Aug. 6, 1963 H. MARKER 3,100,119

TIGHTENING DEVICE FOR SKI BINDINGS

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Fig. 1

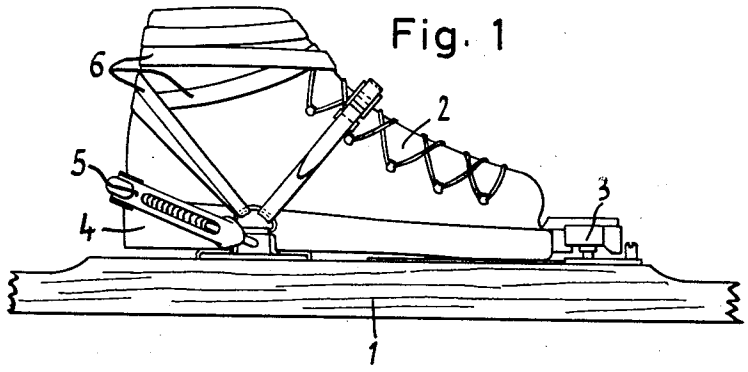



Fig. 4

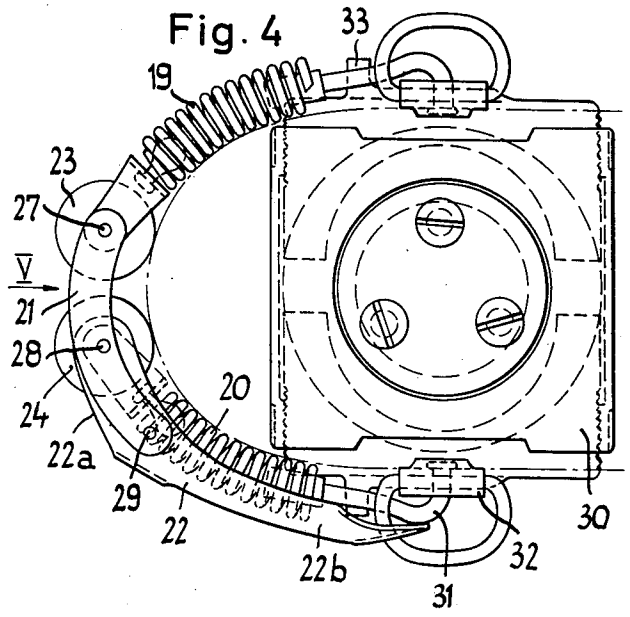
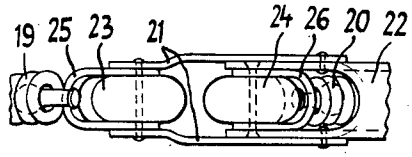



Fig. 5

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TIGHTENING DEVICE FOR SKI BINDINGS

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Fig. 3

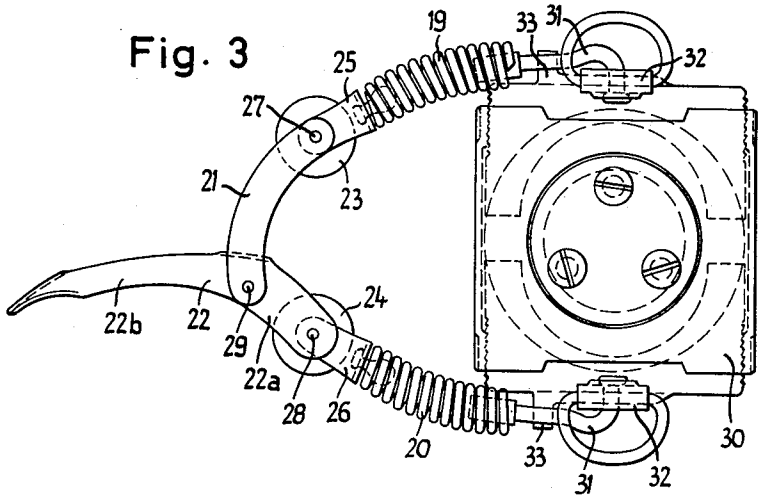
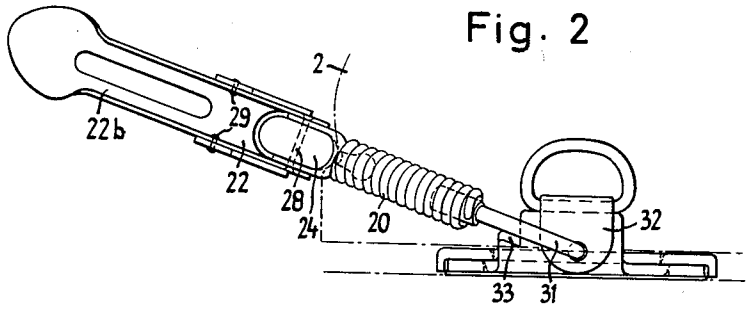



Fig. 2

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TIGHTENING DEVICE FOR SKI BINDINGS

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Fig. 6

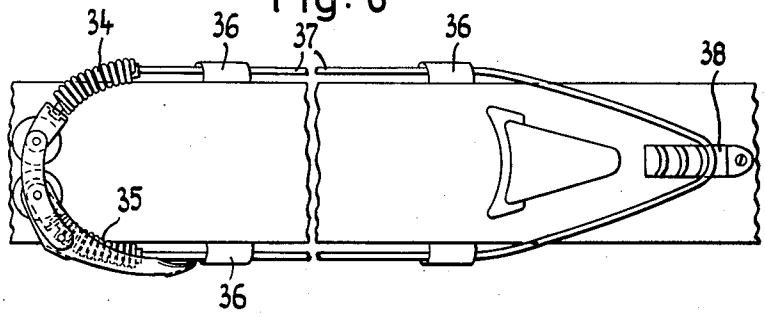


Fig. 7

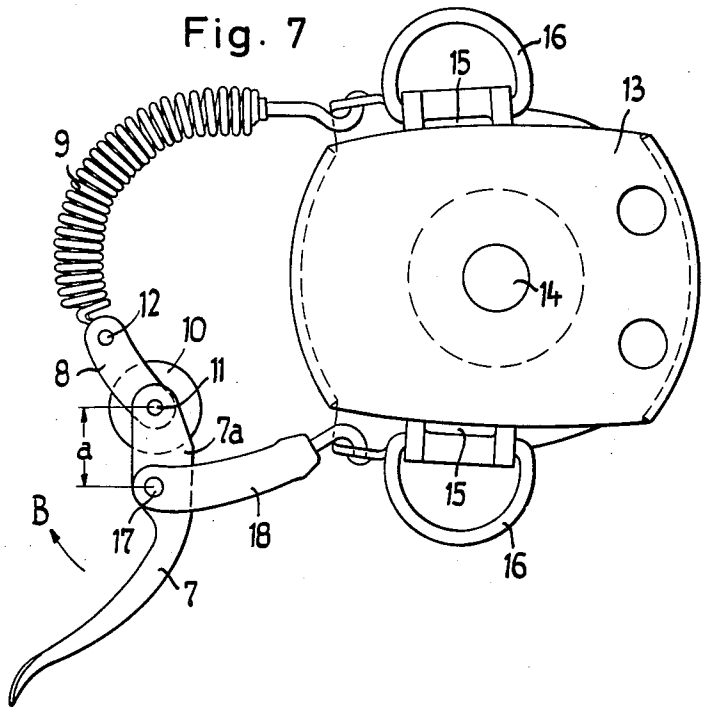


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Fig. 8

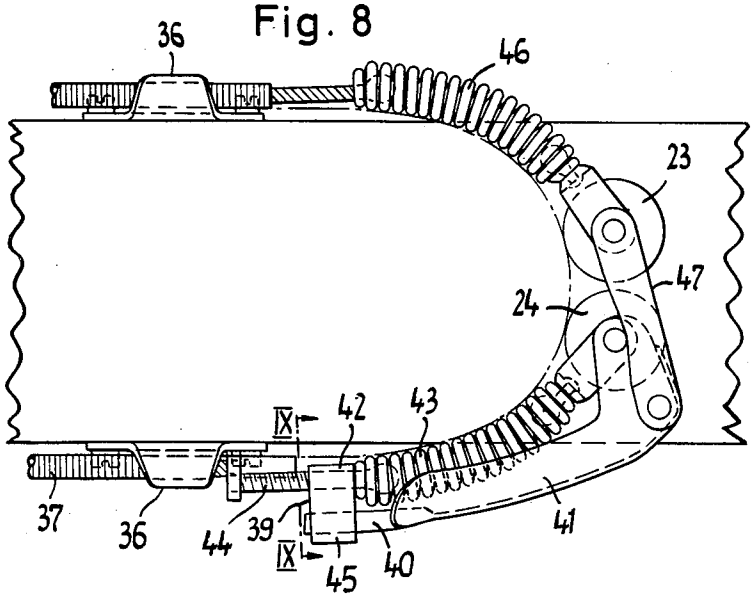
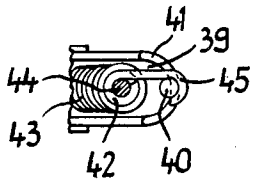



Fig. 9

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United States Patent Office

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# TIGHTENING DEVICE FOR SKI BINDINGS

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9 Claims. (Cl. 280—11.35)

The invention relates to a tightening device for ski bindings which engages on the boot heel, comprising a tightening lever and at least one tension spring connected through a link to the tightening lever. The prior known tightening devices are comparatively difficult to operate and also show various other defects. During the closing and opening of the tightening device, the short lever arm of the tightening lever is supported either directly or through the link on the heel groove of the ski boot and opposes a considerable force to the actuation thereof, this force being further increased by the force necessary for tensioning the spring. In order on the one hand to obtain the largest possible spring tension and on the other hand to open the tightening device as wide as possible, it is desirable to make the closing travel as large as possible by enlarging the short lever arm. However, the result of this is that the force necessary for actuating the device increases. An obvious solution of this difficulty would be to lengthen the long lever arm of the tightening lever which serves for the manual actuation of the tightening device in order to facilitate the closing of the latter. However, this is not possible, since little space is available on the heel of the ski boot and the tightening lever should project as little as possible beyond the ski. Consequently, certain limits are set as regards the length of both the short and long lever arms of the tightening lever in the prior known tightening devices, these limits making impossible an increase in the spring tension and the opening travel. This has the disadvantage that with the known tightening devices, the pressure exerted on the heel of the ski boot is usually too small and in addition the tightening device must be arranged very accurately on the ski, depending on the actual length of the boot. If the tightening device is placed too far towards the rear, the heel of the boot certainly fits comfortably into the tightening device, but then the pressure exerted by the latter is too weak. On the other hand, if the tightening device is mounted too far forwards, a good pressure would certainly be achieved thereby, but the attachment of the binding is made substantially more difficult if not completely impossible.

The object of the present invention is to provide a tightening device which is easy to actuate and in addition has a long closing travel. According to the invention there is provided a tightening device for ski bindings, the said device engaging on the heel of the ski boot and comprising a tightening lever and at least one helical spring connected through a link to the said lever, characterised in that the shorter lever arm of the tightening lever which, in use, is closer to the boot heel than the main part of the tightening lever has arranged thereon a roller projecting beyond the lever arm, the shaft of the said roller being perpendicular to the plane of movement of the tightening lever, and the roller being supported, in use, on and being arranged to roll in the heel groove of the ski-boot on actuating the tightening lever.

The roller arranged on the short end of the tightening lever facilitates the closing of the new tightening device. The tightening lever or the link no longer bites into the leather of the heel, as was formerly the case, because of the forwardly directed force of the spring, but the roller on the end of the tightening lever rolls with considerably reduced friction in the heel groove. This has



the advantage that the force necessary for actuating the tightening device is substantially reduced. By this means, it becomes possible to lengthen the short lever arm of the tightening lever and this has two important results. Firstly, the opening and closing movement of the tightening device is increased, i.e. the binding can be applied more easily to the ski boot, because the tightening loop formed by the short arm of the tightening lever, the link and the tension spring is greatly increased. Secondly, the spring tension is increased by the greater closing movement, so that the ski boot is held with a strong pressure. Furthermore, softer or more resilient springs are possible, which produce the same pressure on the boot with a large closing movement as a hard spring with a short closing movement. However, soft springs have a larger capacity for linear adaptation, i.e. larger tolerances can conveniently be operative when mounting the binding, without substantially altering the pressure produced by the spring and acting on the heel. The new tightening device is advantageously employed with two almost straight helical springs, which are arranged substantially on the two longitudinal sides of the heel and one of which engages on the short lever arm of the tightening lever and the other of which engages through a link on the long lever arm of the said lever.

A roller is preferably arranged on that end of the link engaging on the spring. Since the almost straight springs are arranged on the longitudinal sides of the heel, they cause little friction, and at the same time the spring stressing is much more favourable than is the case with the curved helical springs adapted to the heel groove, which formerly were usual. The two almost straight helical springs produce a very good pressure action and they do not suffer fatigue so quickly as the hitherto usual curved springs.

Further details and advantages of the invention will become apparent in the following description of some constructional embodiments of the invention given by way of example, with reference to the accompanying drawings, in which:

FIG. 1 is a side elevation of a ski and of a ski boot with a complete ski binding,

FIG. 2 is a side elevation of the new tightening device with the tightening lever open,

FIG. 3 is a plan view of the tightening device, also with the tightening lever open,

FIG. 4 is a plan view of the tightening device with the tightening lever closed,

FIG. 5 is a partial view of the tightening device in the direction V of FIG. 4,

FIG. 6 is a plan view of a second embodiment of the new tightening device,

FIG. 7 is a plan view of yet another embodiment,

FIG. 8 is a plan view showing the design of a safety tightener, and

FIG. 9 is a partial section on the line IX—IX of FIG. 8.

As will be seen from FIG. 1 of the drawings, a ski boot **2** is arranged on the ski **1**, the said boot being engaged in known manner by a safety plate **3** or any other holding means acting on the front edge of the boot sole. The new tightening device **5** acts on the heel **4** of the ski boot **2**. FIG. 1 also shows a long strap **6** which can be used in addition to the novel tightening device by good skiers in order to achieve an even more intimate connection between the ski boot and the ski.

In FIG. 7, the reference numeral **7** indicates a tightening lever which is connected through a link **8** to a helical spring **9**. Arranged on the shorter lever arm **7a** of the tightening lever **7** which shorter arm is closer to the boot heel than the main part of the arm **7** is a roller **10** project-

ing beyond the arm 7*a*. Serving as the shaft for the roller is a pivot pin **11**, which also pivotally connects the link **8** to the shorter arm 7*a* of the tightening lever **7**. By means of an additional pin **12**, a helical spring **9** is connected to the link **8**. In this embodiment, the tightening device is fixed on a plate **13** arranged to be rotatable on the ski. This plate, which is rotatable about the pivot **14**, is preferably provided when the tightening device is to be used in combiantion with a so-called cheek plate. The lateral swinging of the ski boot is facilitated or only made possible by the pivotability of the plate **13**. In order to secure the ski boot against lateral displacement, lateral cheek plates **15** can also be arranged on the rotatable plate. Rings **16** serve for drawing through and fixing a long strap which is not shown and which can be used by good skiers for downhill or mountain skiing. Such a long strap can however be dispensed with for normal skiing purposes, especially as a substantially greater pressure can be obtained with the present tightening device.

The operation of the tightening device shown in FIG. 7 is as follows. With the closing of the tightening lever **7** in the direction B, the roller **10** is supported in the heel groove. With this embodiment, as illustrated, the tightening lever is rotated about a pivot pin **17**, which is connected to the rotatable plate **13** by means of a second link **18**. With the closing of the tightening lever, the roller **10** rolls in the heel groove, whereby the friction between the short lever arm and the said groove is substantially reduced. Therefore, a much smaller force is necessary for closing the new tightening device than that required with the hitherto known tightening devices.

This advantage can be utilized in order to lengthen the short lever arm 7*a*, which is characterized by the spacing *a* of the pivot pins **11** and **17**. By this means, firstly the closing and opening travel of the tightening device is increased, as already mentioned above. This makes possible a more convenient fitting of the binding, since the tightening loop is larger, and also has the advantage that the helical spring **9** can be more strongly tensioned. As a result, the pressure exerted by the tightening device on the heel of the boot is substantially increased. Consequently, the ski boot is firstly pressed more firmly on to the ski and secondly, since the tension of the tightening device extends diagonally, it is pressed more strongly against the safety plate **3** engaging on the toe of the boot. By this means, a very rigid and intimate connection is achieved between the ski boot and the ski, thus facilitating control of the ski.

FIGS. 2 to 5 illustrate a particularly advantageous embodiment of the new tightening device. With this advantageous constructional form, two approximately rectilinear helical springs **19** and **20** are arranged on the two longitudinal sides of the heel. The helical spring **19** is connected through the link **21** to the long lever arm 22*b* of the tightening lever **22**, while the spring **20** acts on the short lever arm 22*a* of the tightening lever **22**. Provided on that end of the link **21** which engages the spring **19** is a roller **23**. Furthermore, as in the preceding constructional example, a roller **24** is arranged on the short lever arm 22*a* of the tightening lever **22**. In order to connect the helical springs **19**, **20** with the link **21** and the short lever arm 22*a* of the tightening lever **22**, respectively, connecting elements **25**, **26** are also provided, which have a U-shaped profile for accommodating the rollers **23**, **24** (see FIG. 5). Serving as the shaft for the roller **23** is a pivot pin **27**, which also pivotally connects the link **21** to the connecting element **25**. A pivot pin **28** is also provided, which serves as a shaft for the roller **24** and also for holding the connecting element **26**. The link **21** is pivoted on the long lever arm 22*b* of the tightening lever by pivot pins **29**. In this embodiment, the fulcrum of the tightening lever is not at one of the pivot pins **28** or **29**, but is between those two pins because of the symmetrical arrangement of the two helical springs **19**, **20**.



In this particularly advantageous embodiment, the two helical springs **19**, **20** are approximately rectilinear, as will be seen from the drawing. The almost rectilinear spring travel causes a good and uniform spring stressing, which is not obtained with the prior known tightening devices with curved springs engaging on the heel. A very good pressure by the rollers **23**, **24** on the heel is produced by these straight springs. As will be seen from FIG. 3 of the drawing, the helical springs **19**, **20** do not bear on the heel groove in the first part of the closing operation, since only the rollers **23**, **24** are supported therein. Moreover, with the tightening device closed, the pressure between the springs **19**, **20** and the heel is only slight, since they merely bear on the longitudinal sides or in the first part of the curvature of the heel and here the force component is comparatively small. At the rearmost end of the heel, on the contrary, where the force component of the spring is greatest, only the rollers **23**, **24** are supported in the heel groove. Since these only have a slight rolling friction and the springs practically do not bear or only bear with very slight pressure in the said groove, a very convenient closing of the tightening lever **22** with small expenditure of energy is possible with this particularly advantageous constructional form of the new tightening device. Since only a small force is necessary for closing this tightening device, it is possible, as already explained in connection with the preceding constructional example, to use stronger springs, so that an even better pressure is exerted on the heel of the boot. Both helical springs are preferably made the same size, so that the tightening device is approximately symmetrical. This symmetrical design of the tightening device has the advantage that the boot heel is always accurately centered on the ski, if any guiding lateral cheek plates are missing.

Referring to the constructional example illustrated in FIGS. 2–5, the tightening device is also fixed on a rotatable plate **30**. This fixing can be effected by set bolts **31**, which preferably are longitudinally adjustable. A lateral displacement of the boot is also prevented in this case by lateral cheek plates **32**. The prior known tightening devices also have the disadvantage that they lie flat on the ski when in the open position. However, since the highest point of the heel groove is at 2 to 3 centimetres from the ski surface, the tightening device must be lifted this amount and then placed in the heel groove. Since the tightening device is very loose when the tightening lever is open, it always slips out of the heel groove again if it is not held by one hand. Another hand is then also necessary for actuating the tightening lever. This inconvenient strapping of the hitherto known tightening devices is avoided by the arrangement according to the invention, by the fact that the set bolts **31** and thus also the remainder of the tightening device are held in a position sloping up to the heel groove by supporting elements provided between the ski and the set bolts **31**. With the constructional form as illustrated in FIGS. 2 and 3, these supporting elements are upwardly bent lugs **33** of the rotatable plate **30**. However, similar supporting elements can also be provided on the set bolts **31**, which are then supported on the rotatable plate or on the surface of the ski.

In the embodiments previously described, the new tightening device is fixed on rotatable plates arranged near the heel. FIG. 6 shows another constructional example in which the helical springs **34**, **35** are secured in a known control cable **37** guided by means of staple hooks **36**. This control cable is secured in a holding device **38** which is preferably provided with different detents and fixed on the ski in front of the ski boot. The tightening device itself can be constructed in exactly the same way as in the two constructional examples described above.

In order to ensure a satisfactory rolling of the rollers **10**, **23** and **24** in the heel groove, the said rollers can if necessary also be milled or provided with grooves or the like extending parallel to their axes.

The invention is not limited only to the embodiments illustrated. It is moreover also possible for the tightening device to be secured not on a rotatable plate, but on a rigid plate, on two separate plates or with similar fixing devices on the ski.

FIG. 8 shows a tightening device constructed as a safety tightening means. A holding member **39** is connected to one end of the control cable **37**, it being possible for the end **40** of the tightening lever **41** to be forced into the member **39**. These cooperating components are so arranged that with excessive pull on the cable (i.e. with a dangerous fall forwardly), the end **40** of the lever is pulled out of the holding member **39** and thus the tightening device is automatically opened by the control cable.

In the advantageous embodiment as illustrated, the holding member is formed as a nut **42** which can be screwed on to a threaded bolt **44** connecting the end of the cable **37** to the end of the spring **43** and can thus be adjusted longitudinally of the said bolt **44**. This holding member in the form of a nut **42** comprises a hook-shaped rocker arm **45** which, as shown in the drawing, engages over the end **40** of the tightening lever **41**. With excessive pull on the cable, the two springs **43** and **46** are expanded so strongly that the end **40** of the tightening lever is pulled out of the hook-shaped holding member **45** and then the tightening device is automatically opened under the action of the strong cable pull.

The combination of the roller-type tightening means according to the invention as shown in FIG. 8 with the previously described safety device has the particular advantage that with a dangerous forward fall, the tightening loop consisting of the springs **43**, **46**, the link **47** and the lever **41**, opens instantaneously and to such a degree that the loop can slip off the heel, this being due to the small friction made possible by interposition of the rollers **23**, **24**. As previously described, due to the interposition of the rollers **23**, **24**, the closing pressure produced by the link **47** and tightening lever **41** can be made comparatively strong, so that therefore the enlargement of the tightening loop when opening the tightening device can be comparatively large.

What is claimed is:

1. A tightening device for ski bindings, said device being mountable on a ski and being engageable with the heel of a ski boot, comprising:

two, substantially rectilinear, coil springs arranged to extend along the two longitudinal sides of the heel from the front to the rearward end thereof;

a tightening lever having a long lever arm and a short lever arm, the tightening lever being pivotally movable in a plane which extends lengthwise of the ski, the short lever arm being pivotally connected to the rearward end of one spring;

a link pivotally connected at its respective ends to said long lever arm and to the rearward end of the other spring, said link being adapted to be disposed behind the rear end of the heel and extend substantially crosswise thereof;

a first roller connected to the rearward end of said one spring for rotation about an axis perpendicular to the plane of movement of the tightening lever;

a second roller connected to the rearward end of said other spring for rotation about an axis perpendicular to the plane of movement of the tightening lever;

said rollers being disposed between the rearward ends of said springs and being of such size that they extend inwardly a substantial distance beyond the innermost edges of said tightening lever and said link so that the portion of the periphery of said rollers closest to the heel will engage the heel and hold the rearward ends of the springs out of engagement with the heel.



2. A tightening device according to claim 1, in which the pivotal connection of the short lever arm and said one spring is coaxial with the rotational axis of the first roller and the pivotal connection of the link to the other spring is coaxial with the rotational axis of said second roller.

3. A tightening device according to claim 1, in which both coil springs are the same size, so that the tightening device is approximately symmetrical.

4. A tightening device according to claim 1, in which the front ends of the springs are fixedly connected to a heel plate which is mounted on the ski, the said heel plate being provided with ring holders for drawing through and securing a long strap.

5. A tightening device according to claim 4, in which the springs are secured to the heel plate by adjustable set bolts.

6. A tightening device, according to claim 5, in which the set bolts and thus also the remainder of the tightening device are held in a position sloping up to the heel groove by upwardly inclined surfaces on the heel plate.

7. A tightening device according to claim 1, in which the coil springs are connected to a control cable which is secured to the ski in front of the ski boot and which is guided by staples.

8. A tightening device according to claim 7, in which one end of the control cable has connected thereto a holding member into which the end of the tightening lever can be guided, these co-operating parts being so arranged that with excessive pull on the cable, the end of the tightening lever is pulled out of the holding member and thus the tightening device is automatically opened by the control cable.

9. A tightening device according to claim 8, in which the holding member is constructed as an adjustable nut on a threaded bolt connecting the end of the cable to one end of the spring and comprises a hook-shaped rocker arm which serves for holding the end of the tightening lever.

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