater than or equal to a given minimum-radius of curvature defined depending on the diameter and type of construction of the traction cable 102, enables to maintain a constant and appropriate degree of bending of the redirecting curved section 102r of the intermediate portion 102i of the traction cable 102.

[0112] As a result, for the advantages mentioned above, the lever tightening device 10 ensures durability of its components, in particular of the redirecting guide element 18 and of the traction cable 102, besides their reliable operation after multiple opening/closing steps.

[0113] Furthermore, unlike the first embodiment in which the redirecting guide seat 18S provides for sliding friction with the traction cable 102, the present second embodiment provides for rolling friction between said at least one pulley element 24 and the traction cable 102, therefore ensuring lesser friction between the latter and an easier and more convenient tightening process.

[0114] In the second embodiment shown in Figs. 13 to 15, the redirecting guide element 18 preferably comprises two pulley elements 24. However, this selection shall not be deemed as limiting and there may be provided for a further embodiment in which the redirecting guide element 18 comprises a pulley element 24.

[0115] The embodiment which provides for two pulley elements 24 advantageously allows to obtain a greater compactness of the lever tightening device 10 given that during the design step there can be reduced a distance

between the first R1 and second R2 articulation axes, between which there is substantially arranged the redirecting guide element 18 and the redirecting guide seat 18S, further arranging the latter close to the first articulation axis R1.

[0116] In the present second embodiment shown in Figs. 13 to 15, the lever arm 12 can also be or is removably connected to the abutment base 14.

[0117] Therefore, during the opening steps, the lever arm 12 can be disconnected from the abutment base 14 so as to allow to release a high amount of traction cable 102, substantially obtaining the approaching of the entire lever arm 12 to the redirecting means 108 of the tightening assembly 100.

[0118] Such condition is particularly advantageous when there arises the need to release a high amount of traction cable 102 to extensively separate the pair of flaps, first F1 and second F2, so as to allow, for example, convenient steps for introducing and/or removing the foot into/from the boot 1000. Furthermore, this condition is even more advantageous when the tightening assembly 100, including the present lever tightening device 10, provides for the reel-based tightening device 106 given that the latter requires relatively long time to release the cable and/or to regain previous tightening conditions once the cable has been released.

[0119] To this end, there may be provided for different constructions adapted to removably connect the lever arm 12 to the abutment base 14, further allowing the mutual rotation thereof around the first articulation axis R1.

[0120] In the present second preferred embodiment, as mentioned above, the abutment base 14 comprises a base articulation portion 14A extending from a plate-shaped base element 14B. The base articulation portion 14A is configured to be connected by means of the first articulation pin 16 to the lever arm 12, so as to allow the rotation of the latter around said first articulation pin 16, that is to the first articulation axis R1.

[0121] However, unlike the first embodiment, the base articulation portion 14A does not comprise a pair of fins drilled transversely with circular-shaped holes, but it comprises a pair of fins provided with groove means 28, such as a pair of curvilinear-shaped furrows formed on the upper edge of the fins. Said groove means 28 are configured to define anchoring seats, open at the top, which are adapted to possibly rotatably receive the first articulation pin 16, so as to allow the rotation of the lever arm 12 with respect to the abutment base 14 around the first articulation axis R1.

[0122] Furthermore, the lever tightening device 10 comprises reversible retention means 30, preferably fixed to the abutment base 14 by means of suitable and known fixing means, which are configured to reversibly lock the first articulation pin 16 in the anchoring seats defining said groove means 28.

[0123] Preferably, said reversible retention means 30 comprise a base body 30B fixed to the abutment base 14

and from which there extends an elastic retention element 30E which is flexible between a retention position in which it locks the first articulation pin 16 in the groove means 28, and a release position in which it frees the first articulation pin 16 from the groove means 28, substantially forming a reversible coupling fixing system. However, this configuration shall not be deemed as limiting and there may be provided for further constructions adapted to obtain a reversible connection of the lever arm 12 to the abutment base 14.

[0124] It is clear that there are possible further embodiments of the lever tightening device 10 with respect to what has been described so far, without departing from the claimed scope of protection.

[0125] As a matter of fact, there may be provided for embodiments in which two or more characteristics or preferred variants of the second embodiment described above may be combined with each other.

[0126] For example, there may be provided for a further embodiment in which the redirecting guide element 18 in the first embodiment, rotatably and slidably movable with respect to the lever arm 12, is also provided with said at least one pulley element 24, similarly to the second embodiment.

[0127] Furthermore, there may be provided for a further embodiment in which the lever arm 12 and the abutment base 14 in the first embodiment can be removably connected to each other, similarly to the second embodiment.

[0128] Furthermore, there may be provided for a further embodiment in which the lever arm 12 and the abutment base 14 in the second embodiment are non-removably connected to each other, similarly to the first embodiment.

[0129] Furthermore, for the first embodiment, the second embodiment described above or the combination thereof, there may be provided for a connection assembly that is removable and rotatable between the lever arm 12 and the abutment base 14 substantially similar to that of the Italian patent application n.102023000012099, in which the abutment base 14 comprises a rack formed by a plurality of transverse teeth which define a corresponding plurality of anchoring seats, open at the top, in which there may be selectively received the first articulation pin 16, so as to change the relative position between said lever arm 12 and said abutment base 14.

[0130] In the light of the above, it is clear that significant results have been achieved, overcoming the drawbacks of the prior art, allowing to obtain a lever tightening device 10 configured to provide a reliable degree of tightening of the sports footwear 1000 even after multiple opening/closing steps.

[0131] As a matter of fact, the construction of the lever tightening device 10 ensures the durability of its components and their operation. In particular, the construction of lever tightening device 10 ensures the durability of the traction cable 102 of the tightening assembly 100 to which it is associated.

[0132] Furthermore, the construction of the lever tightening device 10 ensures an even distribution of the loads induced by tensioning the traction cable in the closing position and in intermediate positions between the opening and closing positions.

[0133] Furthermore, the construction of the lever tightening device 10 provides for a construction that can be easily and extensively adapted at the design stage, depending on the needs.

[0134] Furthermore, the construction of the lever tightening device 10 provides for components whose materials, constructions and combinations thereof can be widely chosen, depending on the needs.

[0135] Furthermore, the construction of the lever tightening device 10 makes the tightening process gradual and convenient.

[0136] Furthermore, the construction of the lever tightening device 10 makes the steps for introducing and/or removing the foot into/from the sports footwear 1000 convenient.

[0137] Naturally, the materials and equipment used to implement the present invention, as well as the shape and size of the individual components, may be the most appropriate depending on the specific requirements.

Claims

1. Lever tightening device (10) adapted to be applied to a sports footwear (1000) and to cooperate with an intermediate portion (102i) of a traction element (102) for releasably tightening said sports footwear (1000) around the foot of the user by tensioning said traction element (102),

said lever tightening device (10) comprising a lever arm (12) connected to an abutment base (14) in a rotatable manner about a first articulation axis (R1) between an opening position wherein said traction element (102) is not tensioned by said lever arm (12), and a closing position wherein said traction element (102) is tensioned by said lever arm (12),

said lever arm (12) comprising a redirecting guide element (18) adapted to couple said traction element (102) to said lever arm (12), wherein said redirecting guide element (18) provides for a redirecting guide seat (18S) configured to slidably receive a redirecting curved section (102r) of said intermediate portion (102i) of the traction element (102),

characterised in that

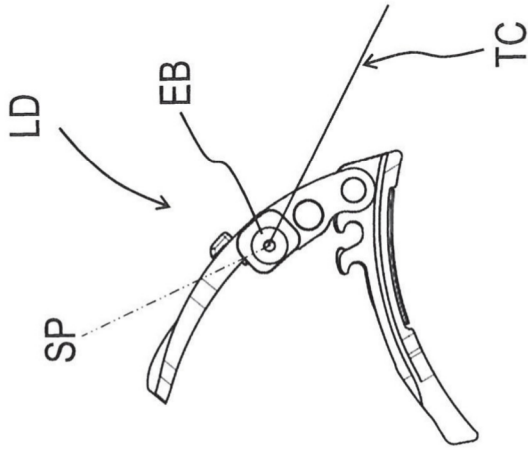
it comprises connection means (20) configured to connect said redirecting guide element (18) to said lever arm (12) in a rotatable manner about a second articulation axis (R2) distinct from said first articulation axis (R1), so as to allow relative rotation of said redirecting guide element (18)

with respect to said lever arm (12) when the latter is moved between said opening and closing positions.

2. The lever tightening device (10) according to claim 1, wherein said connection means (20) are configured to rotatably connect said redirecting guide element (18) to said lever arm (12) so that a longitudinal axis (L18) of said redirecting guide element (18), transversal to said second articulation axis (R2), is adapted to follow remaining parallel to a plane (P1) defined by said redirecting curved section (102r) of the traction element (102) when said lever arm (12) is moved between said opening and closing positions.
3. The lever tightening device (10) according to claim 1 or 2, configured so that said lever arm (12) is arranged between said abutment base (14) and said redirecting guide seat (18S) of said redirecting guide element (18), when said lever arm (12) is in said closed position.
4. The lever tightening device (10) according to any of the preceding claims, configured so that a first distance (D1) of said first articulation axis (R1) from an abutment surface (14U) acting as an interface for abutment with said lever arm (12) on said abutment base (14) is greater than or equal to a second distance (D2) of said redirecting guide seat (18S) from said abutment surface (14U), when said lever arm (12) is in said closing position.
5. The lever tightening device (10) according to any of the preceding claims, configured so that said redirecting guide seat (18S) is arranged between said second articulation axis (R2) and said first articulation axis (R1), when said lever arm (12) is in said closing position.
6. The lever tightening device (10) according to any of the preceding claims, wherein said connection means (20) are further configured to connect said redirecting guide element (18) to said lever arm (12) in a slidable manner along or parallel to a longitudinal extension direction (L12) of said lever arm (12).
7. The lever tightening device (10) according to the preceding claim, wherein said connection means (20) comprise at least an articulation pin (22) connecting said redirecting guide element (18) to said lever arm (12) in a rotatable manner about said second articulation axis (R2), and guide means (12H) slidably engaged by said at least an articulation pin (22).
8. The lever tightening device (10) according to the preceding claim, comprising at least one protruding

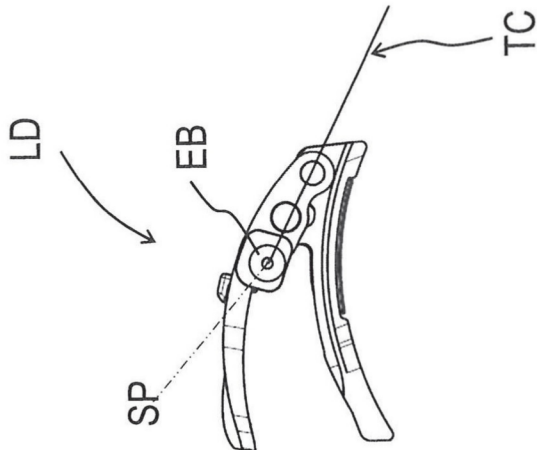
portion (12G) shaped protruding from the top part of said lever arm (12), wherein said protruding portion (12G) comprises said guide means (12H).

9. The lever tightening device (10) according to claim 7 or 8, wherein said guide means (12H) provide for a slot-shape engaged in a rotatable and sliding manner by said at least one articulation pin (22).
10. The lever tightening device (10) according to any of the preceding claims, wherein said redirecting guide element (18) comprises at least one pulley element (24) adapted to at least partially define said redirecting guide seat (18S) and adapted for receiving said redirecting curved section (102r) of said intermediate portion (102i) of the traction element (102).
11. The lever tightening device (10) according to the preceding claim, wherein said redirecting guide element (18) comprises two pulley elements (24).
12. The lever tightening device (10) according to any of the preceding claims, wherein said lever arm (12) is connectable in a removable manner to said abutment base (14).
13. Sports footwear (1000) including a tightening assembly (100) comprising:
 - a traction element (102) adapted to releasably tighten said sports footwear (1000) around the foot of the user by tensioning said traction element (102), and
 - a lever tightening device (10) according to any of the preceding claims.
14. The sports footwear (1000) including a tightening assembly (100) according to the preceding claim, further comprising:
 - a reel-based tightening device (106) configured to tension said traction element (102) by winding.
15. The sports footwear (1000) including a tightening assembly (100) according to the preceding claim, wherein said lever tightening device (10) and said reel-based tightening device (106) are fixed to a same flap (F1) of the sports footwear (1000).



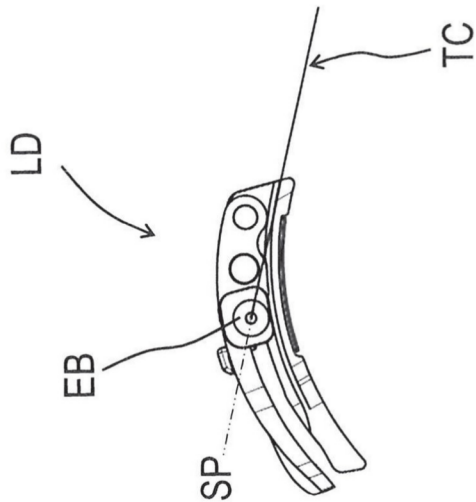
prior art

Fig. 1



prior art

Fig. 2



prior art

Fig. 3

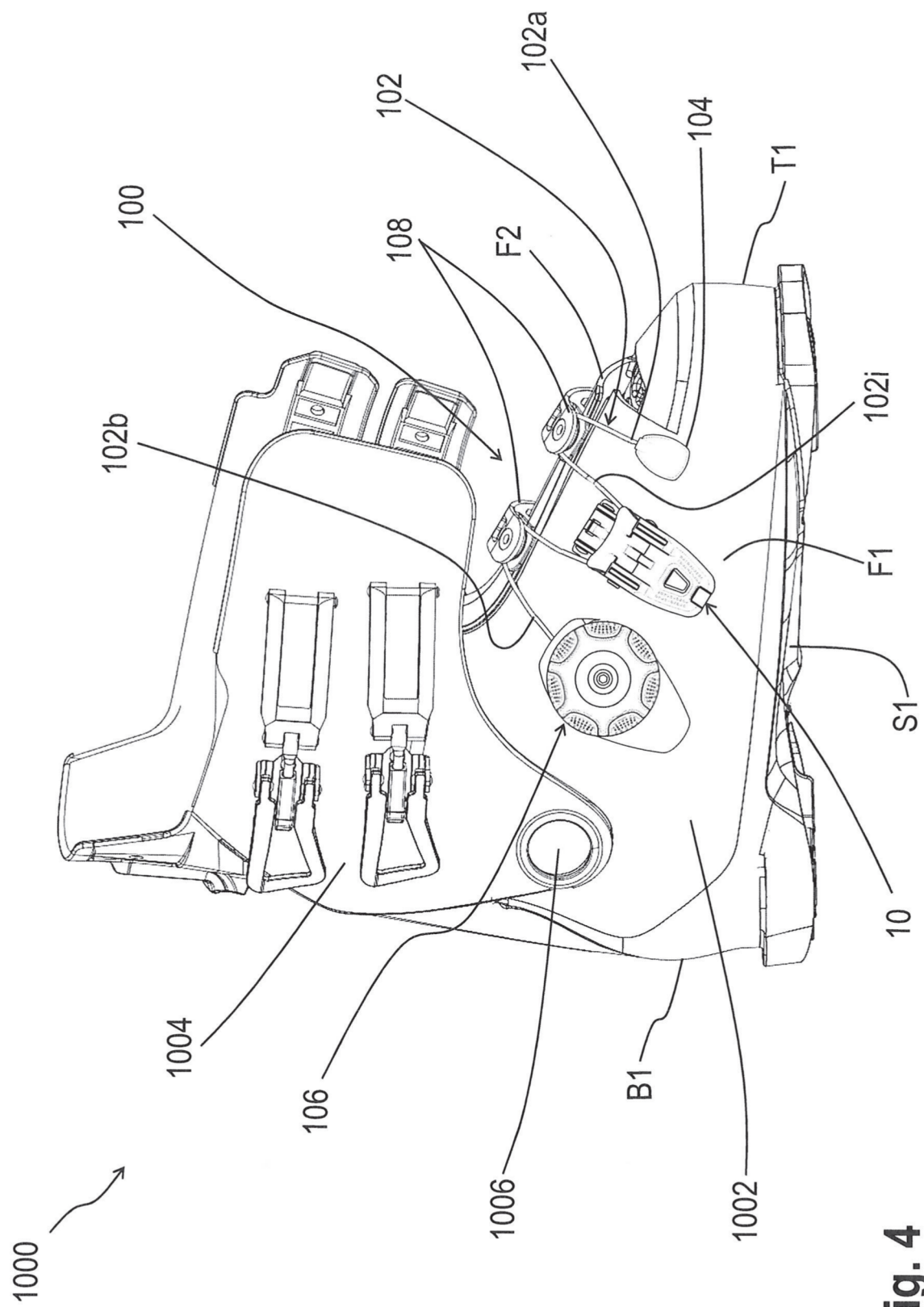


Fig. 4

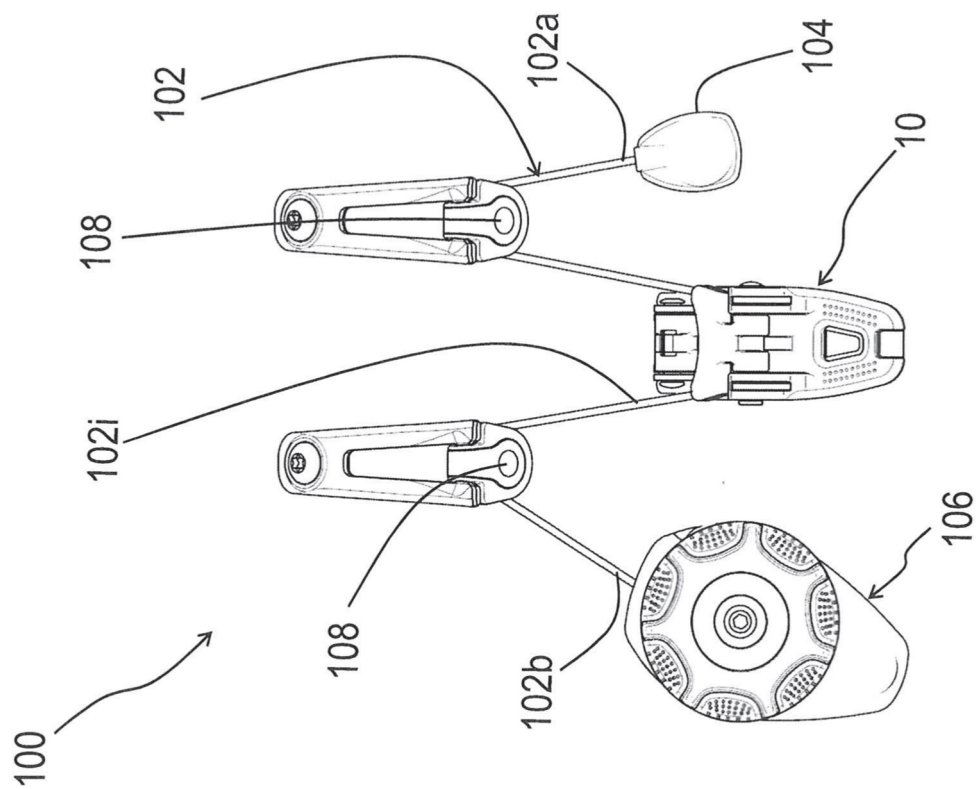


Fig. 5

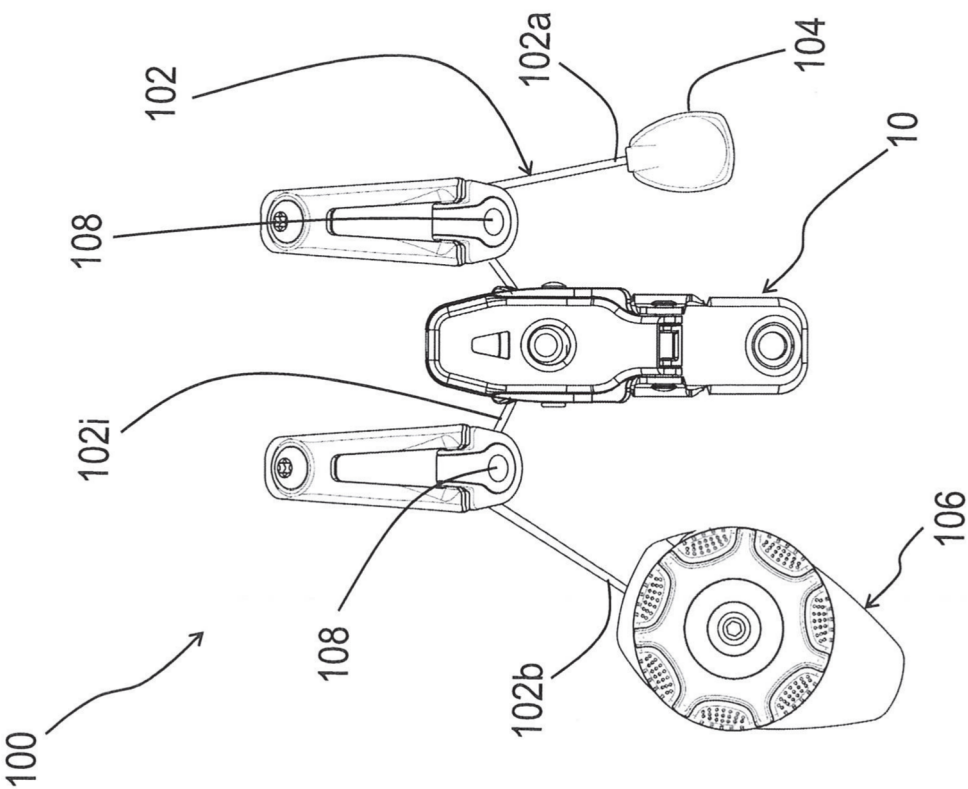


Fig. 6

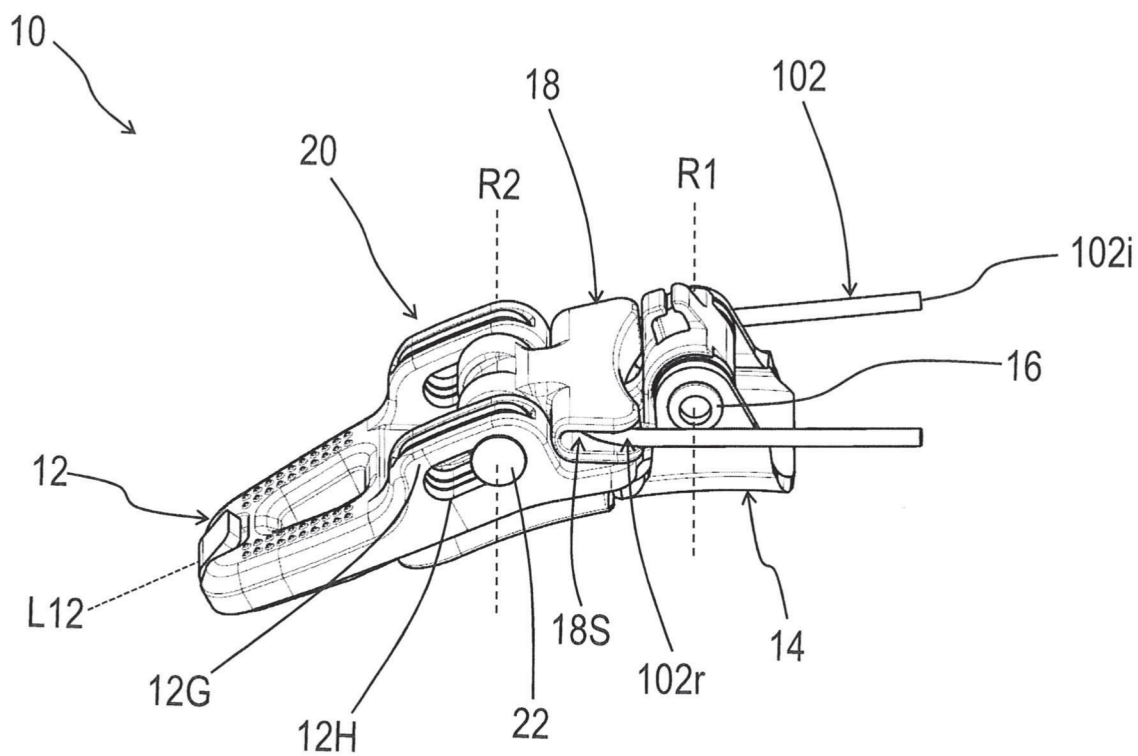


Fig. 7

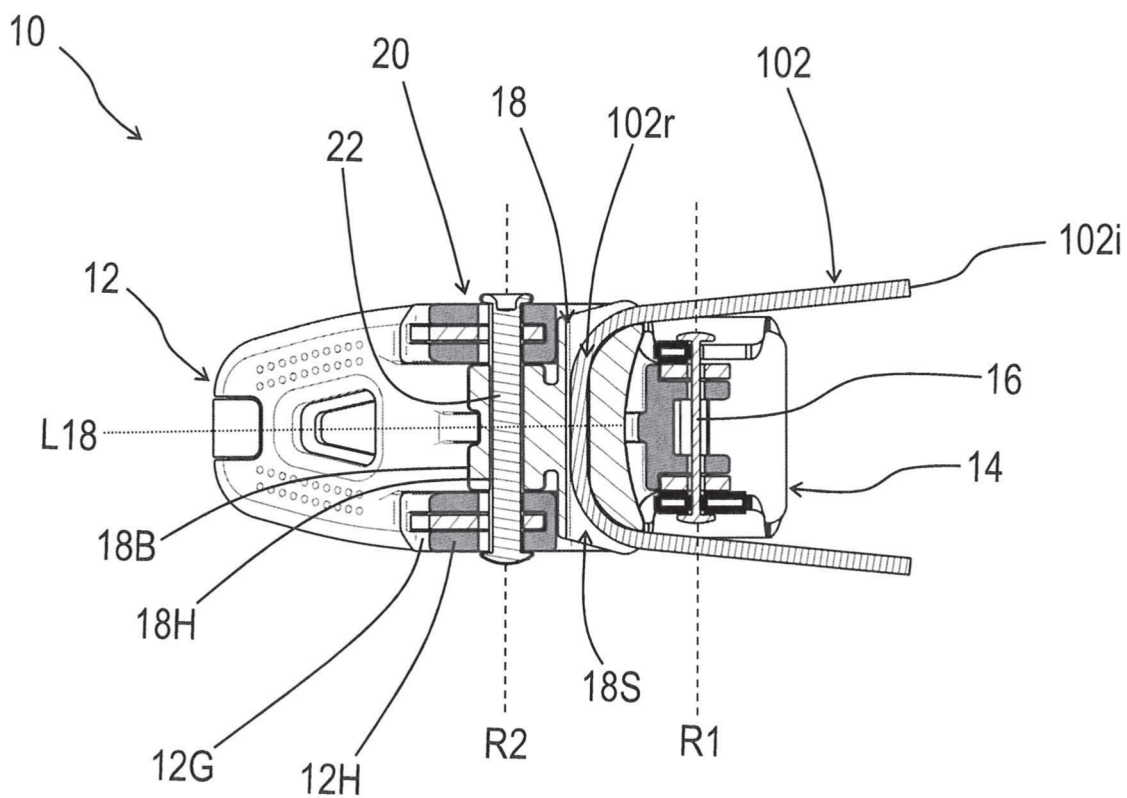


Fig. 8

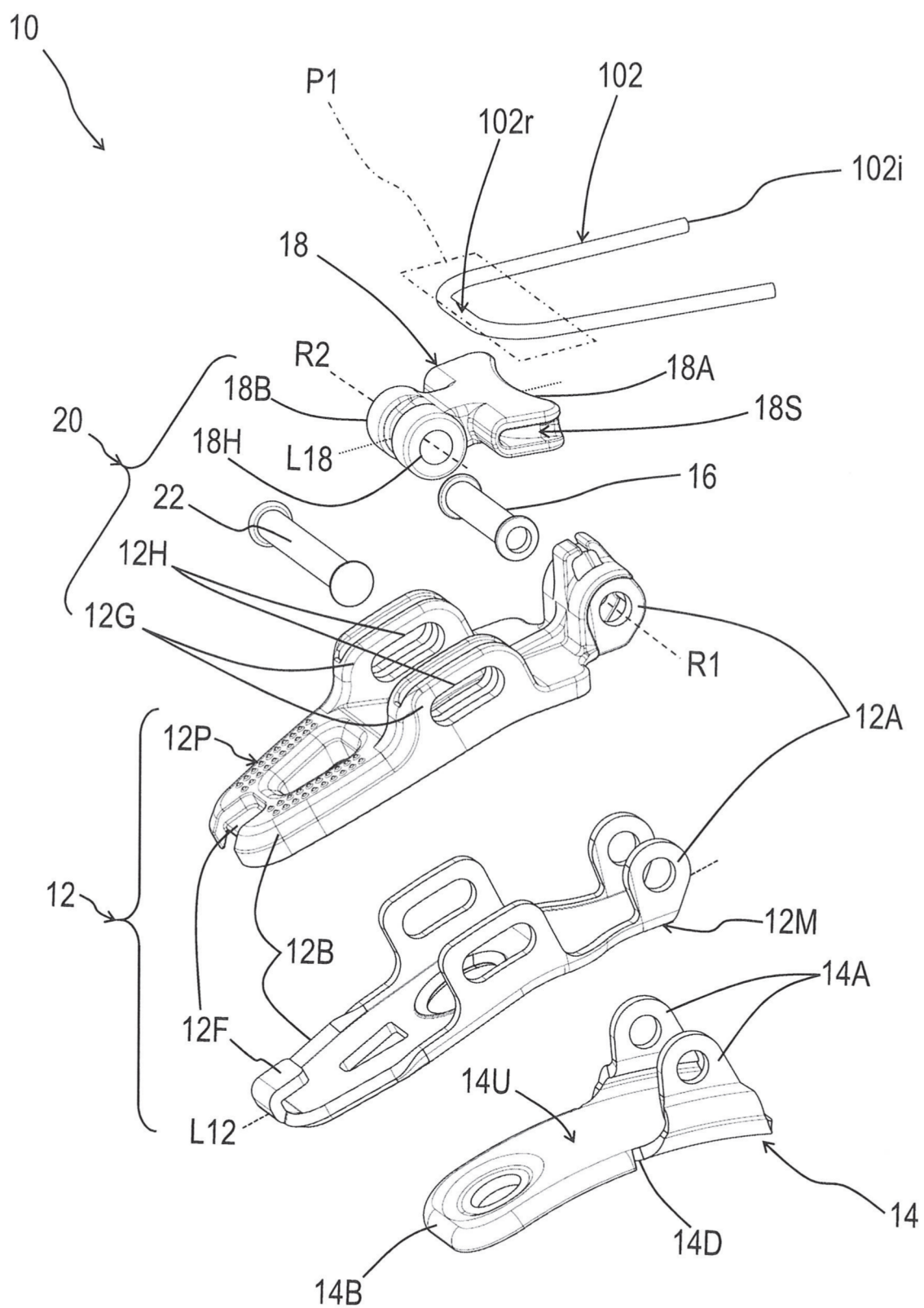


Fig. 9

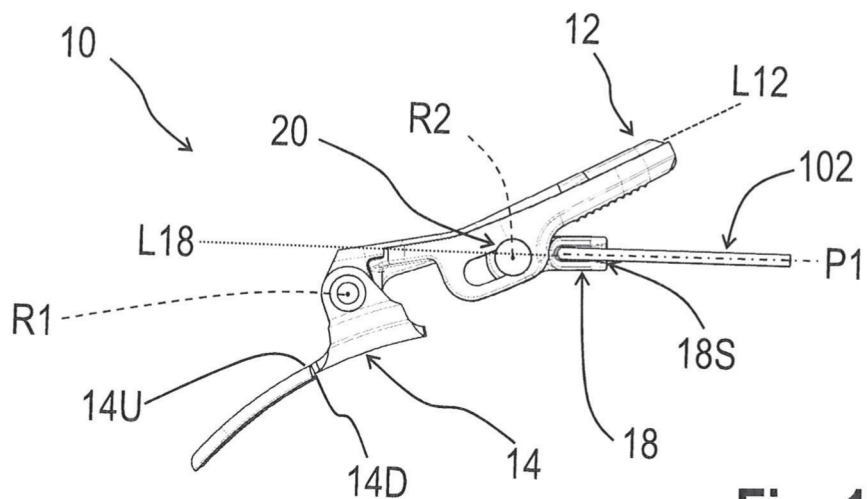


Fig. 10

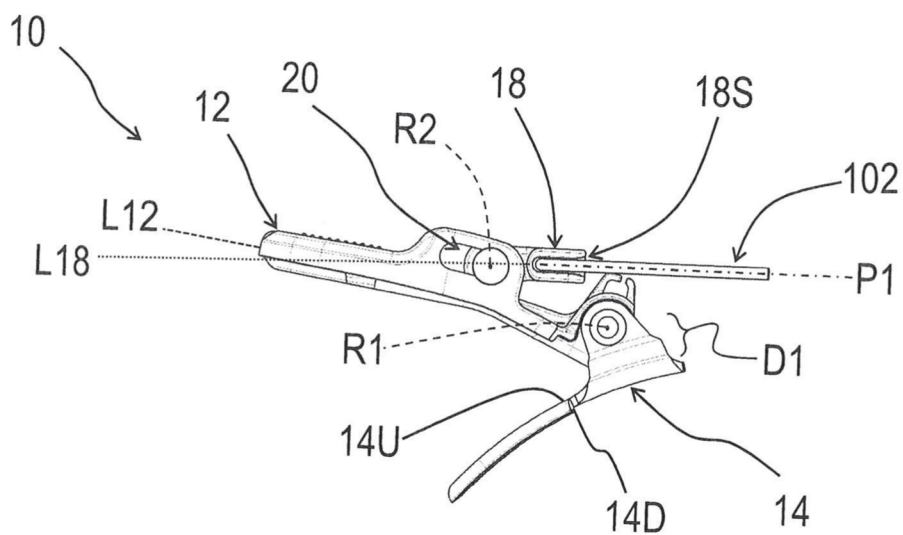


Fig. 11

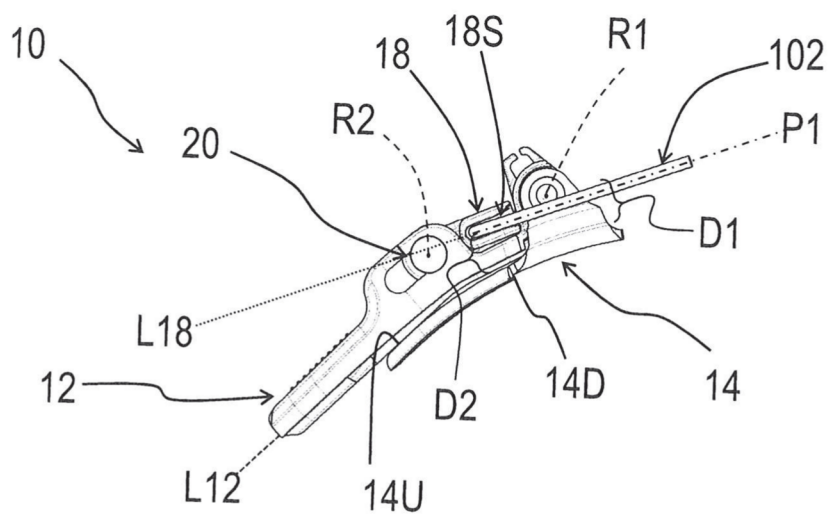


Fig. 12

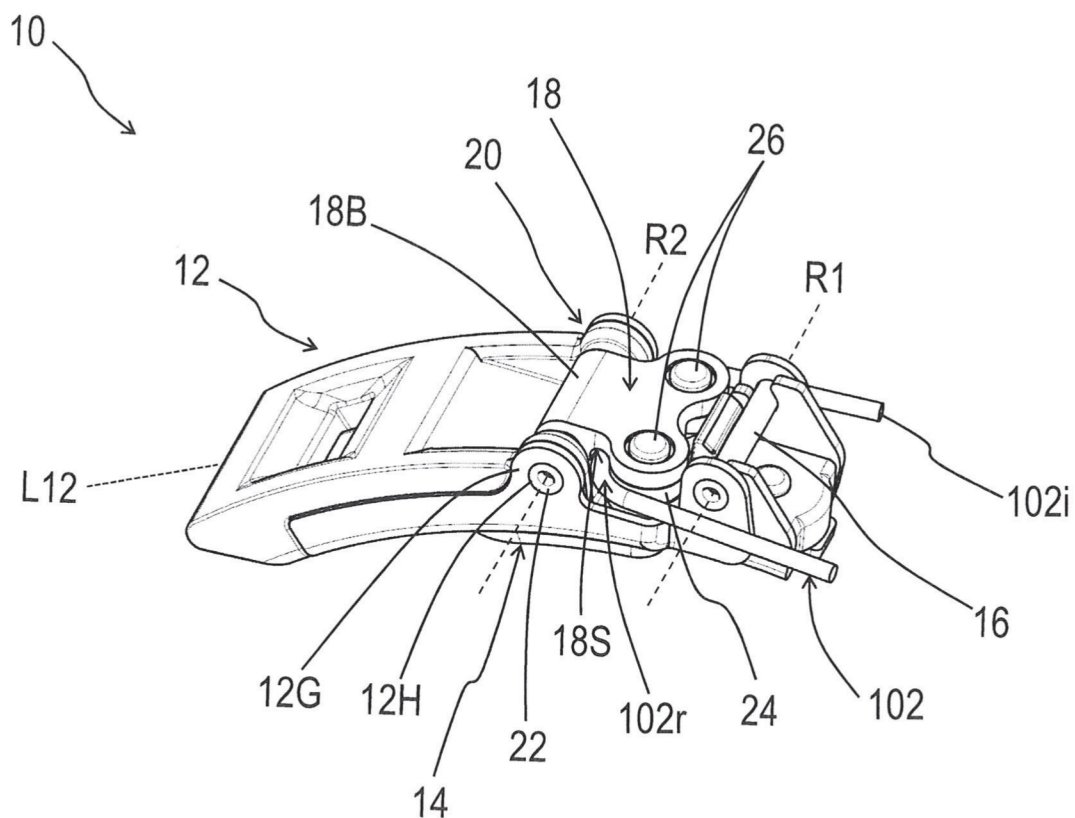


Fig. 13

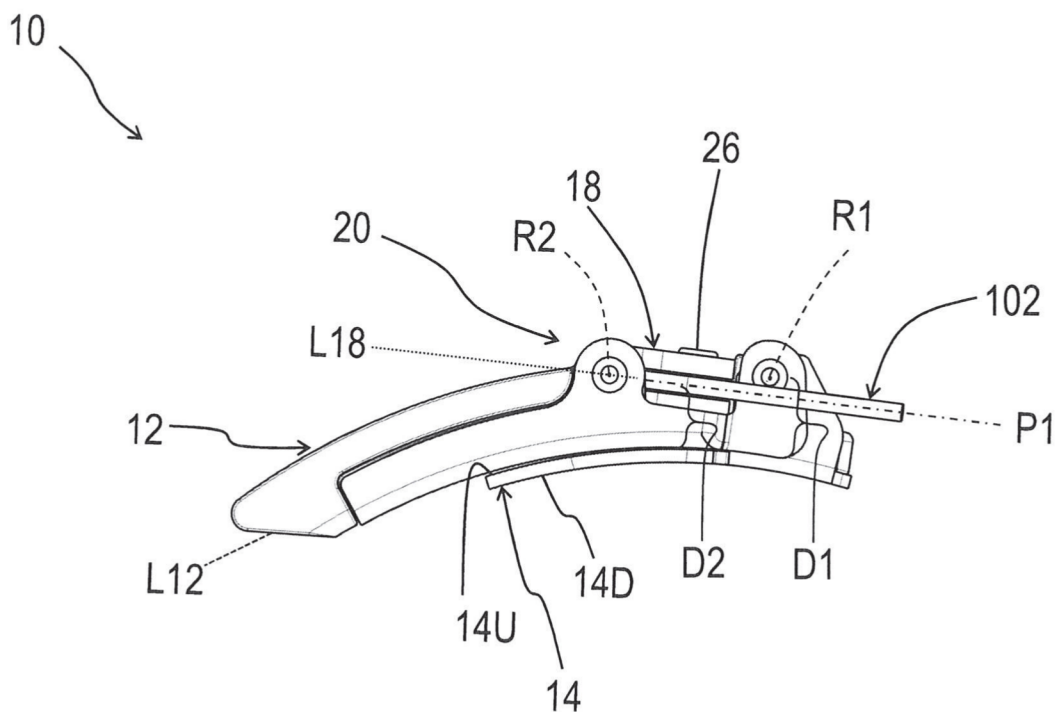


Fig. 14

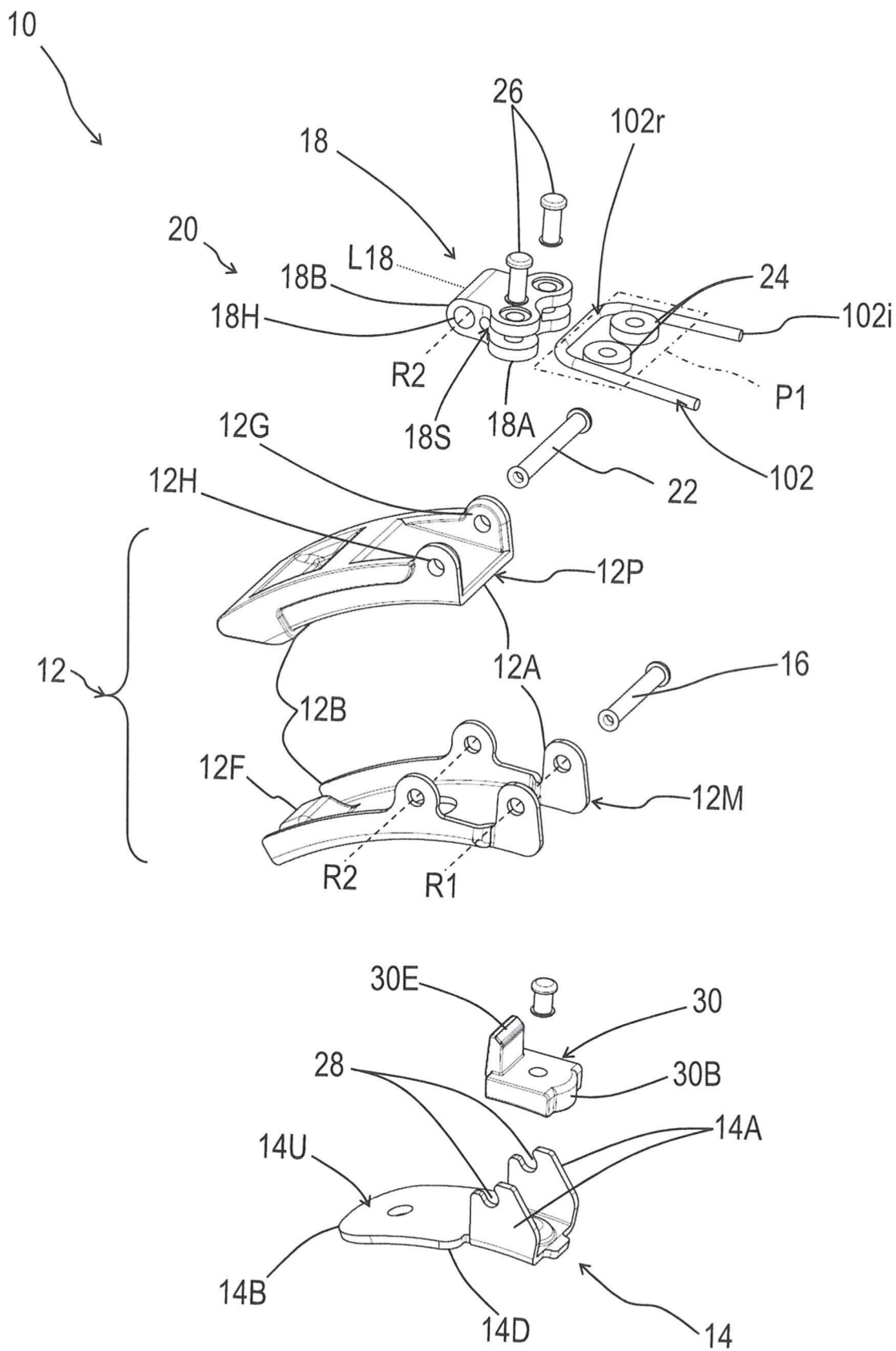


Fig. 15

REFERENCES CITED IN THE DESCRIPTION

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