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(54) **Lace-like closing device for cycling shoe**

(57) The invention concerns a closing and locking mechanism (16) of a lace (12) for a shoe, comprising a lace-winding bush (23), a one-way rotation control device (29, 36, 49, 58) to control the rotation of the lace-winding bush (23) in a first direction and to hold the lace-winding bush (23) against rotation in a second direction opposite to the first direction, and a release device (39, 58, 64, 75, 93) of the lace-winding bush (23) from the control device (29, 36, 49, 58) comprising an actuation element (58) that is actuated through rotation about a rotation axis (55). The invention also concerns a closing device for a shoe, in particular for a cycling shoe, as well as a shoe comprising such a closing device.

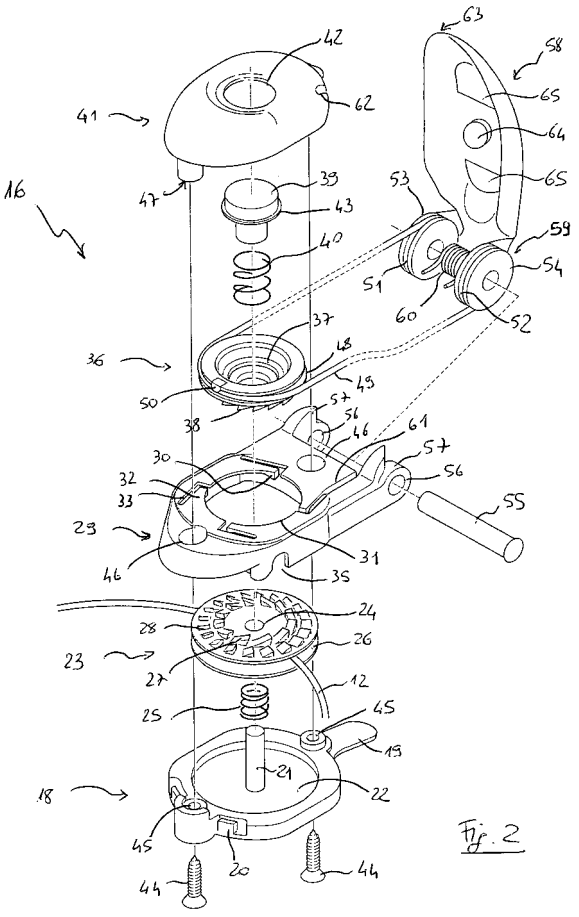

Fig. 2

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Description

[0001] The present invention concerns a lace-like closing device for a shoe, in particular for a cycling shoe, as well as a lace tightening, locking and releasing mechanism thereof, and a cycling shoe comprising such a lace-like closing device.

[0002] Especially in the case of sports shoes, and in particular cycling shoes for racing or road or spinning bicycles, it is appropriate for the shoe to be properly closed around the foot.

[0003] To this purpose, such shoes typically have a closing device comprising a string or lace slidable along the free edges of the side portions of the upper, and a lace tightening, locking and releasing mechanism. The lace tightening, locking and releasing mechanism can comprise a lace-winding bush, a ratchet gear device actuated by hand to control the rotation of the lace-winding bush in a first direction and to hold the lace-winding bush against rotation in a second direction opposite to the first direction, and a release device of the lace-winding bush from the control device. Typically, the release device of the lace-winding bush from the control device consists of a push-button, which must be pressed against the dorsum of the foot.

[0004] The Applicant has now perceived that the action of pressing the release push-button is quite uncomfortable and requires a substantial effort by the cyclist or wearer, especially when he/she wishes to loosen the lace reaching down to the shoe from the seated position on the saddle of a bicycle.

[0005] The technical problem at the basis of the present invention is to avoid the aforementioned drawbacks.

[0006] In a first aspect thereof, the invention concerns a lace tightening, locking and releasing mechanism for a shoe, comprising a lace-winding bush, a one-way rotation control device to control the rotation of the lace-winding bush in a first direction and to hold the lace-winding bush against rotation in a second direction opposite to the first direction, and a release device of the lace-winding bush from the control device, **characterised in that** the release device of the lace-winding bush comprises an actuation element that is actuated through rotation about a rotation axis.

[0007] By providing for an actuation element that is rotationally controlled it is advantageously possible to exploit the reduction ratio of a lever, and at the same time provide a gripping surface that is easier for the cyclist or wearer to identify and grip, even from the seated position on the saddle.

[0008] In some embodiments, the actuation element comprises a cam surface configured to move said lace-winding bush away from the control device while the actuation element is actuated to rotate within a predetermined angular sector of rotation about said rotation axis.

[0009] Preferably, the actuation element further comprises a plane configured to keep said lace-winding bush away from the control device when the actuation element has been actuated to rotate beyond said predetermined angular sector of rotation about said rotation axis.

[0010] In this way, a stable release position of the lace is obtained, which does not need continued actuation by the cyclist or wearer, who therefore has his/her hands free for other operations, for example to totally unwind the lace from the lace-winding bush.

[0011] The actuation element can be distinct from an actuation element of said control device.

[0012] In this case, advantageously each manual actuation element can be configured in the manner most suitable for the movement required for its actuation by the cyclist or wearer. Moreover, it becomes less probable that the cyclist or wearer might accidentally actuate the mechanism to control rotation instead of to release, or vice-versa.

[0013] In an embodiment, the rotation axis of the actuation element is parallel to a rotation axis of the actuation element of said control device.

[0014] In another embodiment, the rotation axis of the actuation element is perpendicular to a rotation axis of the actuation element of said control device.

[0015] In an alternative embodiment, the actuation element is also an actuation element of said control device.

[0016] This provision advantageously allows the pieces to be minimized and thus allows the complexity and the cost of the lace tightening, locking and releasing mechanism to be reduced.

[0017] Preferably, in this case said actuation element is provided with an actuation projection configured to move said lace-winding bush away from the control device while the actuation element is actuated to rotate within a predetermined angular sector of rotation about said rotation axis.

[0018] Preferably, the release device comprises a push-button arranged between said manual actuation element and said lace-winding bush.

[0019] Such a push-button can be made of a different material to the lace-winding bush, for example with low friction coefficient to improve the sliding of the actuation element, and/or lighter.

[0020] Preferably, the tightening, locking and releasing mechanism comprises means for removably fixing to a holder fixed to an upper of a shoe.

[0021] In this way the tightening, locking and releasing mechanism is easy to remove from the shoe, together with the lace, for example when it breaks, or to allow the shoe to be totally opened.

[0022] Preferably, the lace-winding bush comprises means for fixing the two ends of a lace.

[0023] In this way, the ends of the lace are fixed once and for all to the lace tightening, locking and releasing mechanism, which projects therefrom in a closed loop and can be wound around sliding guides provided on the upper of the shoe. Therefore, the ends of the lace are not worn out.

[0024] Alternatively, the lace-winding bush can be con-

figured to house a non-end length of the lace. In this case, two end lengths of the lace project from the tightening, locking and releasing mechanism to be slid along suitable guide means provided on the upper of the shoe and fixed to them or to each other.

[0025] Preferably, the one-way rotation control device of the lace-winding bush is a ratchet gear device.

[0026] More preferably, the ratchet gear device is actuated through a traction cable.

[0027] In a second aspect thereof, the invention concerns a lace-like closing device for a shoe, comprising a lace, at least one lace guide element, and a tightening, locking and releasing mechanism of the lace as described above.

[0028] In a third aspect thereof, the invention concerns a shoe comprising a sole, an upper having a toe portion, a heel portion and two side portions, and a closing device of the side portions as described above.

[0029] Preferably, the sole is configured to support a bicycle cleat.

[0030] Further characteristics and advantages of the invention shall become clearer from the description of some preferred embodiments thereof, made with reference to the attached drawings, wherein:

- fig. 1 is a perspective view of a shoe according to the invention,
- fig. 2 is an exploded view of an embodiment of a lace-tightener of the shoe of fig. 1,
- figs. 3 to 5 are cross-section views of the lace-tightener of fig. 2, in different operating conditions,
- fig. 6 is an exploded view of another embodiment of a lace-tightener of the shoe of fig. 1,
- figs. 7 to 9 are cross-section views of the lace-tightener of fig. 6, in different operating conditions,
- fig. 10 is an exploded view of another embodiment of a lace-tightener of the shoe of fig. 1, and
- figs. 11 to 13 are diagrammatic views that represent the lace-tightener of fig. 10 in cross-section, in different operating conditions.

[0031] Figure 1 is a perspective view of a shoe 1 according to an embodiment of the present invention. The shoe 1 depicted is a left shoe, but those skilled in the art will understand that a right shoe will be its mirror image, and therefore does not need further description, apart from what is indicated hereinafter.

[0032] The depicted shoe 1 is a cycling shoe for a racing, road or spinning bicycle, however the closing device of the invention can have advantageous application in other types of sports shoe. In the case of a cycling shoe for a racing, road or spinning bicycle, the sole (not visible in figure 1) of the shoe is typically rigid or substantially rigid, and is configured to hold a cleat (not visible in figure 1) in a ball region, in other words between the arch of the foot and the toes.

[0033] The shoe 1 comprises, in addition to the sole, an upper 2. The upper 2 is a substantially flexible body shaped around a foot housing cavity 3 defined by the upper 2 itself and by the sole. The upper comprises a toe portion 4, a heel portion 5, two side portions 6, 7, and a tongue 8 located between them.

[0034] The portions 4-8 of the upper 2 described above are made of one or any combination of flexible materials.

[0035] Although not visible in figure 1, typically, the cycling shoe preferably further comprises at least one insole, and a half sole or finishing sole and/or a heel-reinforcement element or stiffener extending under and preferably also around the heel. As an alternative to the half sole and to the heel-reinforcement element, the shoe can comprise an outsole.

[0036] In order to bring together the side portions 6, 7 of the upper 2 and keep them in closed position above the dorsum of the foot, with the interposition of the tongue 8, the shoe 1 comprises closing means.

[0037] A strap 9 that can be folded around a ring 10 and fastened through hook-and-ring fastening means (of the VELCRO™ type) is provided on the upper 2 in a position roughly corresponding to between the dorsum of the foot and the toes. The strap 9 could be absent or, on the other hand, there could be more than one.

[0038] The side portions 6, 7 also have an associated lace-like closing device 11, comprising a lace 12 extending between a first pair of guides 13, 14 fixed to the free edges of the side portions 6, 7 of the upper 2 in facing positions, near to the toe portion 4, a guide 15 fixed to the free edge of the side portion 6 of the upper 2 near to the foot housing cavity 3 and a tightening, locking and releasing mechanism 16 of the lace 12, hereinafter briefly called lace-tightener 16, fixed to the free edge of the side portion 7 of the upper 2 near to the foot housing cavity 3, in a position facing the guide 15.

[0039] The lace 12 more specifically extends around the guides 13, 14 of the pair, crossing over itself, and then extending between the guide 15 and the lace-tightener 16, which preferably also acts as an element for holding the ends of the lace 12, as better explained hereinafter.

[0040] There could also be one or more additional pairs of facing guides along the edges of the side portions 6, 7 of the upper 2, as well as the guides 13, 14 could be absent, for example in the case of a small size shoe 1.

[0041] The lace 12 preferably consists of a filament made of Dyneema® (by DSM - Netherlands). Alternatively, the lace can be made of metal, for example it can consist of spirally wound steel strands (AISI 304), and preferably with a plastic coating having low friction coefficient, for example made of a polymeric material (Nylon PA6). The lace 12 preferably has a circular cross section, however it could have a square or flattened cross section.

The lace 12 can alternatively be an elongated element made of another synthetic or natural material, including leather, plastic without metallic core, string.

[0042] Each guide 13, 14, 15 consists of an element made of a material having a low friction coefficient, for example Nylon PA6/6, having a throat 17 of substantially semicircular shape for receiving the lace 11, with the concavity facing towards the free edge of the side portion 6 or 7, respectively, of the upper 2 to which it is fixed.

[0043] The throat 17 is open on the side of the convexity, opposite to the free edge of the side portion 6 or 7, respectively, of the upper 2, to allow easy insertion/removal of the lace 12 into/from the throat 17 during assembly/disassembly of the closing device 11. Instead of the throat 17 open at the side, each guide 13, 14, 15 could however be provided with a passage closed at the side, into which to thread the lace 12 by one of its ends.

[0044] The radius of curvature of the throat 17 is suitably selected also according to the material making up the lace 12.

[0045] As an alternative to the guides 13, 14 and optionally 15, there can be other guiding and constraining means for the lace 12 to the side portions 6, 7 of the upper 2, such as holes, eyelets or hooks, although they are less preferred since the friction on the lace 12 is greater.

[0046] The guides 13, 14, 15 are typically glued to the upper 2. The lace-tightener 16, on the other hand, is preferably removably fixed, for example snapped, to a holder 180 glued to the upper 2, so as to allow it to be removed, together with the lace 12, for example in the case of the lace-tightener 16 or the lace 12 breaking, or to allow the foot housing cavity 3 to be totally opened, for example to replace an insole (not shown) of the shoe 1 or to gain access to means for fixing the cleat. The holder 180 preferably comprises two guides 181 for the lace 12.

[0047] Figure 2 is an exploded view of a first embodiment of the lace-tightener 16.

[0048] The lace-tightener 16 comprises a base 18 provided with a tongue 19 and hooks 20 for connection to the holder 180 that is glued to the upper 2. Alternatively, the base 18 could be without the connection means 19, 20 and be directly fixed to the upper 2, for example through gluing, the holder 180 being absent. In this case, the base 18 could be provided with guides for the lace 12, similar to the guides 181 of the holder 180.

[0049] A main pin 21 is erected from the base 18, at the centre of a recessed seat 22. A bush 23 for winding the lace 12 is rotatable about the main pin 21, which is inserted in a hole 24 thereof. A first compression spring 25 extends around the main pin 21, arranged between the base 18 and the lace-winding bush 23.

[0050] The lace-winding bush 23 is a disc-shaped element, provided with a peripheral throat 26 sized so as to receive one or more revolutions of the lace 12, as explained more clearly hereinafter. The two ends of the lace 12 are held in the peripheral throat 26, preferably in substantially diametrically opposite positions, with suitable means. For example, each end of the lace 12 can be threaded in a hole extending between the throat 26 and the bottom of the lace-winding bush 23, and then knotted on itself. Alternatively, there can be two cable clamp elements.

[0051] Still alternatively, the lace-winding bush 23 can be provided with a transverse through hole in which to thread a non-end length of the lace 12, the ends of which will then be fixed elsewhere to the upper 2, for example at one of the guides 13, 14, 15.

[0052] The upper face of the bush 23 is provided with two saw tooth toothings, a first toothing 27 extending along a circumference and a second toothing 28 extending along a circumference coaxially external to the first toothing 27. The two toothings 27, 28 could however extend only for one or more lengths of the respective circumferences.

[0053] In figure 2, the two toothings 27, 28 have different tooth height, however this is not strictly necessary.

[0054] The lace-tightener 16 further comprises a retention element 29 resting on the base 18 over - with reference to the orientation of figure 2 - the lace-winding bush 23. The retention element 29 is provided with a series of retention teeth 30, four in the illustrated embodiment, made about a circular hole 31 having a greater diameter than that of the first inner toothing 27 of the bush 23.

[0055] The retention teeth 30 project downwards from tongues 32 defined by L-shaped notches 33 extending from the circular hole 31. The tongues 32 are elastically yielding along a direction substantially parallel to that defined by the main pin 21, and slightly inclined downwards, in the direction of the retention teeth 30. The retention teeth 30 have a shape matching those of the second outer toothing 28 of the bush 23.

[0056] A pair of notches 35, only one of which can be seen in figure 2, is made in the retention element 29 for the passage of the lace 12.

[0057] The lace-tightener 16 further comprises a traction wheel 36. The traction wheel 36 is sized so as to be housed at the circular hole 31 of the retention element 29, and it is provided with a perforated seat 37, having a greater diameter than the diameter of the main pin 21.

[0058] The traction wheel 36 is provided at the bottom with a saw tooth toothing 38, the teeth of which are of a shape matching those of the inner toothing 27 of the lace-winding bush 23.

[0059] The lace-tightener 16 preferably comprises a release push-button 39, housed in the perforated seat 37 of the traction wheel 36, and fitted onto the free end of the main pin 21 with the interposition of a second compression spring 40.

[0060] The lace-tightener 16 further comprises a cover 41, provided with a hole 42 coaxial to the main pin 21. The push-button 39 is held beneath the cover 41, for example through a peripheral rim 43 thereof, and its head projects from the hole 42.

[0061] The base 18, the retention element 29 and the

cover 41 are fixed to each other with suitable means, such as two screws 44 extending in through holes 45 of the base 18, through holes 46 of the retention element 29, and blind holes made in projections 47 of the cover 41, and they hold the lace-winding bush 23, the push-button 39 and the compression springs 25, 40. Alternatively, there can be snap-type fixing means or glueing. Moreover, although in the illustrated embodiment the retention element 29 contributes to defining the outer casing of the lace-tightener 16, together with the base 18 and the cover 41, this is not necessary since the retention element 29 could be internal to a casing only defined by the base 18 and the cover 41.

[0062] The traction wheel 36 is cable-actuated and for this purpose it comprises a peripheral throat 48, in which a length of a traction cable 49 is housed. The traction cable 49, made of entwined strands of steel, is fixed in the peripheral throat 48 through a cable clamp 50. The ends of the traction cable 49 are respectively fixed in peripheral throats 51, 52 of two small wheels 53, 54 rotatable around a pin 55. The pin 55 is fixed, along a direction substantially transverse to the main pin 21, in holes 56 made in projections 57 projecting from the retention element 29 beyond the cover 41.

[0063] A manual actuation element 58 is hinged at a first end 59 thereof about an axis defined by the pin 55, and the small wheels 53, 54 rotate as a unit with it, if they are not made in one piece with it. The first end 59 of the manual actuation element 58 is hooked, through a projection not visible in figure 2, at an intermediate point of a helical torsion spring 60 wound around the pin 55 between the small wheels 53, 54, the ends of which are hooked at or below - with reference to the orientation of figure 2 - the retention element 29.

[0064] Alternatively, the pin 55 and the ends of the torsion spring 60 could be fixed to the base 18.

[0065] The two ends of the traction cable 49 are fixed to the small wheels 53, 54 so that the traction cable 49 winds partially around them in opposite directions, more specifically with reference to the orientation of figure 2, in the clockwise direction around the small wheel 53 and in the anti-clockwise direction around the small wheel 54.

[0066] The retention element 29 is provided with a groove 61 for housing the length of the traction cable 49 extending between the small wheel 53 and the traction wheel 36. A similar groove could be provided for housing the length of the traction cable 49 extending between the small wheel 54 and the traction wheel 36. The cover 41 is provided with two holes 62, only one of which is visible in figure 2, for the passage of the traction cable 49.

[0067] The manual actuation element 58 is provided on its inner face with an actuation projection 64. The manual actuation element 58 can finally be provided with apertures 65.

[0068] As explained more clearly hereinafter, the traction wheel 36 with the traction cable 49 and the manual actuation element 58, and the retention element 29 make up a one-way rotation control device of the lace-winding bush 23.

[0069] With reference also to figure 3, in the rest condition of the lace-tightener 16, the manual actuation element 58 extends above the cover 41 and its second end 63, or free end 63, projects beyond the cover 41 to be grippable with the fingers. In such a rest condition, the actuation projection 64 of the manual actuation element 58 is in a position corresponding to the hole 42 of the cover 41, and therefore to the push-button 39.

[0070] The torsion spring 60, in combination with the compression springs 25 and 40, are sized and preloaded so that, in the rest condition illustrated in figure 3 and with reference to the orientation of such a figure, the manual actuation element 58 is kept above and slightly spaced from the cover 41. The actuation projection 64 is spaced from or just in contact with the push-button 39, without however actuating it. The push-button 39 is therefore kept in a raised position towards the cover 41 by the second compression spring 40. The second compression spring 40 also keeps the traction wheel 36 pushed downwards, towards the retention element 29, while the first compression spring 25 keeps the lace-winding bush 23 pushed upwards, towards the retention element 29 and the traction wheel 36. The inner toothing 27 of the lace-winding bush 23 is therefore engaged with the toothing 38 of the traction wheel 36, while the retention teeth 30 of the retention element 29 are engaged with a corresponding number of teeth of the outer toothing 28 of the lace-winding bush 23. The traction cable 49 is partially wound in the anti-clockwise direction around the small wheel 54 and it is substantially unwound from the small wheel 53. The traction wheel 36 consequently has a predetermined angular position, as does the lace-winding bush 23.

[0071] With reference to figure 4, which illustrates the condition of the active step of actuation in traction of the lace-tightener 16, when the manual actuation element 58 is rotated, gripping its second free end 63 with the fingers, away from the cover 41 against the action of the torsion spring 60, the traction cable 49 winds in the clockwise direction around the small wheel 53 and unwinds from the small wheel 54. Since the traction cable 49 is fixed to the traction wheel 36 through the cable clamp 50, the traction wheel 36 is rotated, in the clockwise direction as seen from above in figure 2. The traction wheel 36 makes the lace-winding bush 23 rotate in the clockwise direction through the engagement of the toothing 38 of the traction wheel 36 with the first inner toothing 27 of the lace-winding bush 23, and thanks to the orientation of the two saw tooth profiles. During the rotation in the clockwise direction of the lace-winding bush 23, the retention teeth 30 of the retention element 29 slide, thanks to the elastic yielding of the tongues 32, over the outer toothing 28 of the lace-winding bush 23, riding over its teeth and going to engage the spaces that are respectively adjacent on each occasion, to lock the lace-winding bush 23 in the new position, which will be rotated by one or more teeth according to the extent of the rotation of

the manual actuation element 58 and/or the number of teeth of the toothings 28, 30. Thanks to the rotation of the lace-winding bush 23, the lace 12 of the shoe 1 is wound by a certain amount in the peripheral throat 26 thereof, thus pulling the guides 13, 14, 15 and therefore the two side portions 6, 7 of the upper 2 towards one another.

[0072] When the manual actuation element 58 is released and taken back towards the rest condition of figure 3 with the fingers and through the action of the torsion spring 60, in a so-called neutral step of the actuation in traction of the lace-tightener 16, the traction cable 49 winds under traction in the anti-clockwise direction around the small wheel 54 and unwinds from the small wheel 53, making the traction wheel 36 rotate in the anti-clockwise direction, as seen from above in figure 2. The toothing 38 of the traction wheel 36 slides over the inner toothing 27 of the lace-winding bush 23, while the lace-winding bush 23 is held still by the engagement of the retention teeth 30 of the retention element 29 with a corresponding number of teeth of the outer toothing 28 of the lace-winding bush 23. The sliding of the toothing 38 of the traction wheel 36 over the inner toothing 27 of the lace-winding bush 23 is permitted by the fact that it is possible for the traction wheel 36 to move upwards, away from the lace-winding bush 23, against the thrust of the second compression spring 40.

[0073] Subsequent actuations of the manual actuation element 58, with oscillating movements around the pin 55, allow other portions of the lace 12 of the shoe 1 to be wound around the lace-winding bush 23, up to what the cyclist or wearer desires.

[0074] With reference to figure 5, which illustrates the release condition of the lace-tightener 16, when the manual actuation element 58 is pushed toward the cover 41 beyond the rest condition, with the fingers and thanks also to the action of the torsion spring 60, and is rotated within an angular sector of rotation (α) about the pin 55, the traction cable 49 unwinds slightly from the small wheel 53 and winds up slightly in the anti-clockwise direction around the small wheel 54, making the traction wheel 36 rotate again in the anti-clockwise direction, as seen from above in figure 2. Like during the neutral step of the actuation in traction of the lace-tightener 16, the toothing 38 of the traction wheel 36 slides over the inner toothing 27 of the lace-winding bush 23, while the lace-winding bush 23 is held still by the engagement of the retention teeth 30 of the retention element 29 with a corresponding number of teeth of the outer toothing 28 of the lace-winding bush 23. Moreover, however, the actuation projection 64 of the manual actuation element 58, through the hole 42 of the cover 41, pushes on the push-button 39 against the action of the second compression spring 40. The push-button 39 in turn pushes the lace-winding bush 23 downwards, towards the base 18 against the action of the first compression spring 25. The lace-winding bush 23 is thus taken away from both the traction wheel 36 and the retention element 29, and therefore both its inner toothing 27 and its outer toothing 28 disengage from the toothing 38 of the traction wheel 36 and from the retention teeth 32 of the retention element 29, respectively. In such a condition, the lace-winding bush 23 is free to rotate to unwind the lace 12 of the shoe 1. When the manual actuation element 58 is released, it goes back into the rest condition of figure 3 described above.

[0075] In practice, in the release condition of the lace-tightener 16, the lace 12 will loosen by itself due to the release of the traction around the lace-winding bush 23. The loosening of the lace 12 can then be facilitated by the movement of the foot in the shoe 1 and/or by pulling it with the fingers gripping it in other points, for example where it crosses over itself between the pair of guides 13, 14 and the guide 15 and the lace-tightener 16.

[0076] The actuation of the push-button 39 is facilitated due to the fact that the manual actuation element 58 acts as a second class of lever. Moreover, the size of the push-button 39 - and consequently of the entire lace-tightener 16 - can be kept as small as desired, as the push-button does not have to be actuated directly by the fingers of the cyclist or wearer. Furthermore, the pressure felt on the dorsum of the foot is lower than a direct actuation of the push-button 39 by the cyclist or wearer.

[0077] It is worthwhile highlighting that the winding and unwinding action of the lace 12 through the lace-tightener 16 takes place in both cases by acting on the single manual actuation element 58, in the two different directions of rotation with respect to the rest condition of the lace-tightener 16. This embodiment of the lace-tightener 16 therefore has the advantage of comprising few pieces.

[0078] Moreover, the lace-tightener 16 can advantageously be identical, both for a left shoe and for a right shoe. Preferably, the holder 180 in the case of a left shoe is the mirror image of the one in the case of a right shoe.

[0079] Figure 6 is an exploded view of a second embodiment of the lace-tightener 70 of the closing device 11 of the shoe 1. The lace-tightener 70 shall only be described hereinafter to the extent to which it differs from the lace-tightener 16.

[0080] In the lace-tightener 70, the manual actuation element 58 lacks the actuation projection 64 and has, instead of such an actuation projection 64 and the optional apertures 65, an opening 71.

[0081] The cover 41 rotationally supports a second manual actuation element 75 pivoted about a pin 72, defining the rotation axis. The pin 72 extends in a through hole 76 of the second manual actuation element 75, and is transverse to the main pin 21, and preferably parallel to the rotation pin 55 of the manual actuation element 58. The pin 72 is more specifically supported in holes 73 of a hemi-collar 74 extending partially around the hole 42, preferably on the side corresponding to the pivot side of the manual actuation element 58.

[0082] Alternatively, the pin 72 can extend in through holes 76 made in suitable flanges made in the second manual actuation element 75, or the second manual ac-

tuation element 75 could provide for two side projections that snap into the holes 73.

[0083] Preferably, the second manual actuation element 75, at a first end 78, has a concavity 79 facing towards the cover 41 in the mounted state, which makes a seat that makes it easier to be gripped with a finger to control into rotation the second manual actuation element 75 itself.

[0084] The second end 80 of the second manual actuation element 75, opposite the first end 78, is configured for the actuation of the push-button 39. More specifically, with reference to figures 7 to 9, wherein the lace-tightener 70 is shown in different operating conditions, said second end 80 has a cam surface 81 extending for a predetermined angular sector α about the pin 72, and a plane 82 adjacent to the cam surface 81, extending for another predetermined angular sector β about the pin 72.

[0085] In the rest condition of the lace-tightener 70 illustrated in figure 7 and with reference to the orientation of such a figure, the second manual actuation element 75 is arranged substantially horizontally, along the cover 41. The beginning of the cam surface 81 projects through the hole 42 of the cover 41 up to a position spaced from or just in contact with the push-button 39, without however actuating it. The lace-winding bush 23 is therefore under the control of the one-way rotation control device described above.

[0086] With reference to figure 8, which illustrates the temporary release condition of the lace-tightener 70, when the second manual actuation element 75 is rotated, by gripping its first end 78 with the finger, away from the cover 41 within the angular sector α, the cam surface 81 acts by pushing on the push-button 39 through the hole 42 of the cover 41. As described above with reference to the first embodiment, the push-button 39 in turn pushes the lace-winding bush 23 downwards, towards the base 18 against the action of the first compression spring 25. The lace-winding bush 23 is thus taken away from both the traction wheel 36 and the retention element 29, and therefore both its inner toothing 27 and its outer toothing 28 disengage from the toothing 38 of the traction wheel 36 and from the retention teeth 32 of the retention element 29, respectively. In such a condition, the lace-winding bush 23 is free to rotate to unwind the lace 12 of the shoe 1. When the second manual actuation element 75 is released, it goes back into the rest condition of figure 7 described above thanks also to the action of the compression spring 40. A torsion spring (not shown) however be provided around the pin 72 to bias the second manual actuation element 75 into the rest condition of figure 7.

[0087] With reference to figure 9, which illustrates the stable release condition of the lace-tightener 70, when the second manual actuation element 75 is rotated, by gripping its first end 78 with the finger, away from the cover 41 beyond the angular sector α, the plane 82 downstream of the cam surface 81 keeps pushing on the push-button 39 through the hole 42 of the cover 41. At the same time, the plane 82 keeps the second manual actuation element 75 in a substantially vertical position, which can be released by the cyclist or wearer. Therefore he/she has both hands free, for example to totally unwind the lace 12 from the lace-winding bush 23.

[0088] It should be noted that the second end 80 of the second manual actuation element 75, on the side of the cam surface 81 opposite the plane 82, has a size, calculated in the radial direction with respect to the pin 72, that is smaller than the size in the radial direction of the beginning of the cam surface 81. In this way, even when the second manual actuation element 75 is rotated towards the cover 41 beyond the rest condition of figure 7, it would not act to push on the push-button 39.

[0089] It should also be noted that the actuation of the second manual actuation element 75 is independent of the actuation of the first manual actuation element 58.

[0090] The lace-tightener 70 can also be advantageously identical, both for a left shoe and for a right shoe, optionally varying its holder 180.

[0091] Figure 10 is an exploded view of a third embodiment of a lace-tightener 90 of the closing device 11 of the shoe 1. The lace-tightener 90 shall only be described hereinafter to the extent to which it differs from the lace-tightener 70 of the second embodiment.

[0092] In the lace-tightener 90, the cover 41 rotationally supports a second manual actuation element 93 pivoted, at a first end 94 thereof, about a pin 91, defining the rotation axis. The pin 91 extends in a hole 95 made on the second manual actuation element 93 (figures 11-13). The pin 91 is parallel to the main pin 21, extending in a hole 92 made in the cover 41 preferably on the opposite side of the hole 42 with respect to the pivot side of the manual actuation element 58, however it could also extend anywhere around the hole 42.

[0093] The second free end 96 of the second manual actuation element 93 has a portion 97 for gripping with a finger, projecting upwards, away from the cover 41, to control into rotation the second manual actuation element 93 itself.

[0094] The bottom face 98 of the second manual actuation element 93, facing towards the cover 41 in the mounted state, is configured to actuate the push-button 39. More specifically, with reference also to figures 11-13, wherein the lace-tightener 90 is diagrammatically shown in different operating conditions, the bottom face 98 of the second manual actuation element 93 has a first plane 99 extending from its first end 94 along an end portion of the manual actuation element 93, a cam surface 100 extending along a portion adjacent to the plane 99, and a second plane 101 extending from the cam surface to the second end 96 of the manual actuation element 93.

[0095] In the rest condition of the lace-tightener 90 illustrated in figure 11 and with reference to the orientation of such a figure, the second manual actuation element 93 is arranged in an angular position of rotation about the pin 91 such that its second plane 101 is at the hole 42 of the cover, spaced from or just in contact with the push-button 39, without however actuating it. The lace-

winding bush 23 is therefore under the control of the one-way rotation control device described above.

[0096] With reference to figure 12, which illustrates the temporary release condition of the lace-tightener 90, when the second manual actuation element 93 is rotated within an angular sector of rotation α, by gripping its second end 96 with the finger, the cam surface 100 acts by pushing on the push-button 39 through the hole 42 of the cover 41. As described above with reference to the first and second embodiments, the push-button 39 in turn pushes the lace-winding bush 23 downwards, towards the base 18 against the action of the first compression spring 25. The lace-winding bush 23 is thus taken away from both the traction wheel 36 and the retention element 29, and therefore both its inner toothing 27 and its outer toothing 28 disengage from the toothing 38 of the traction wheel 36 and from the retention teeth 32 of the retention element 29, respectively. In such a condition, the lace-winding bush 23 is free to rotate to unwind the lace 12 of the shoe 1. When the second manual actuation element 93 is released, it goes back into the rest condition of figure 11 described above, also thanks to the action of the compression spring 40. A torsion spring (not shown) can however be provided around the pin 91 to bias the second manual actuation element 93 into the rest condition of figure 12.

[0097] With reference to figure 13, which illustrates the stable release condition of the lace-tightener 90, when the second manual actuation element 93 is rotated beyond the angular sector α, by gripping its second end 96 with the finger, the first plane 99 keeps pushing on the push-button 39 through the hole 42 of the cover 41. At the same time, the first plane 99 keeps the second manual actuation element 93 in rotated position, which can be released by the cyclist or wearer, who therefore has both hands free, for example to totally unwind the lace 12 from the lace-winding bush 23.

[0098] It should be noted that in the illustrated embodiment, the cam surface 100 is shown as comprising two ramps and a small intermediate plane, however alternatively it could comprise a single ramp or a single curved surface or two curved surfaces with an intermediate plane.

[0099] An abutment surface (not shown) can be provided to prevent the rotation of the second manual actuation element 93 beyond the angular sector $\alpha+\beta$.

[0100] It should be noted that also in this embodiment, the actuation of the second manual actuation element 93 is independent of the actuation of the first manual actuation element 58.

[0101] In the various embodiments, the push-button 39 could be absent, the actuation projection 64 of the manual actuation element 58, the cam surface 81 or 100, respectively, and the plane 82 or 99, respectively, acting directly to push on the lace-winding bush 23. In this case, the lace-winding bush 23 will preferably have a pin projecting upwards, through the hole 37 of the traction wheel 36 towards the cover 41, provided with a blind hole to receive the main pin 21 and acting as a guide for the second compression spring 40.

[0102] In the second and third embodiments described above, the second manual actuation element 75, 93 could be pivoted in different positions with respect to the manual actuation end and to the portion acting on the push-button 39.

[0103] In the various embodiments described, the one-way rotation control device for tightening the lace 12 can undergo various modifications. For example, the traction wheel 36, instead of being controlled through the traction cable 49, could be controlled through gears.

[0104] Moreover, the one-way rotation control device does not necessarily have to be of the ratchet gear type, rather it can be any system configured to control the rotation of the lace-winding bush 23 in a first direction and to hold the lace-winding bush 23 against rotation in a second direction opposite to the first direction. Just by way of an example, there could be a ball-type system arranged between discs provided with grooves for controlled rolling of the balls.

[0105] The lace-tightener 90 can be made identically, both for a left shoe and for a right shoe, apart from optionally having a mirror-image holder 180 in the two cases. Preferably, however, its second manual actuation element 93 will also be the mirror image in the two cases, and mounted for rotation in opposite directions, so as to be able to be actuated more easily. Preferably, the direction of rotation to release the lace will be clockwise as seen from above for a right shoe, anti-clockwise for a left shoe.

Claims

1. Tightening, locking and releasing mechanism (16, 70, 90) of a lace (12) for a shoe (1), comprising a lace-winding bush (23), a one-way rotation control device (29, 36, 49, 58) to control the rotation of the lace-winding bush (23) in a first direction and to hold the lace-winding bush (23) against rotation in a second direction opposite to the first direction, and a release device (39, 58, 64, 75, 93) of the lace-winding bush (23) from the control device (27-29, 36, 49, 58), **characterised in that** the release mechanism (39, 58, 64, 75, 93) of the lace-winding bush (23) comprises an actuation element (58, 75, 93) that is actuated through rotation about a rotation axis (55, 72, 91).

2. Mechanism (70, 90) according to claim 1, wherein the actuation element (75, 93) comprises a cam surface (81, 100) configured to move said lace-winding bush (23) away from the control device (29, 36, 49, 58) while the actuation element (75, 93) is actuated to rotate within a predetermined angular sector (α) of predetermined rotation about said rotation axis (72, 91).

3. Mechanism (70, 90) according to claim 2, wherein the actuation element (75, 93) further comprises a plane (82, 99) configured to keep said lace-winding bush (23) away from the control device (29, 36, 49, 58) when the actuation element (75, 93) has been actuated to rotate beyond said predetermined angular sector (α) of rotation about said rotation axis (72, 91).

4. Mechanism (70, 90) according to claim 2 or 3, wherein the actuation element (75, 93) is distinct from an actuation element (58) of said control device (29, 36, 49, 58).

5. Mechanism (70) according to claim 4, wherein the rotation axis (72) of the actuation element (75) is parallel to a rotation axis (55) of the actuation element (58) of said control device (27-29, 36, 49, 58).

6. Mechanism (90) according to claim 4, wherein the rotation pin (91) of the actuation element (93) is perpendicular to a rotation axis (55) of the actuation element (58) of said control device (27-29, 36, 49, 58).

7. Mechanism (70, 90) according to claim 1, wherein the actuation element (58) is also an actuation element (58) of said control device (27-29, 36, 49, 58).

8. Mechanism (70, 90) according to claim 7, wherein said actuation element (58) is provided with an actuation projection (64) configured to move said lace-winding bush (23) away from the control device (29, 36, 49, 58) while the actuation element (58) is actuated to rotate within a predetermined angular sector (α) of rotation about said rotation axis (55).

9. Mechanism (70, 90) according to any of the previous claims, wherein the release device (39, 58, 64, 75, 93) comprises a push-button (39) arranged between said actuation element (58, 75, 93) and said lace-winding bush (23).

10. Mechanism (70, 90) according to any of the previous claims, comprising means (19, 20) for removably fixing to a holder (180) fixed to an upper (2) of a shoe (1).

11. Mechanism (70, 90) according to any of the previous claims, wherein the lace-winding bush (23) comprises means for fixing the two ends of a lace (12).

12. Mechanism (70, 90) according to any of the previous claims, wherein the one-way rotation control device (29, 36, 49, 58) is a ratchet gear device (29, 36, 49, 58).

13. Mechanism (70, 90) according to claim 12, wherein the ratchet gear device (29, 36, 49, 58) is actuated through a traction cable (49).

14. Lace-like closing device (11) for a shoe (1), comprising a lace (12), at least one lace guide element (13, 14, 15), and a tightening, locking and releasing mechanism (16, 70, 90) of the lace (12) according to any of the previous claims.

15. Shoe (1) comprising a sole, an upper (2) having a toe portion (4), a heel portion (5) and two side portions (6, 7), and a device (11) for closing the side portions (6, 7) according to claim 14.

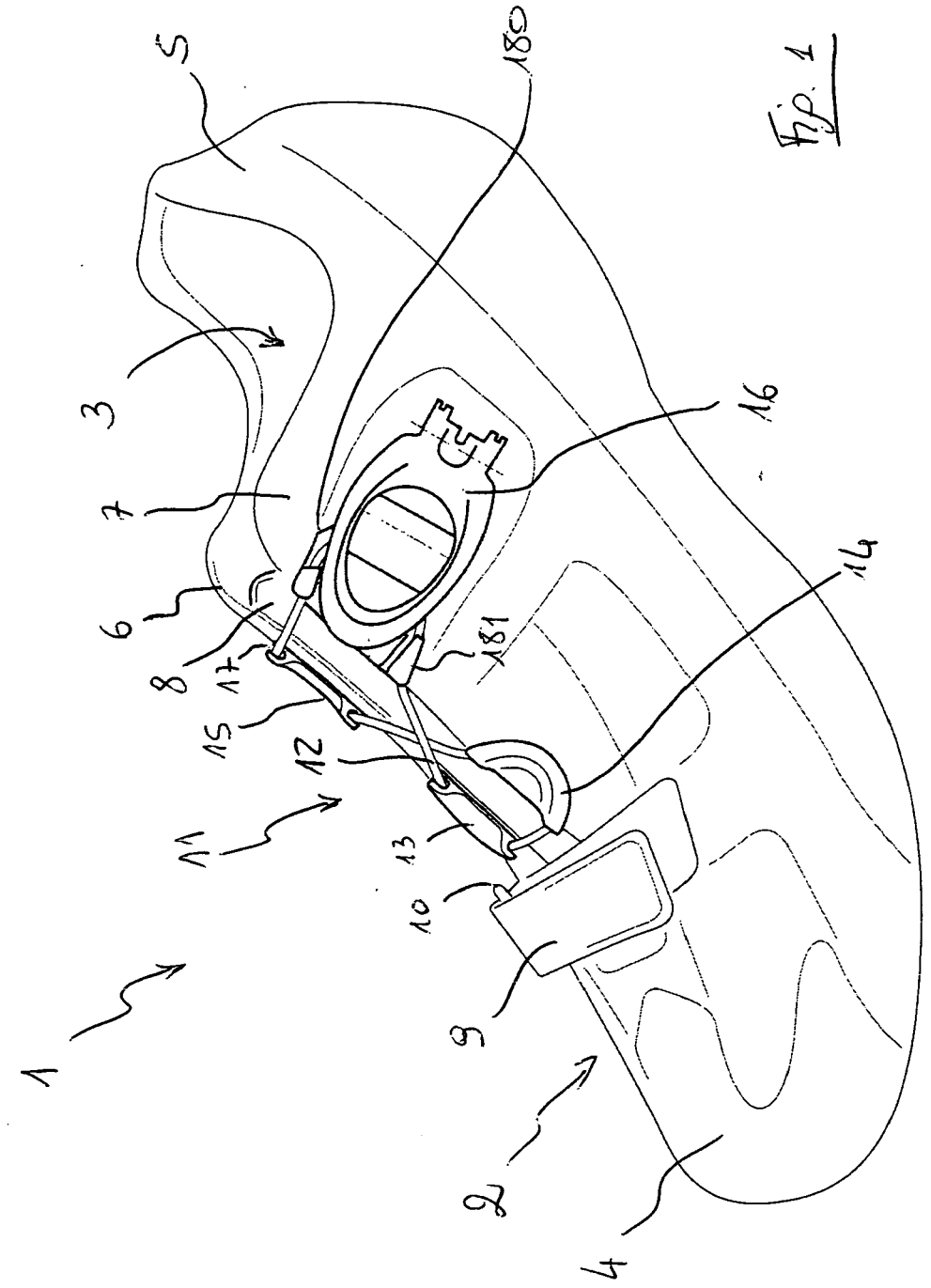

Fig. 1

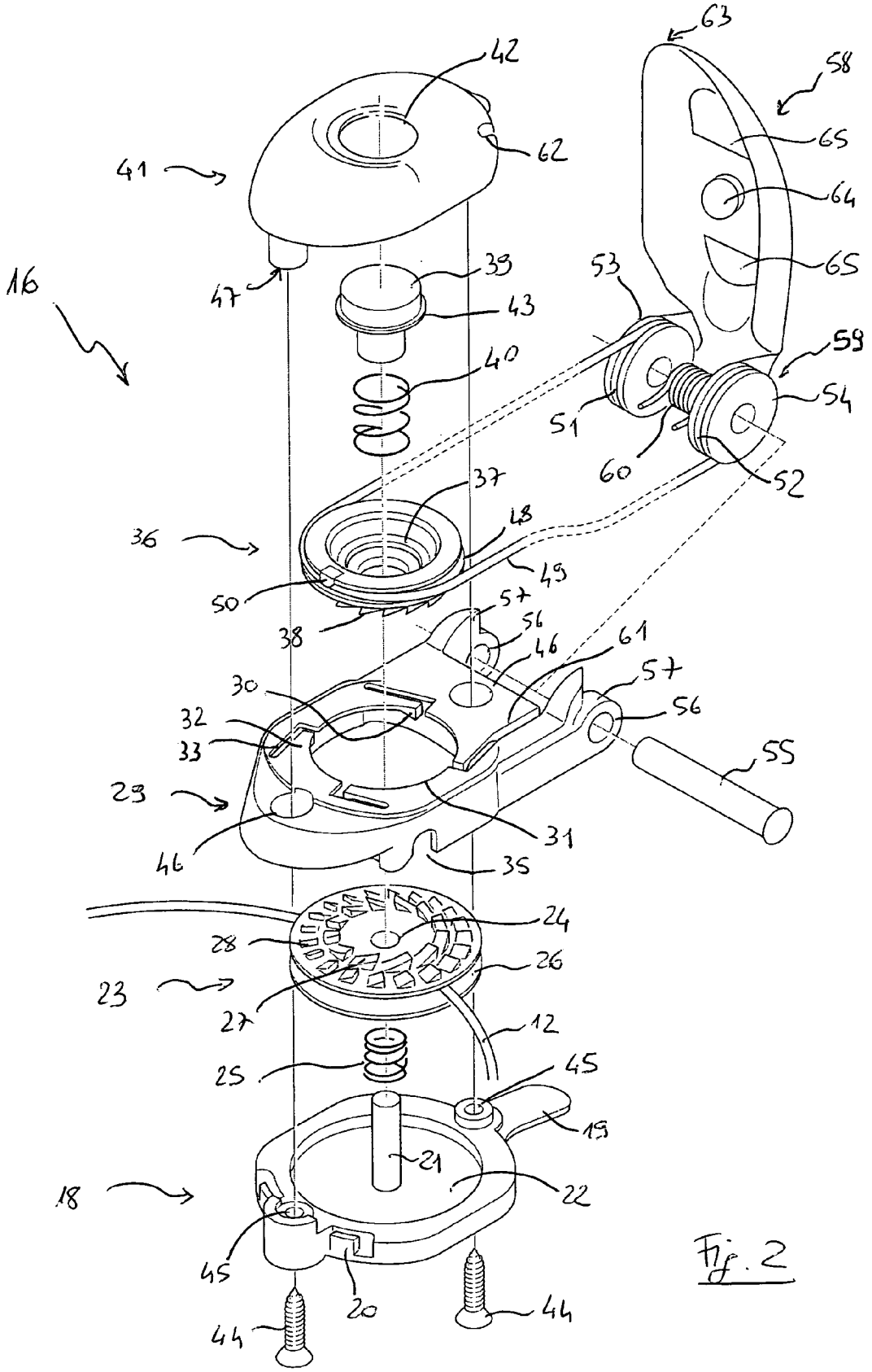
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Fig. 2

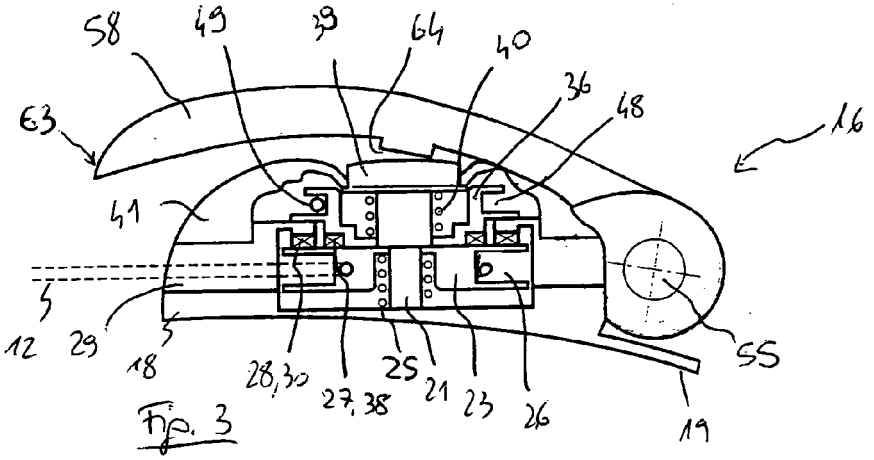

Fig. 3

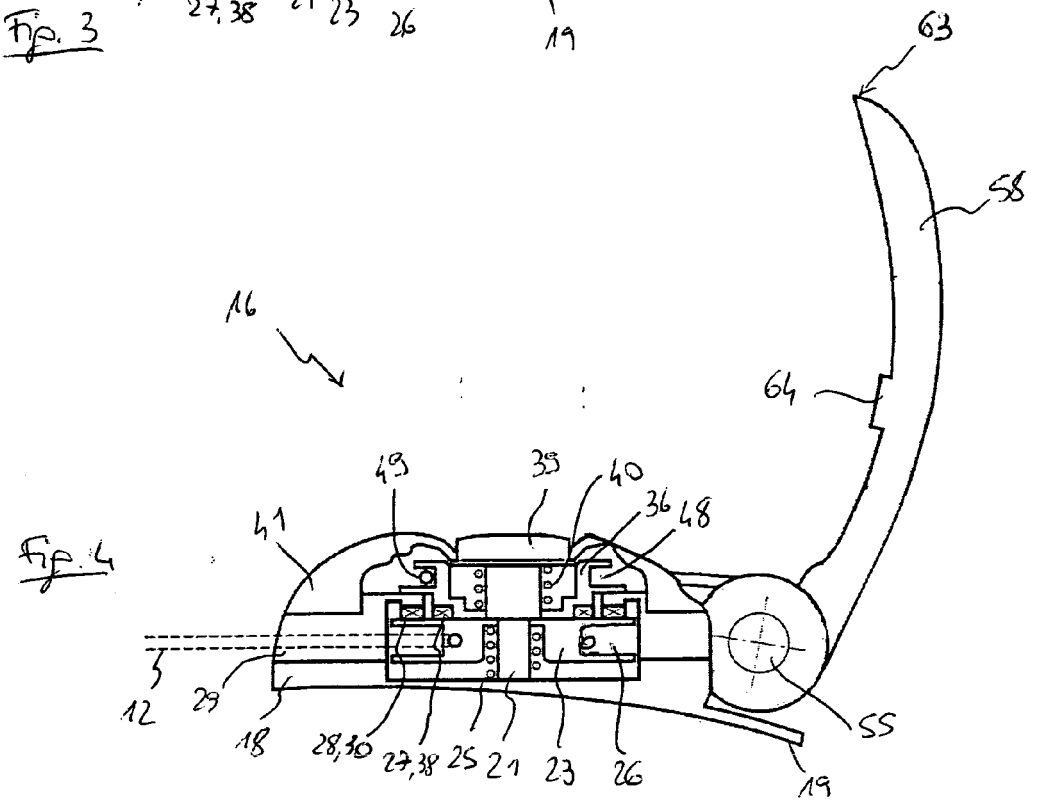

Fig. 4

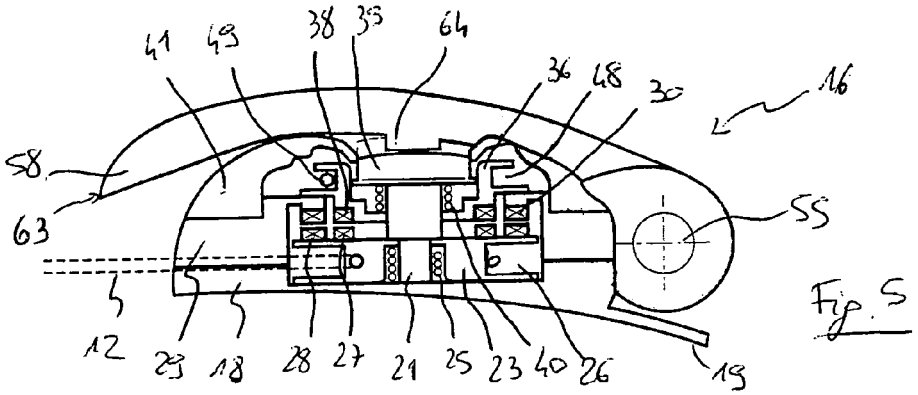

Fig. 5

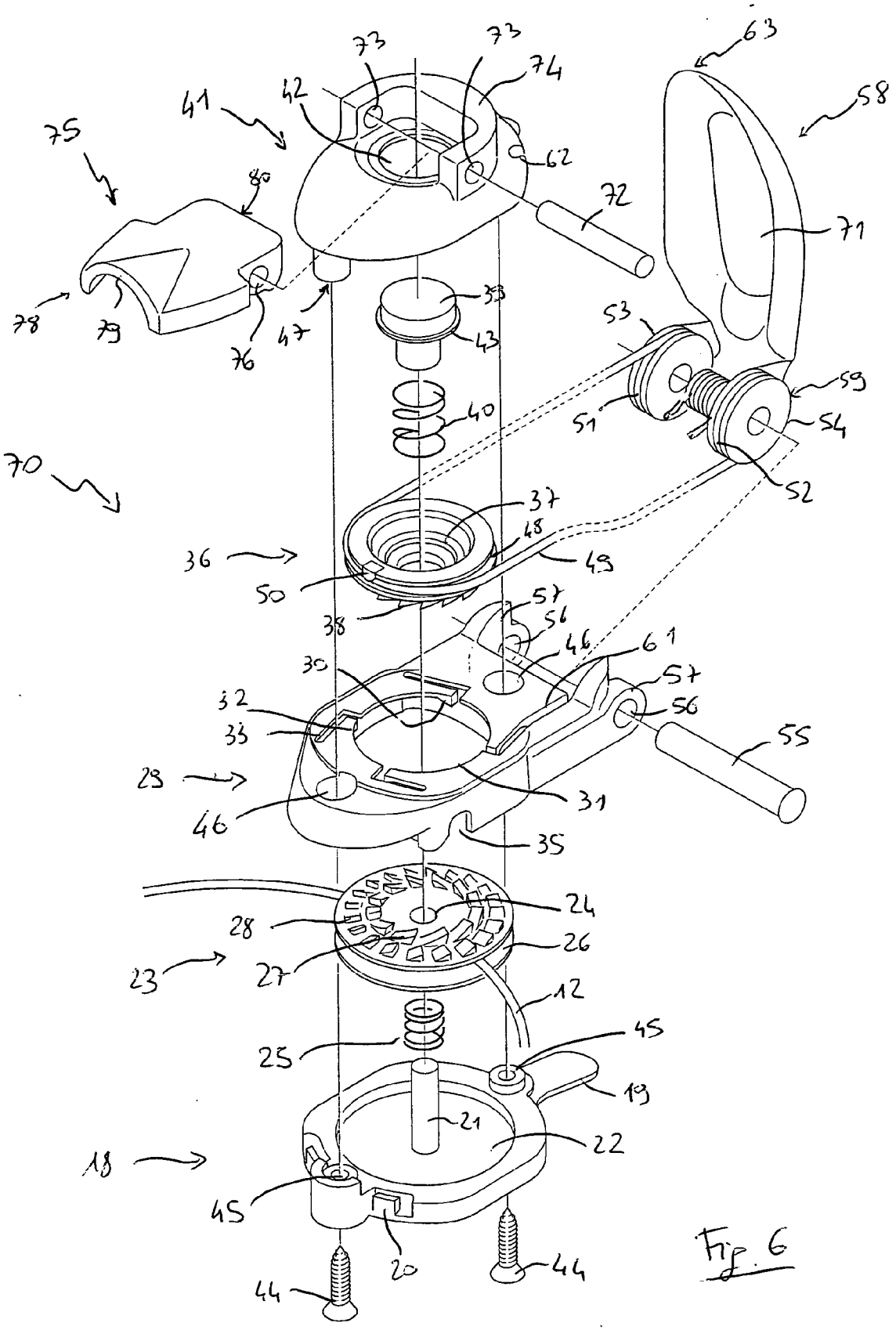
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Fig. 6

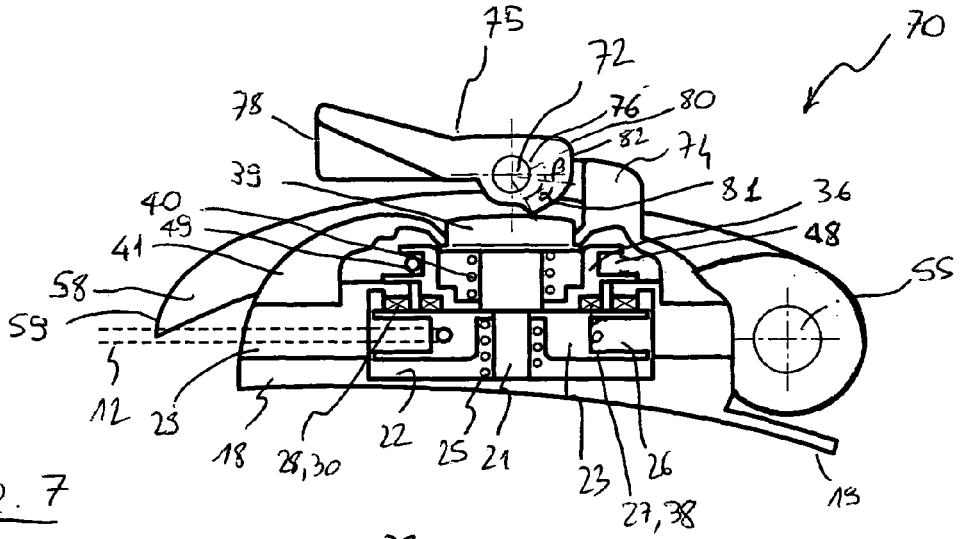

Fig. 7

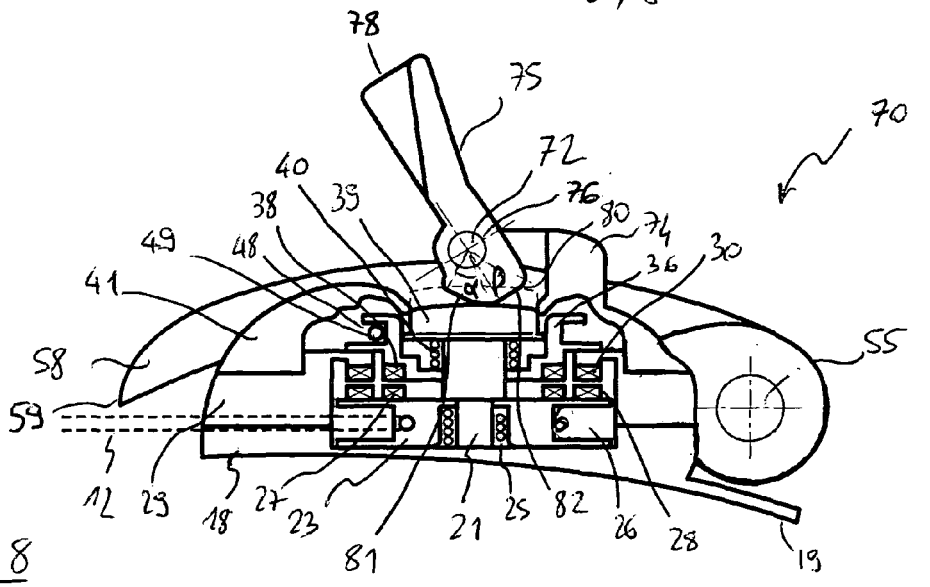

Fig. 8

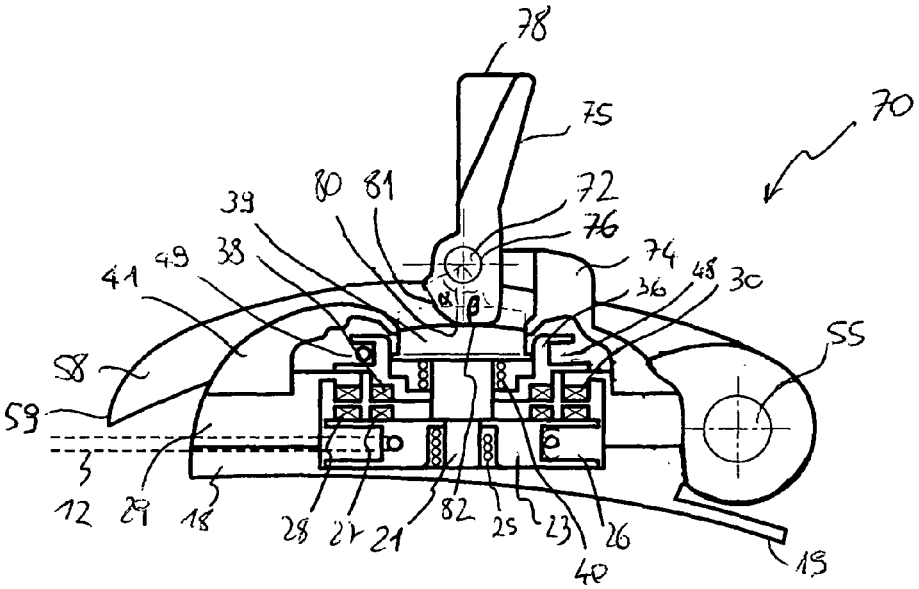

Fig. 9

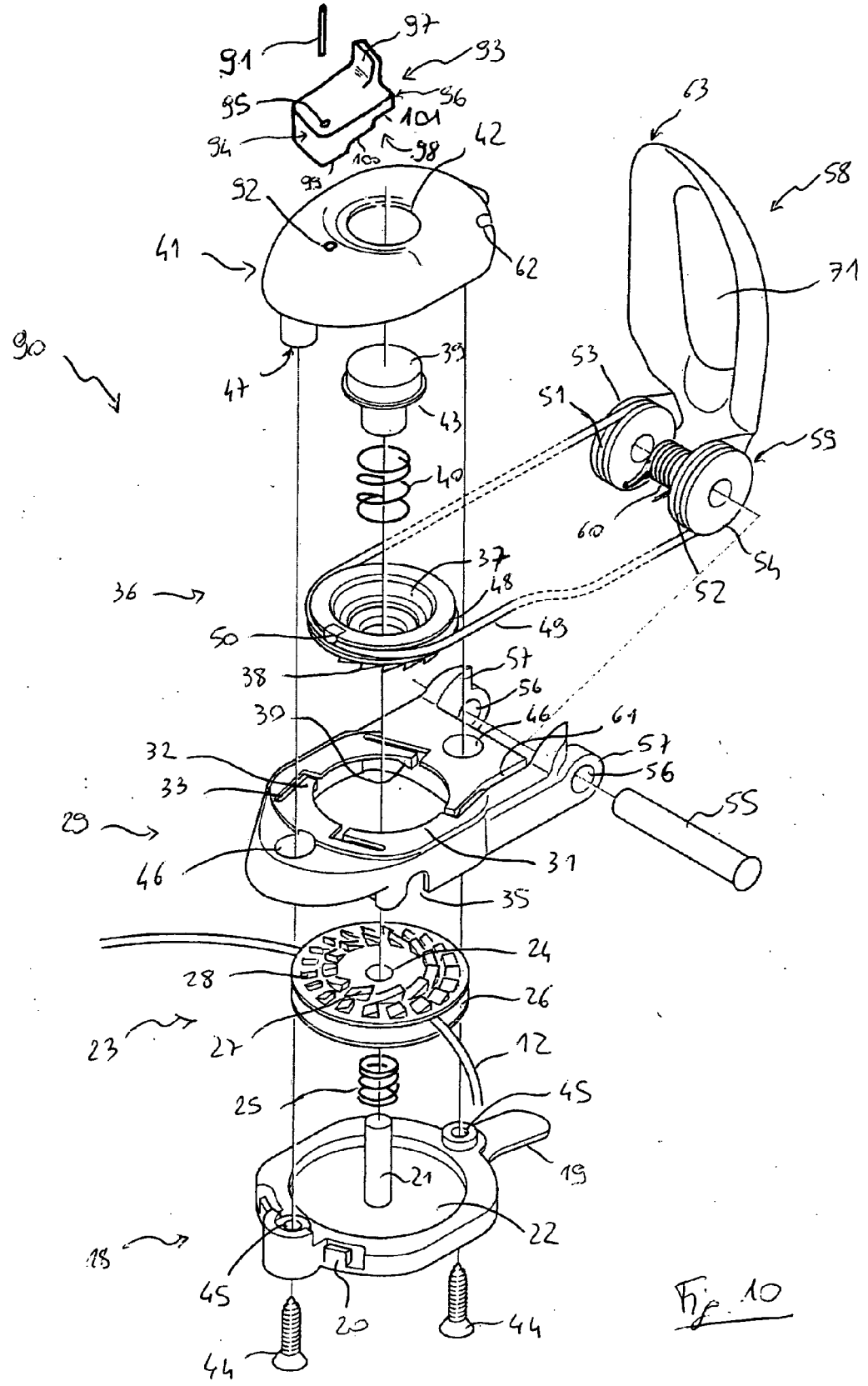
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Fig. 10

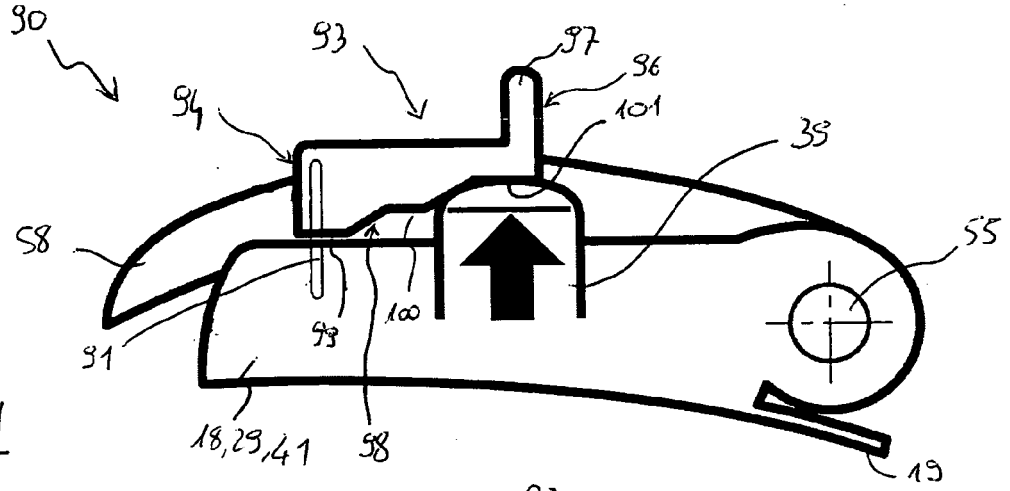

Fig. 11

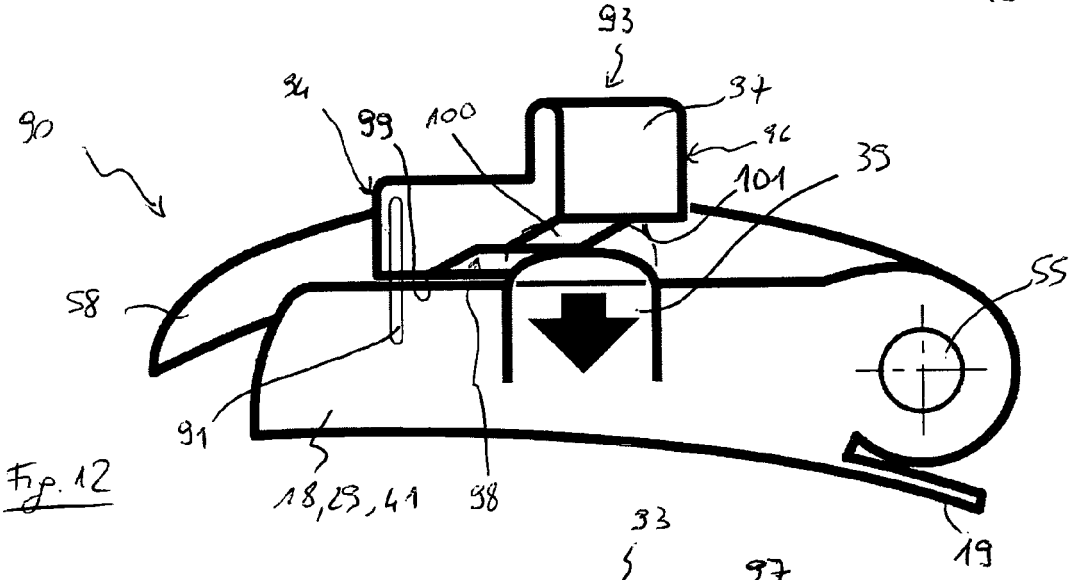

Fig. 12

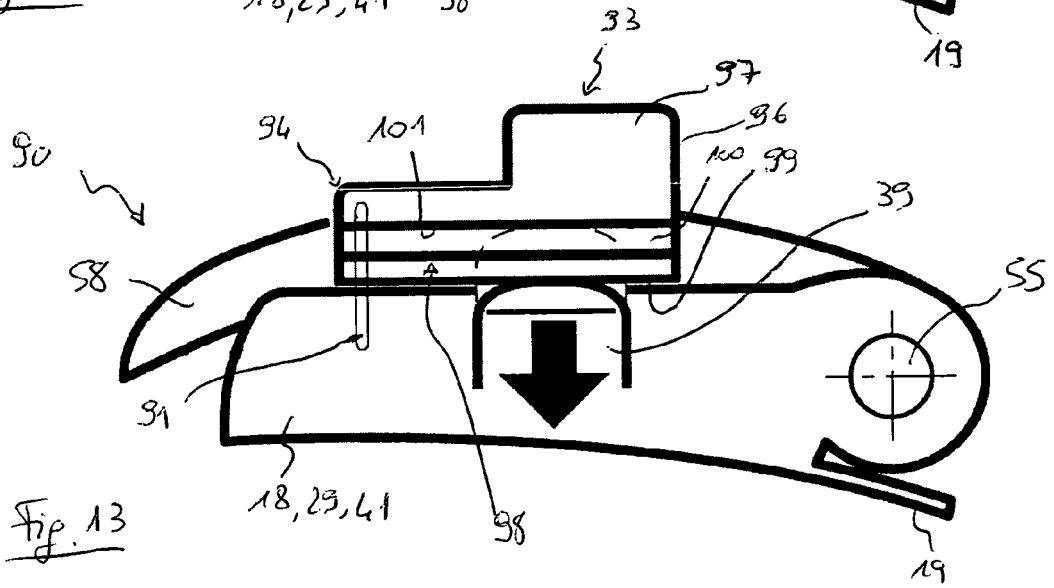

Fig. 13

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EUROPEAN SEARCH REPORT

Application Number
EP 09 42 5253

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Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	US 4 761 859 A (CALABRIGO GIOVANNI B [IT]) 9 August 1988 (1988-08-09) * column 1, lines 6,23 * * column 2, lines 26-54 * * claims; figures *	1-15	INV. A43C11/16
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TECHNICAL FIELDS SEARCHED (IPC)

A43C

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	1 December 2009	Claudel, Benoît

CATEGORY OF CITED DOCUMENTS

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