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(54) **A tightening device, particularly for a sports shoe**

(57) A tightening device, particularly for a sports shoe comprising a first mechanism (15) for transmitting movement to a second mechanism (21), which is oper-

atively connected to at least a first cable element (26) for fastening the sports shoe, the first mechanism being activated by a third mechanism (27), which is manually operated by the user.

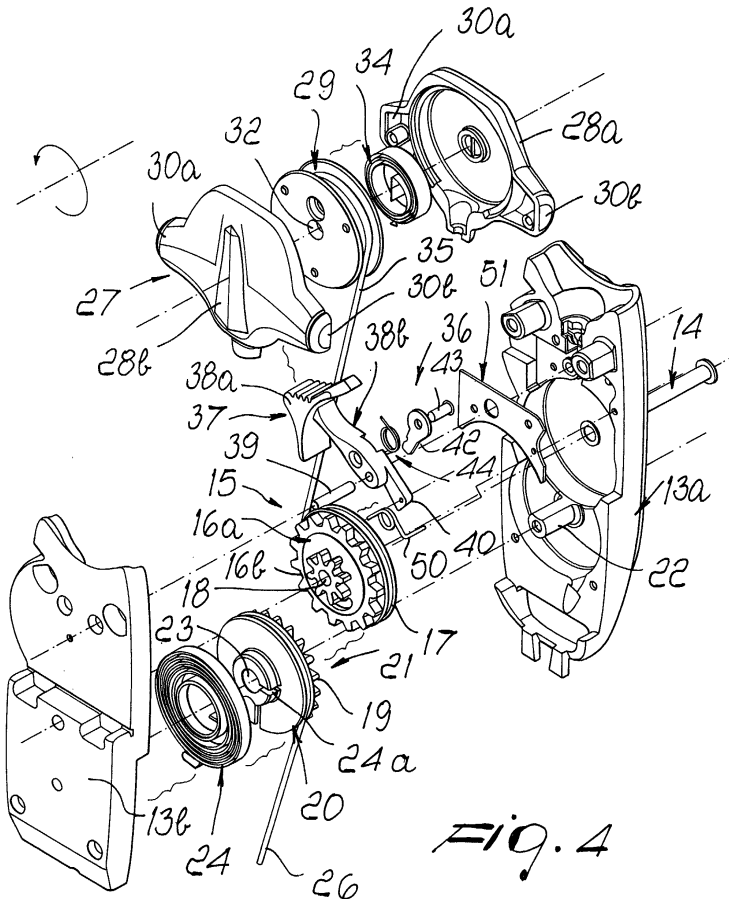


Fig. 4

Description

[0001] The present invention relates to a tightening device, which is particularly suitable for the closure of a sports shoe, such as a ski boot, a snowboard boot, a skate boot or the like.

[0002] Nowadays, tightening devices for sport shoes usually comprise two or more pairs of buckles, which are arranged transversely to the shell and/or the cuff of the sports shoe, to allow a selectively adjustable tightening between the shoe flaps.

[0003] The main drawback of such known devices is that tightening adjustment is particularly long and cumbersome, since it is necessary to adjust each buckle several times until the desired degree of fastening of the boot around the foot is achieved.

[0004] Another shortcoming resides in that the clamping force of such known tightening devices is not usually evenly distributed along the longitudinal axis of the flaps, since the adjustment of the buckles is discrete and discontinuous. The consequence is that the foot is not compressed evenly within the flaps, but certain areas of the foot prove to be more subjected to pressure while in others the foot is barely in contact with the internal surface of the boot.

[0005] Another important shortcoming consists in that the buckles occupy considerable space, as a result of which they can also cause falls due to the accidental contact of the same with a protrusion in the ground or with an obstacle, with the consequent possibility of breaking or at the least damaging such buckles.

[0006] As a partial solution to these shortcomings, U. S. patent No. 4.433.456, by the same Applicant, discloses a tightening device, particularly for ski boots, comprising a box-shaped body that may be connected with a first portion of the ski boot, a pulley pivotally connected inside the box-shaped body, at least one cable strand connected at one end to the pulley and windable on the same. At the other end, the cable strand is connected, externally to the box-shaped body, to a second portion of the ski boot. A rotating knob is connected to the exterior of the box-shaped body, designed to bring about a rotation of the pulley, mechanical means being provided between the knob and the pulley, so as to lock the pulley at a certain desired position, in one direction of rotation, and release the pulley in the opposite direction.

[0007] U.S. patent No. 4.841.649 also by the same Applicant, discloses a tightening device that comprises a box-shaped body connected to a ski boot. The tightening device comprises a knob pivotally connected to the exterior of the box-shaped body, and interacting with mechanical means designed to transmit the motion to a first and a second pulleys that are freely pivotally mounted inside said box-shaped body. A first and a second cable strand of interconnection with portions of the boot, such as two opposing flaps or a tongue, are partially windable on the first and second pulleys. These known tightening devices, although partially solving the afore-

mentioned drawbacks and shortcomings, have the disadvantage of allowing an activation that is not always easy when the user is wearing padded gloves for protection against the cold. Furthermore the force required to turn the knob increases with the increase in the clamping action, is also able to reach such values as to cause difficulties to user.

[0008] Therefore, the aim of the present invention is to provide a tightening device, particularly for a sports shoe such as a ski boot, a snowboard boot, a skate boot or the like, which allows achieving an excellent fastening of the sports shoe around the foot of the user to be accomplished simply and quickly.

[0009] Within this aim, another object of the present invention is to provide a tightening device, which allows fastening to be accomplished easily even while wearing padded gloves.

[0010] Another object of the present invention is to provide a tightening device, which allows effective fastening to be accomplished also without requiring the user to develop considerable force.

[0011] A further object of the present invention is to provide a tightening device, with limited overall dimensions, thereby avoiding accidental impact with the snowy surface and with obstacles.

[0012] Another object of the present invention is to provide a tightening device, which is structurally simple and has low manufacturing costs.

[0013] The above aim and these and other objects that will become better apparent hereinafter are achieved by a tightening device, particularly for a sports shoe such as a ski boot, a snowboard boot, a skate boot or the like, characterised in that it comprises a first mechanism for transmitting movement to a second mechanism, which is operatively connected to at least a cable element for fastening the sports shoe, the first mechanism being activated by way of the manual activation of a third mechanism.

[0014] As it will be shown in detail hereinafter, the tightening device, according to the present invention, allows overcoming the mentioned drawbacks related to the prior art. In fact, the combined action of such first and second mechanisms allows providing an excellent fastening of the sports shoe. Such a fastening action can be easily controlled by the user through the mentioned third mechanism.

[0015] Further characteristics and advantages of the tightening device, according to the present invention, will become better apparent from the following detailed description of a preferred embodiment, illustrated by way of non-limitative example in the accompanying drawings, wherein:

Figure 1 is a side view of a ski boot fitted with the tightening device, according to the present invention;

Figure 2 is a partially sectional view of the fastening device, according to the present invention;

Figures 3 and 4 are exploded views of the fastening device, according to the present invention;
 Figures 5 to 7 are detail views for illustrating the operation of a portion of the fastening device, according to the present invention.

[0016] With reference to the figures, the tightening device, according to the present invention is designated by the reference number 1. The tightening device 1 will be described hereinafter with particular reference to its application to a ski boot 2. However, it is not intended to limit in any way the scope of the present invention. In fact, as will better appear hereinafter, the skilled person can easily adapt the tightening device, according to the present invention, for application to other kinds of sports shoes such as snowboard boots, skate boots or the like.

[0017] The ski boot 2 comprises a shell 3, to which a cuff 4 that wraps around the lower portion of the leg is pivotally connected at the anklebone area. The shell 3 is provided, at the bottom, with a sole 5, advantageously comprising a normalised toe unit and a heel unit for the interconnection of a known type of ski binding. The shell 3 further has an opening 6 provided approximately in the area of the upper surface and instep of the foot. The opening 6 is delimited, at the front, by a stiffener 7 designed to retain the toe area of the foot and to accomplish the connection between a pair of lateral edges 8, which protrude from the top of the sole 5. The opening 6 is at least partially recloseable by means of a tongue 9, which is, at a first end, pivotally mounted to the stiffener 7, approximately above the toe area of the foot. An upper, not shown in the figures, is advantageously arranged below the tongue 9 and between the pair of lateral edges 8, so as to wrap around at least the instep of the foot. A soft liner 10 to retain the user's foot is then suitably arranged inside the shell 3 and the cuff 4. A fastening buckle 11 is also preferably provided, so as to allow the closure of the cuff 4 around the tibia area.

[0018] The fastening device 1 comprises a first box-shaped body 12, which is, in this particular embodiment, operatively associated to the boot 2 approximately to the rear of the cuff 4.

[0019] The first box-shaped body 12 advantageously consists of a first and a second shell, respectively designated by reference numbers 13a and 13b, that may be coupled to each other for example by means of a first pin or screw 14. The first box-shaped body 12 is aimed at including and protecting a first mechanism 15 for movement transmission, which comprises a first gearwheel and a second gearwheel, respectively 16a and 16b, and a first pulley 17. The first and second gearwheels 16a and 16b and the first pulley 17 are advantageously made in a single body. The first gearwheel 16a has a larger diameter than the second gearwheel 16b. The first pulley 17 is preferably positioned at the front of the first gearwheel 16a and therefore in an opposite position to the second gearwheel 16b. The first and the second gearwheels 16a and 16b and the pulley

17 are pivotally mounted inside the first box-shaped body 12, preferably through a first axial hole 18, approximately counter-shaped to the first pin 14 and interacting in a rotating manner with the same.

[0020] The second gearwheel 16b engages a third gearwheel 19, preferably having a greater diameter, in order to have a reduction ratio of gear of more than one. The third gearwheel 19 is advantageously made in a single body with a second pulley 10, arranged to the rear. The third gearwheel 19 and the second pulley 20 form a second mechanism 21, which interacts with the first mechanism 15. The second mechanism 21 is advantageously pivotally connected to the first front shell 13a, preferably by means of a second pin 22. The second pin 22, protruding transversely from the first shell 13a, interacts with a second hole 23 provided axially in the second mechanism 21. A first resilient element 24 is arranged to the rear of the second pulley 20, such as a first spring for example of the spiral type, housed in a first seat 25 provided in the second shell 13b. The first spring 24, lying coaxially to the second pin 22, is operatively connected, at one end, to the pulley 20, in the seat 24a, and, at the other end, to the second shell 13b, in the seat 24b, in such a way as to oppose, by preloading, a clockwise rotation of the second mechanism 21 (according to the view of figure 3). A first cable element 26 may be wound, at least partially on the second pulley 20. The first cable 26 outcomes from the fastening device 1 in such a way as to involve the tongue 9 and the side edges 8 of the shell 3. In particular, the first cable element 26 may advantageously run, as shown in figure 1, on top of the tongue 9 and inside the shell 3, within appropriate second seats, not shown in detail. At a free end 26a, the first cable 26 is connected to one of the side edges 8 in such a way that upon a rotation of the second pulley 20 such first cable 26 is pulled with the consequent approach between the pair of side edges 8 and the tongue 9 and, therefore, performing the fastening of the boot 2. The first cable 26 is wound, at least partially, onto the second pulley 20 in such a way as to be put into traction by a clockwise rotation of the pulley 20, as shown in figure 3. In this way the fastening of the ski boot 2 may be achieved through a rotation of the first mechanism 15 in a counter-clockwise direction, resulting in a clockwise rotation of the second mechanism 21 and the simultaneous partial winding of the first cable 26 on the second pulley 20. The rotation of the first mechanism 15 may be obtained by way of the manual activation of a third mechanism 27, arranged externally to the box-shaped body 12.

[0021] In the preferred embodiment of the present invention, illustrated herein merely by way of example, the third mechanism 27 is arranged in a second box-shaped body 270, positioned above the box-shaped body 12 so that it may be easily gripped by the user. The second box-shaped body 270 comprises a third shell 28a and a fourth shell 28b, aimed at containing and supporting an internal third pulley 29. Advantageously, the third

shell 28a and the fourth shell 28b have an approximately triangular configuration, with a pair of spurs 30a and 30b respectively, which protrude laterally, so as to form a handle or easy gripping means for the user. The third pulley 29 is axially and pivotally mounted on a third pin 31, which protrudes from the fourth shell 28b and passes through a third axial hole 32, provided in the third pulley 29. The third pulley 29 has a second seat 33, which is provided axially at the front face and which houses a second resilient element, such as a second spring 34. The second spring 34, for example of the spiral type, is joined at the ends to the third pulley 29, in the seat 34a, and to the third pin 31, in the seat 34b, in such a way as to become preloaded upon a counter-clockwise rotation of the third pulley 29 (according to the view of figure 3).

[0022] A second cable element 35 is wound between the first pulley 17 and the third pulley, and defines a means of interconnection between these pulleys. In the rest position, and therefore with the ski boot 2 open, the second cable 35 is wound on the third and first pulleys 29 and 17, preferably to a greater extent around the first pulley 17. In this way, the upwards pull of the third mechanism 27 causes a first unwinding of the second cable strand 35 wound on the third pulley 29, with preloading of the second spring 34, and then a second unwinding of the second cable 35 from the first pulley 17. This second unwinding is made possible by the counter-clockwise rotation of the first mechanism 15, which transmits the movement to the second mechanism 21. The clockwise rotation of the third gearwheel 19, moved by means of the second gearwheel 16b, causes the partial winding of the first cable strand 26 on said second pulley 20. At the same time the first spring 24 is loaded. The result is that the returning action of the first cable strand 26 into the second mechanism 21 brings about the approach of the tongue 9 towards the aperture 6 and therefore the closing of the same towards the upper surface of the foot. This fastening or clamping action is greater the more the user lifts the second box-shaped body 270, including the third mechanism 27. To ensure that the fastening or clamping is maintained when the user releases the third control mechanism 27, means of locking and release 36 are provided, suitably interacting selectively with the first mechanism 15. The locking and release means 36, shown in detail in figures 5-7, advantageously consist of a buckle 37, approximately "T" shaped, and therefore formed by a head 38a, of substantially triangular shape, from which a shank 38b protrudes. The shank 38 is transversely and pivotally mounted between the first and second shells 13a and 13b by means of a fourth pin 39, arranged above the first mechanism 15. With the buckle 37 placed in the locking position, the first free end 40 of the shank 38 interacts with the teeth of the first gearwheel 16a, acting as "first click" therefore preventing a clockwise rotation of the whole first mechanism 15 (see figure 5). To allow this operation, a third resilient element is provided advantageously consisting

of a third spring 50, for example of the coil type, operatively joined at the ends between the first free end 40 of the buckle 37 and a separating plate 51, integral with the box-shaped body 12. The head 38a of the buckle 37 protrudes externally to the box-shaped body 12, in such a way as to be reachable by the user for manual activation. Pressing downwards on the head 38a, which can slide along the curved surface 41, results in a clockwise rotation of the buckle 37, permitting deactivation of the same (figures 6 and 7). Locking of the buckle 37 in the deactivated position is ensured by the presence of a small lever 42, which is pivotally mounted on the shank 38b by means of a fifth pin 43. This small lever 42 protrudes transversely to the buckle 37 in a downward direction to interact selectively with the teeth of the first gearwheel 16a.

[0023] Once the buckle 37 has been deactivated, the first spring 24, preloaded, exerts a rotation, in opposite directions, both on the second and on the first mechanism 21 and 15, with consequent unwinding (loosening) of the first cable strand 26 and winding of the second cable strand 35 on the second pulley 20 and the first pulley 17. To easily accomplish this operation, the torque developed by the first spring 24 should be greater than the resisting torque of the second spring 34 multiplied by the reduction ratio of gear between the first and the second gearwheels 16a and 16b, to which the frictions of the whole kinematic motion should be added.

[0024] When the first mechanism 15 turns clockwise, the small lever 42 acts as "second click". In fact, it is kept in contact with the profile of the gearwheel 16a by means of a fourth resilient element, the latter also being preferably formed by a fourth coil spring 44, which is joined, at one end, to the upper edge of the small lever 42 and, at the other end, to the shank 38b.

[0025] In this way, once the rotation of the first mechanism 15 has ceased, the second free end 45 of the small lever 42 is inserted between two subsequent teeth, thereby preventing the buckle 37 from turning and permitting the repositioning of the first end 40 of the shank 38b in contact with the first gearwheel 16a. Upon reactivation of the third mechanism 27, which controls the fastening force on the ski boot 2, the user exerts a counter-clockwise rotation on the first mechanism 15. The first movement of the first gearwheel 16a exerts on the small lever 42, such a force as to cause a counter-clockwise rotation of the buckle 37, which is thus returned to the original position with the first free end 40 in contact with the profile of the first gearwheel 16a (fig. 5). To reduce the force required by the user in the traction stage, a reduction ratio of gear between the gearwheels 16a and 16b of preferably more than two is used. In particular, in the embodiment described herein merely by way of example, this ratio corresponds to 2.5 (twenty teeth for the larger wheel, eight for the smaller one).

[0026] Operation of the invention is therefore as follows. Once the user has introduced his foot into the ski boot 2, he may achieve closure of the same by simply

pulling the third control mechanism 27 upwards. After a first unwinding of the second cable 35 from the third pulley 29, causing a further loading of the second spring 34, there is the rotation in a counter-clockwise direction of the first mechanism 15 and in a clockwise direction of the second mechanism 21. There is consequently the recovery of a part of the first cable 26, which is previously arranged to involve the lateral edges 8 of the shell 3 and the tongue part 9, particularly in the area of the upper surface of the foot. During the clockwise rotation of the second mechanism 21, not only the first cable 26 returns, but the first spring 24 is also preloaded at the same time. The recovery of the first cable 26 implies the fact that the first cable 26 itself exerts a tightening force on the flaps 8 and the tongue 9. In this stage, the buckle 37 remains resting on the first gearwheel 16a (as in figure 5), the first end 40 of the shank 38b allowing a free rotation of the first gearwheel 16a only in the boot tightening direction, and therefore in a counter-clockwise direction. Once the desired fastening has been achieved, the user releases the third mechanism 27, which returns to the original position by way of the returning action, accomplished by the previously preloaded second spring 34, of the second cable 35 on the third pulley 29. The first free end 40 of the shank 38b of the buckle 37 is inserted between the teeth of the first gearwheel 16a, preventing a clockwise rotation of the same by the preloaded first spring 24 of the second mechanism 21. Thus, the desired level of the tightening force is maintained during the sports activity and the closure of the ski boot is completed.

[0027] Once the sports activity is finished, or in any case at will, the user may open the boot by means of the head 38a of the buckle 37 so that the latter is turned clockwise, disengaging the teeth of the first wheel 16a from the first free end 40 of the shank 38b. The first spring 24, free to release, sets in rotation the first, second and third pulley according to the respective speed ratios, thereby causing the partial winding of the second cable 35 on the first pulley 17 and the complete loosening of the first cable 26 on the second pulley 20, which permits the opening of the footwear and the foot to be taken out. During this stage, the buckle 37 remains automatically in the rest position thanks to the action of the spring 50 (as in figure 6), and therefore the first end 40 of the shank 38b does not engage the teeth of the first gearwheel 16a. When tightening of the ski boot is again required, it is sufficient to activate the third mechanism 27: upon a first counter-clockwise rotation of the first mechanism 15, the small lever 42 is expelled from the teeth of the first gearwheel and the buckle 37 is simultaneously reset in the locking position.

[0028] It has thus been shown that the invention has achieved the proposed aim and objects since the tightening device, according to the present invention, permits excellent closure and opening of athletic footwear to be accomplished in a simple and quick way.

[0029] The tightening device, according to the present

invention, is provided with a control mechanism, consisting of a handle, which may be easily activated by the user, since it does not require the use of excessive force, and may also be accomplished while wearing gloves.

[0030] Being preferably positioned in the rear area of the footwear, the tightening device, according to the present invention, allows avoiding any accidental contact with the snowy surface or with posts, in particular when accomplishing a turn or during a slalom race.

[0031] Of course, the tightening device, according to the present invention, is naturally susceptible to many changes and variations, all falling within the scope of the same inventive concept.

[0032] For example, it is possible to provide a fastening device 1 that may be used with ski boots comprising shell and/or cuff fitted with overlapping flaps, or with other athletic sports shoes, such as snowboard boots, ice skating or roller skating boots that in any case have flaps to be joined or brought together.

[0033] Furthermore, the handle formed by the third and the fourth shells 30a and 30b may have different shapes; in the described example, the lateral spurs 30a and 30b provide the user with a comfortable, safe grip, also while wearing gloves. In the same way, however, the handle may have an opening or a projection designed to aid the insertion of one or more fingers, in any case achieving in an excellent way the proposed aims and objects.

[0034] Alternatively to what described above, the use of the second gearwheel 16b can be avoided. In this case, the first wheel 16a engages directly the third gearwheel 19. As a consequence, the necessary force for accomplishing the tightening will be greater, since the reduction ratio of gear is unitary.

[0035] The disclosures in Italian Patent Application No. TV2001A000152 from which this application claims priority are incorporated herein by reference.

[0036] Where technical features mentioned in any claim are followed by reference signs, those reference signs have been included for the sole purpose of increasing the intelligibility of the claims and accordingly, such reference signs do not have any limiting effect on the interpretation of each element identified by way of example by such reference signs.

Claims

1. A tightening device, particularly for a sports shoe, **characterised in that** it comprises a first mechanism for transmitting movement to a second mechanism, which is operatively connected to at least a first cable element for fastening said sports shoe, said first mechanism being activated by means of a third mechanism, which is manually operated by the user.
2. The tightening device according to claim 1, **charac-**

- terised in that** it comprises means of locking and release interacting selectively with said first mechanism.
3. The tightening device according to one or more of the preceding claims, **characterised in that** a first box-shaped body is associated to said sports shoe for containing at least said first mechanism and said second mechanism. 5
4. The tightening device according to one or more of the preceding claims, **characterised in that** said second mechanism comprises first recovery means for recovering a first cable strand, which is partially arranged along said sports shoe and which is connected at a free end to a portion of said sports shoe. 10
5. The tightening device according to one or more of the preceding claims, **characterised in that** said first mechanism and said third mechanism comprise, at least partially, second recovery means for recovering a second cable strand connecting said first mechanism and said third mechanism. 20
6. The tightening device according to one or more of the preceding claims, **characterised in that** said first mechanism comprises at least one first gearwheel, said first gearwheel being made in a single body with a first pulley, which houses, at least partially, said second cable strand. 25 30
7. The tightening device according to one or more of the preceding claims, **characterised in that** said first mechanism comprises a second gearwheel, which is connected to said first gearwheel, said second gearwheel having a smaller diameter than said first gearwheel. 35
8. The tightening device according to one or more of the preceding claims, **characterised in that** said second mechanism comprises a third gearwheel, which interacts with said second gearwheel, said third gearwheel having a smaller diameter than said second gearwheel. 40
9. The tightening device according to one or more of the preceding claims, **characterised in that** said first recovery means comprise a second pulley, which is made in a single unit with said third gearwheel. 45 50
10. The tightening device according to one or more of the preceding claims, **characterised in that** said second recovery means comprise said first pulley, positioned at the front of said first gearwheel in an opposite position to said second gearwheel, and a third pulley, which is arranged with said third mechanism, in a second box-shaped body, arranged above said first box-shaped body. 55
11. The tightening device according to one or more of the preceding claims, **characterised in that** it comprises, approximately at the rear of said second pulley, a first resilient element, aimed at exerting by pre-loading a force, which opposes to an action of recovery of said first cable strand, obtained by means of a rotation of said second mechanism.
12. The tightening device according to one or more of the preceding claims, **characterised in that** said third mechanism comprises gripping means for the user and a second resilient element, arranged so as to be pre-loadable during a counter-clockwise rotation of said third pulley.
13. The tightening device according to one or more of the preceding claims, **characterised in that** said means of locking and release interact with said first mechanism, so as to ensure that a pre-set clamping force is maintained.
14. The tightening device according to one or more of the preceding claims, **characterised in that** said means of locking and release comprise a buckle, which is pivotally mounted inside said first box-shaped body and which protrudes externally from said first box-shaped body, so as to be manually activated by the user.
15. The tightening device according to one or more of the preceding claims, **characterised in that** said buckle is operatively associated to a third resilient element ensuring the locking of said buckle in a deactivated position.
16. The tightening device according to one or more of the preceding claims, **characterised in that** said buckle is pivotally connected to a lever, which protrudes transversely downwards, so as to interact selectively with said first gearwheel.
17. The tightening device according to one or more of the preceding claims, **characterised in that** a fourth resilient element is operatively connected, at one end, to said lever and, at the another end, to said buckle.

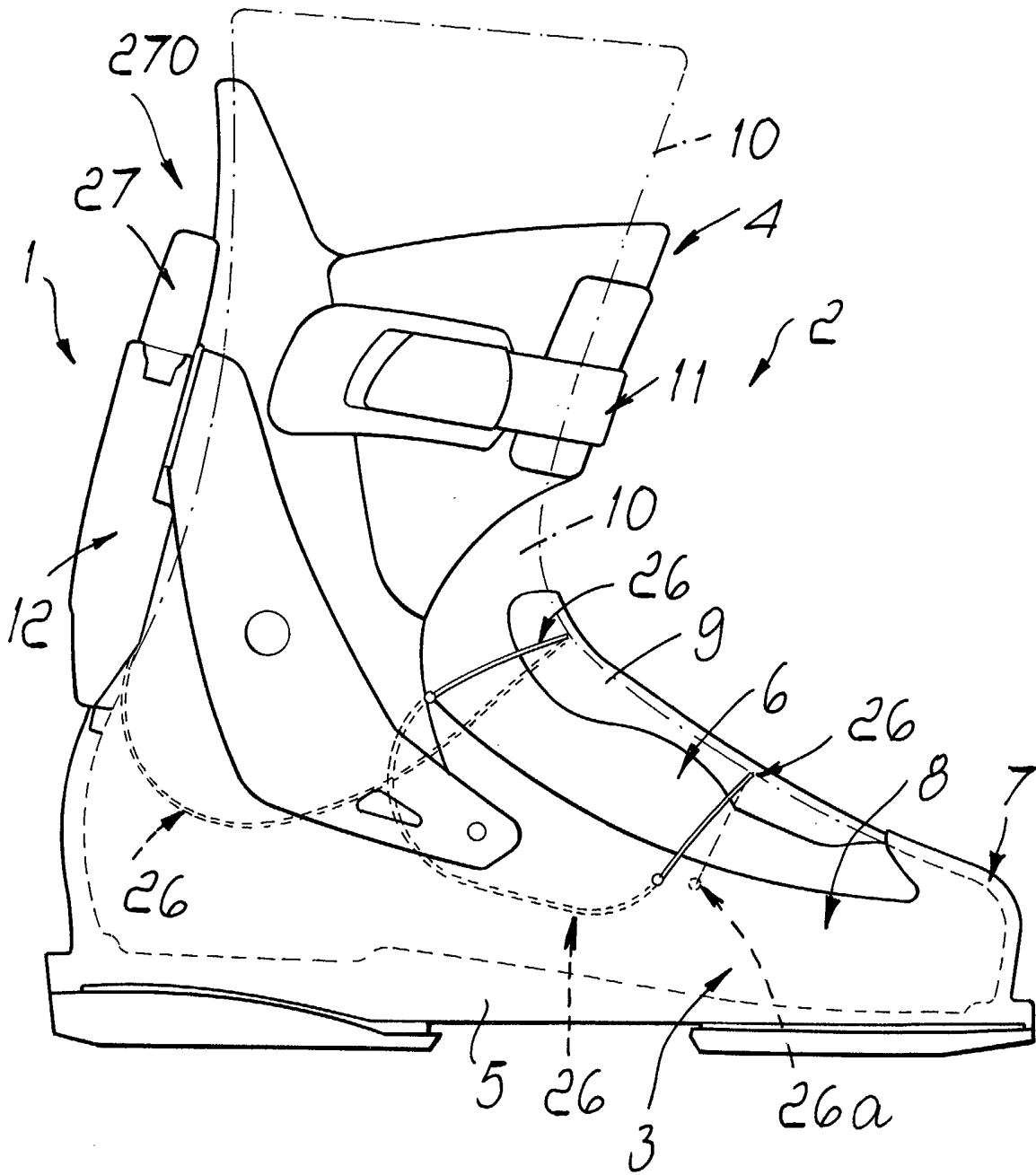


Fig. 1

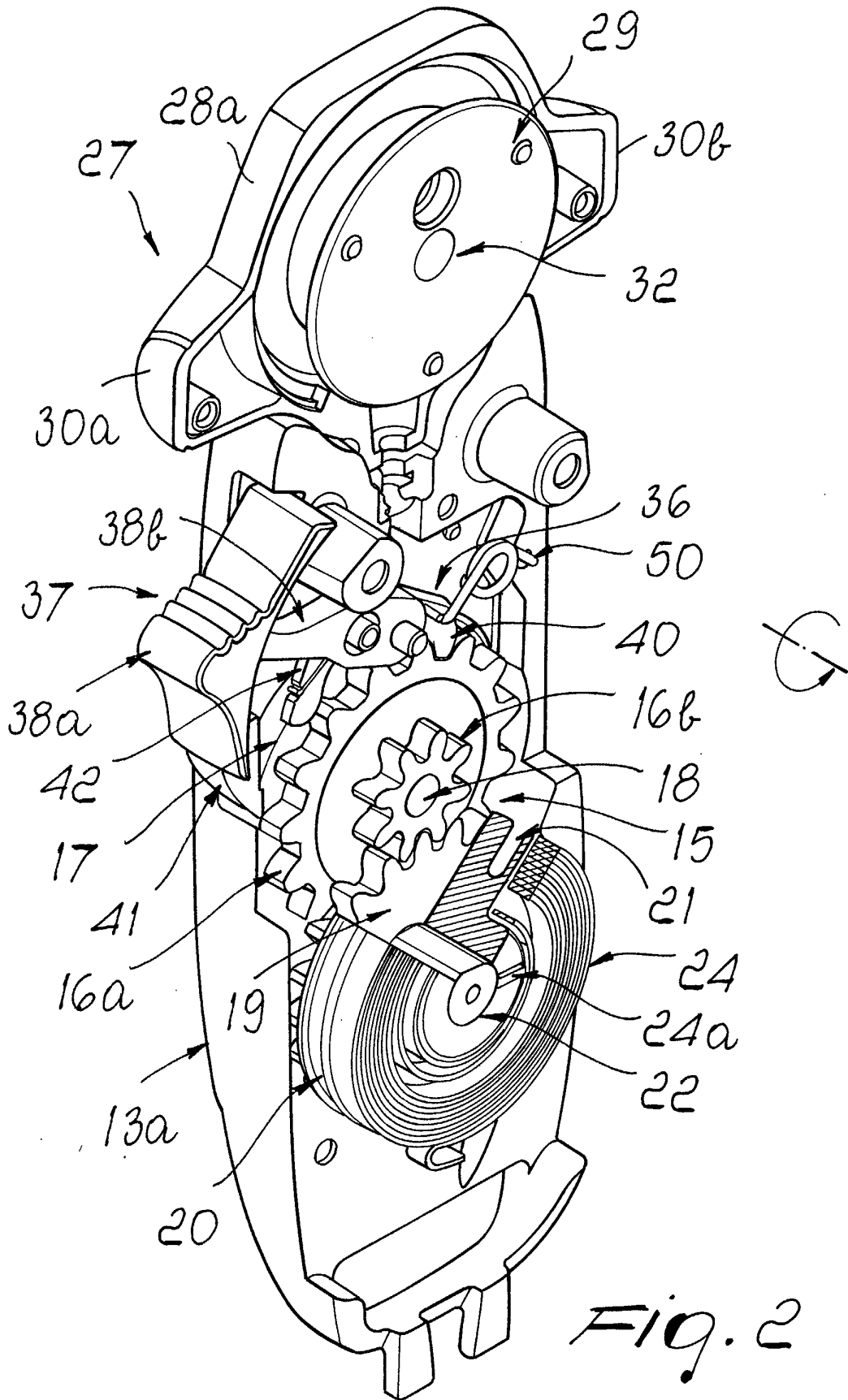


Fig. 2

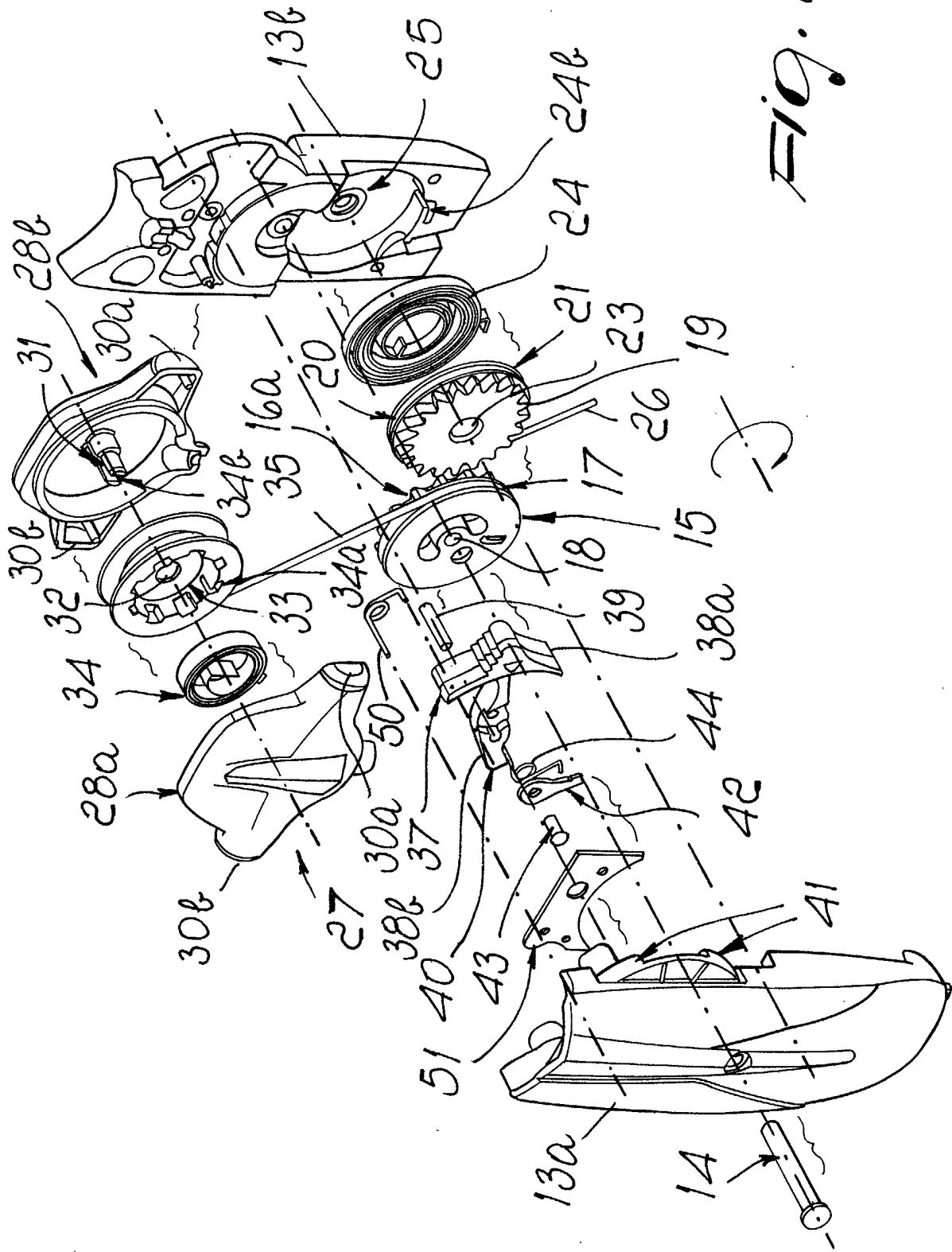


FIG. 3

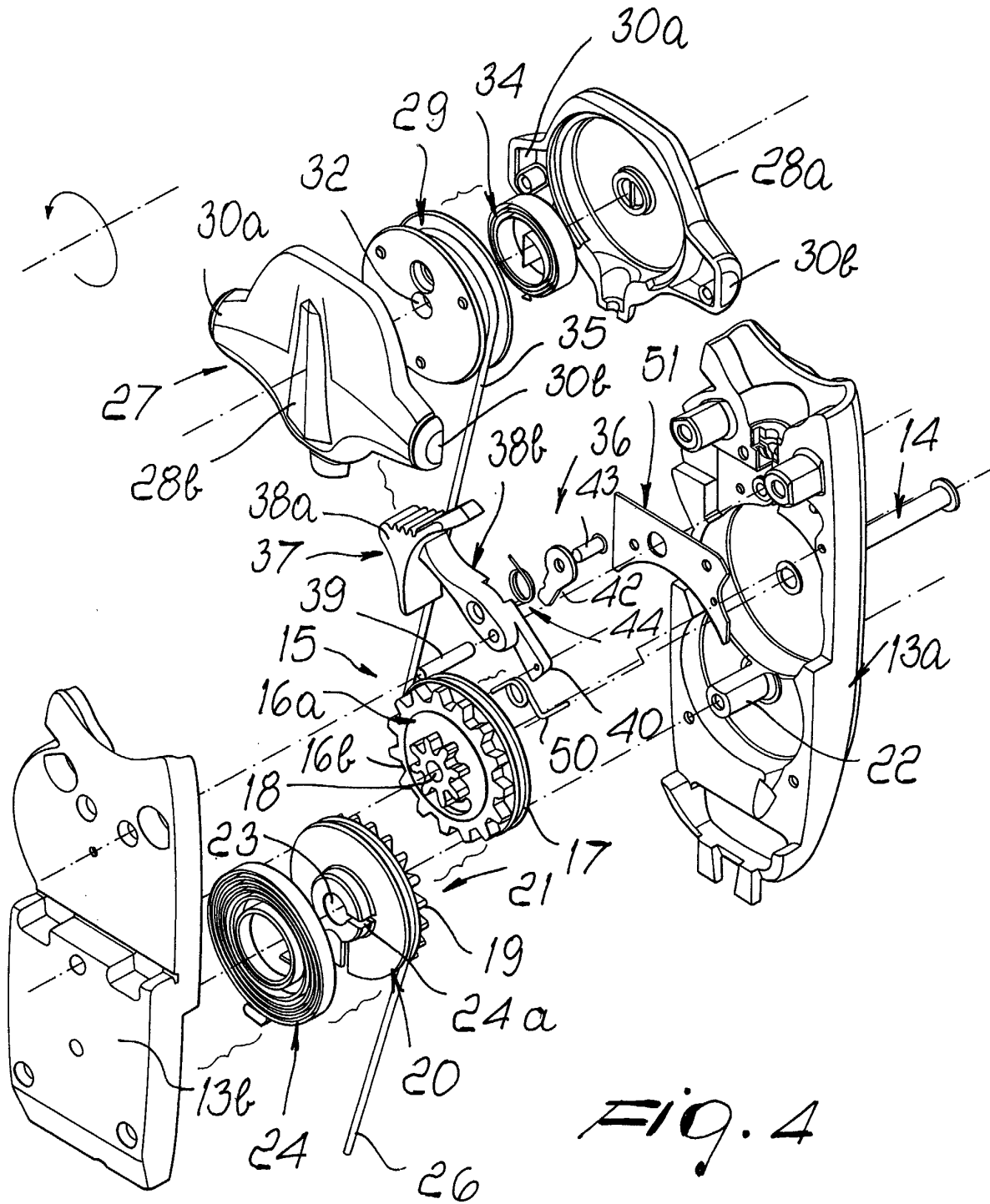
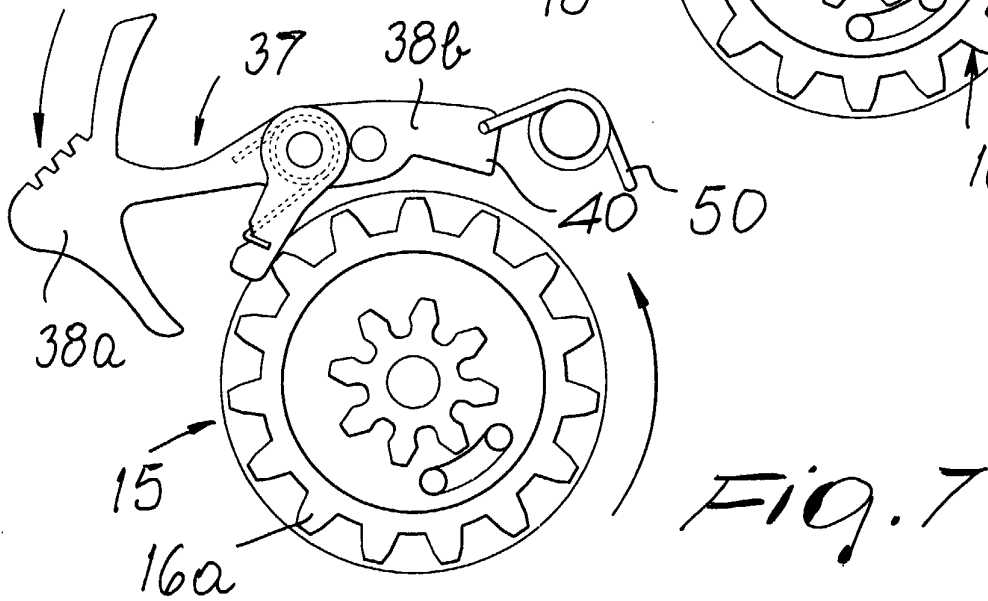
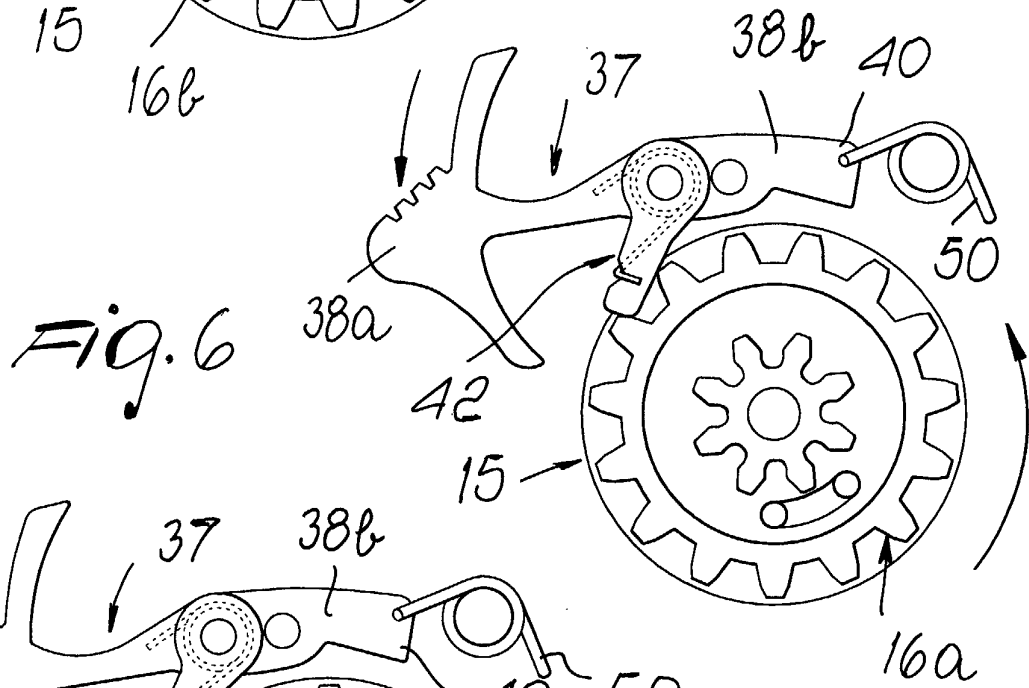
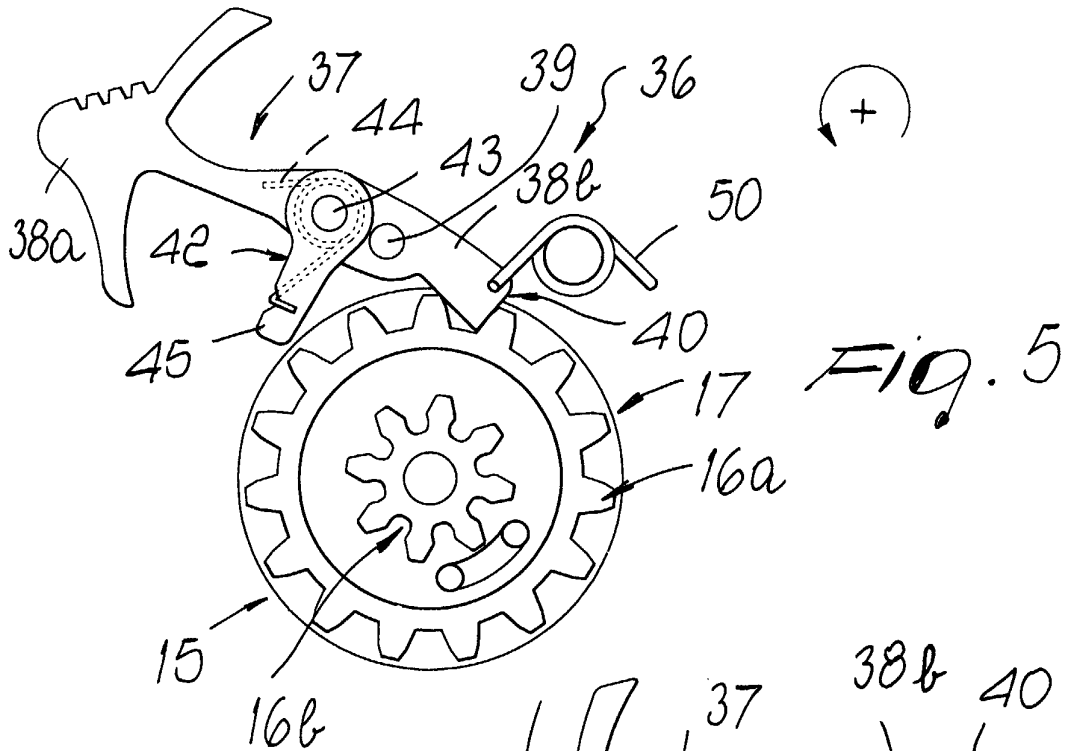


FIG. 4





European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 02 02 5017

| DOCUMENTS CONSIDERED TO BE RELEVANT | | | |
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| Category | Citation of document with indication, where appropriate, of relevant passages | Relevant to claim | CLASSIFICATION OF THE APPLICATION (Int.Cl.7) |
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| The present search report has been drawn up for all claims | | | |
| Place of search THE HAGUE | | Date of completion of the search 12 February 2003 | Examiner Stegman, R |
| CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document | | T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document | |

EPO FORM 1503.03 B2 (P04/C01)



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Application Number
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