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(54) A CROSS COUNTRY SKI ARRANGEMENT

(57) A cross country ski arrangement, comprising a cross country ski (10, 110), and a binding apparatus (30, 130) which comprises an upper chassis section (40, 140) comprising a first contact surface (43, 143) having a front end and a rear end, and a lower chassis section (50, 150) comprising a second contact surface (53, 153) having a front end and a rear end. At least one of the first (43, 143) and second (53, 153) contact surfaces exhibits a curved portion, thereby allowing the upper chassis section (40, 140) to pivot relative to the lower chassis section (50, 150) by rolling contact motion between the first (43, 143) and second (53, 153) contact surface, such that a momentary contact region (CR) of the first (43, 143) and second (53, 153) contact surfaces moves back and forth in the longitudinal direction between the front and rear ends of the first (43, 143) and second (53, 153) contact surfaces. A spring back means (60, 160) is arranged to urge the momentary contact region (CR) to a neutral position between the front and rear ends of the first (43, 143) and second (53, 153) contact surfaces. At least a portion of the upper (40, 140) and the lower (50, 150) chassis sections are recessed into the ski body (11, 111) from the upper ski surface (12, 112) such that the first (43, 143) and second (53, 153) contact surfaces are arranged below the upper ski surface (12, 112).

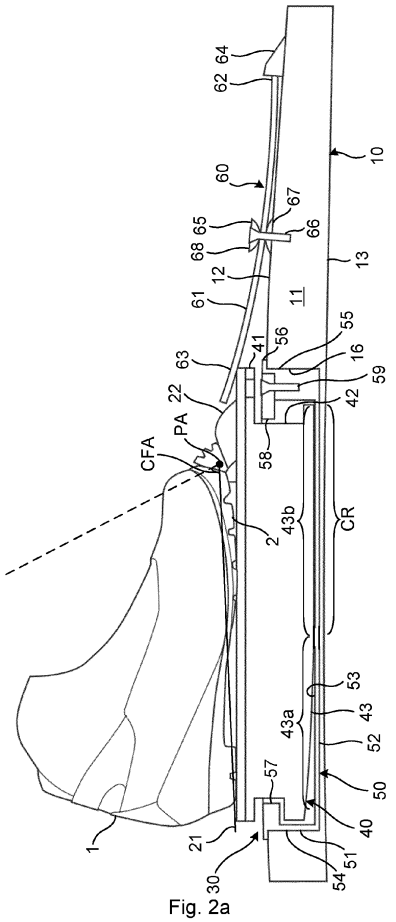

Fig. 2a

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Description

TECHNICAL FIELD

[0001] The present disclosure relates to the field cross country skiing, sometimes referred to as Nordic skiing. In particular, the disclosure relates to a cross country ski arrangement comprising a ski and a binding apparatus. The disclosure also relates to a binding apparatus for such a cross country ski arrangement. The cross country ski arrangement and the binding apparatus may be utilized at all kinds of cross country skies including skis designed and intended for both classical cross country skiing and cross country skating.

BACKGROUND

[0002] Cross country skiing involves several different techniques to be performed by the skier. These techniques comprise e.g. diagonal stride, double poling and skating. At most techniques it is required that the heel of the skier is lifted from the ski, whereas the front region of the skier's foot and ski boot is fixed to the ski. For this reason, traditional cross country ski bindings and boots are arranged to securely fix the toe region of the boot to the upper surface of the ski and to allow the heel portion to be swung up from the upper ski surface and back. At modern ski binding and boot combinations, the toe portion of the boot is provided with a transverse rod which is fixed in a downwardly open recess in the sole of the boot. When the boot is fixed to the ski by means of the binding, the rod is pivotally held by the binding such that the entire boot may be pivoted about a transverse pivotal axis defined by the rod. This affords for the advantage that the sole of the boot may be rigid while still allowing the heel, midfoot and forefoot of the skier to be swung from and towards the upper ski surface.

[0003] EP 2 696 949 B1 discloses a vehicle in the form of a skate or a ski at which a so-called clap binding has been mounted on top of an auxiliary binding arrangement which is mounted on top of the vehicle. The auxiliary binding arrangement comprises an upper chassis section exhibiting a curved contact surface and a lower chassis section exhibiting a planar contact surface. The biding arrangement allows the upper chassis section to be pivoted relative to the lower chassis section by a rolling contact motion between the curved and the planar contact surfaces.

SUMMARY

[0004] One object of the present disclosure is to provide an enhanced cross country ski arrangement comprising a cross country ski and a binding apparatus.

[0005] Another object is to provide such an arrangement which allows for that the angle of the skier's foot in a vertical plane through the longitudinal direction of the ski may be varied within a comparatively great interval.

[0006] A further object is to provide such an arrangement which allows prolonged leg strokes at various skiing techniques.

[0007] Yet another object is to provide such an arrangement which allows for that the skier may readily shift the centre of gravity along an increased longitudinal distance of the ski.

[0008] Still another object is to provide such an arrangement which allows for that the length of the grip or kick wax zone of the ski may be shortened to thereby enhance gliding while still providing a sufficient grip at kick off.

[0009] A further object is to provide such an arrangement which facilitates the adjustment of the foot pitch angle.

[0010] Another object is to provide such an arrangement which is reliable in use.

[0011] Yet another object is to provide such an arrangement which may easily be assembled.

[0012] Another object is to provide such an arrangement which is simple in construction, and which may be manufactured at a comparatively low cost.

[0013] A further object is to provide a cross country ski binding apparatus which may form part of such an arrangement.

[0014] According to a first aspect of this disclosure, these and other objects are achieved by a cross country ski arrangement as set out in the appended claim 1. The cross country ski arrangement comprises a cross country ski, which comprises a ski body delimited by a lower ski surface arranged to glide on snow and an upper ski surface arranged opposite to the lower surface, which ski body exhibits a longitudinal direction extending from a tail to a ski tip, and a binding apparatus. The binding apparatus comprises an upper chassis section comprising a first contact surface having a front end and a rear end, a lower chassis section comprising a second contact surface having a front end and a rear end. At least one of the first and second contact surfaces exhibits a curved portion, thereby allowing the upper chassis section to pivot relative to the lower chassis section by rolling contact motion between the first and second contact surface, such that a momentary contact region of the first and second contact surfaces moves back and forth in the longitudinal direction between the front and rear ends of the first and second contact surfaces. A spring back means is arranged to urge the momentary contact region to a neutral position between the front and rear ends of the first and second contact surfaces. At least a portion of the upper and the lower chassis sections are recessed into the ski body from the upper ski surface such that the first and second contact surfaces are arranged below the upper ski surface.

[0015] The cross country ski arrangement is intended to be used together with a traditional cross country ski binding which is mounted onto or formed integral with the upper chassis section of the binding apparatus. The biding apparatus allows for that a boot fixed to the tradi-

tional binding is allowed to pivot in the longitudinal direction over an angle, sometimes referred to as the foot angle, which is greater that the pivotal angle allowed by the traditional binding. Thereby the skier gains the ability to, at each moment, select the optimal foot angle relative to the ski and the ground over a grater angle interval. This has proven to be of great importance since it allows the skier to better adapt his or her overall movements to the momentary conditions at hand, such as the ground inclination, the snow conditions and the specific technique practiced. For example, at diagonal stride the skier may extend the forward movement of the gliding ski at the same time as he or she maintains pressure on the kick-off ski for a prolonged time. At double poling, the skier may kneel deeper when initiating the pole push-off and also more easily raise the body at the end of the push-off phase of each stroke. At gliding, the increased foot angle interval both facilitates the skier's displacement of the centre of gravity in the longitudinal direction and extends the longitudinal distance along which the centre of gravity may be shifted. Both these effects increase the skier's ability to minimize contact between the grip vax zone of the ski and the snow. When practising the skating technique, the increased foot angle interval allows for a prolongation of each leg stroke.

[0016] Additionally, by selecting the geometry of the contact surfaces it is also possible to readily adjust the foot's angel, in a vertical plane, relative to the ground, at the initial push-off moment. This relative foot angle is herein referred to as the foot pitch angle.

[0017] In practice, the binding apparatus may be designed to allow the upper chassis section a rolling pivotal movement relative to the lower chassis section over a pivotal angle of less than 10 ° such as e.g. approx. 3°. Even though this may appear to be a small increase of the total foot angle interval, numerous and comprehensive tests have proven that this seemingly small increase of the skier's moveability greatly enhances his or her performance as compared to when utilizing traditional ski bindings.

[0018] The recessed arrangement of the binding apparatus into the ski, such that the contact surfaces are arranged below the upper ski surface, also provides for a number of advantages. Such an arrangement contributes to maintain the centre of gravity, both of the binding apparatus and the skier, as low as possible. This in turn enhances the skier's ability to keep in balance. The recessed arrangement also prevents snow and other foreign matter to interfere with the contact surfaces and the functioning of the binding apparatus. In addition, the recessed arrangement of the upper pivotal chassis section allows for that this section may readily be arranged securely guided in the lateral direction to thereby prevent any wiggling of the upper chassis section and the foot about a longitudinal axis.

[0019] A further advantage obtained by the recessed arrangement of the contact surfaces is that the vertical height of that portion of the upper chassis section which is recessed into the ski may be comparatively great. This is important since the material forming the upper chassis section's lower portion contributes to provide stiffness and rigidity to the upper portion of the upper chassis section. This upper portion receives the downwardly directed force exerted by the skier, especially at push-off. For gaining maximal push-off efficiency it is important that an as great portion as possible of the force generated by the skier is transmitted to the contact region between the lower ski surface and the snow. That is, it is important that an as small portion as possible of the generated force is absorbed by causing deformation of the various components arranged between the foot of the skier and the snow. The recessed arrangement of portions of the upper chassis section greatly contributes to achieving this goal since any increase in the vertical height of the lower portion of the upper chassis section increases the rigidity of the upper chassis section's upper portion as well as of any plate member of a traditional binding mounted thereon. Hence, the recessed arrangement contributes to increase the rigidity of the entire cross country ski arrangement thereby reducing loss of energy due to deformation of constituent components, especially at push-off.

[0020] At certain embodiments, the lower chassis section comprises an elongate member exhibiting a U-shaped cross section defined by a bottom wall exhibiting the second contact surface and two mutually parallel side walls extending upwardly from respective side edges of the bottom wall.

[0021] The upper chassis section may comprise an elongate structure arranged to be received in the lower chassis section and comprising a lower edge exhibiting the first contact surface.

[0022] The elongate structure may exhibit two mutually parallel and opposed side surfaces extending upwardly from the lower edge.

[0023] The distance between the two side walls of the lower chassis member may be essentially equal to the distance between the two side surfaces of the elongate structure of the upper cassis section.

[0024] The neutral position of the momentary contact region (CR) may be arranged at the frontmost portions of the first and second contact surfaces. By this means the foot of the skier is restricted to preform merely so-called backward tolling from the neutral position which has proven to be especially advantageous.

[0025] The spring back means may be arranged to pretension a front portion of the upper chassis section downwardly.

[0026] The spring back means may comprise at least one elongate spring element such as leaf spring or a resilient rod.

[0027] The at least one curved contact surface is arranged on an exchangeable insert.

[0028] The exchangeable insert may be arranged as a removable portion of the elongate fin-like structure of the upper chassis section.

[0029] The spring back means may be adjustable for controlling the force by which the momentary contact region (CR) is urged towards the neutral position.

[0030] At least a portion of the curved portion of a contact surface may have a radius of curvature of more than 1 m, preferably approx. 2-8 m and more preferably approx. 4-6 m.

[0031] At least a portion of the first and/or second contact surface may exhibit a curvature and length which are arranged such that the maximum rolling pivot angle is between 1-10 °, preferably between 2-5 ° and most preferably approx. 3°, when the contact region moves between the front and rear ends of the first and second contact surfaces.

[0032] The cross country ski arrangement may further comprise a cross country ski binding attached to the upper chassis section and being arranged to allow a ski boot to be pivotally fixed to the upper chassis section.

[0033] According to a second aspect, there is provided a cross country ski binding apparatus as set out in independent claim 13. The cross country ski apparatus is intended for use at a cross country ski arrangement as set out above. The cross country ski apparatus comprises an upper chassis section comprising a first contact surface having a front end and a rear end, and a lower chassis section comprising a second contact surface having a front end and a rear end. At least one of the first and second contact surfaces exhibits a curved portion, thereby allowing the upper chassis section to pivot relative to the lower chassis section by rolling contact motion between the first and second contact surface, such that a momentary contact region of the first and second contact surfaces moves back and forth in the longitudinal direction between the front and rear ends of the first and second contact surfaces. A spring back means is arranged to urge the momentary contact region to a neutral position between the front and rear ends of the first and second contact surfaces. At least a portion of the upper and lower chassis sections are arranged to be recessed into a ski body of a cross country ski, from an upper ski surface such that the first and second contact surfaces are arranged below the upper ski surface.

[0034] Further objects and advantages will appear from the following detailed description of embodiments and from the appended claims.

[0035] Generally, all terms used in the claims are to be interpreted according to their ordinary meaning in the technical field, unless explicitly defined otherwise herein. All references to "a/an/the element, apparatus, component, means, step, etc." are to be interpreted openly as referring to at least one instance of the element, apparatus, component, means, step, etc., unless explicitly stated otherwise. The steps of any method disclosed herein do not have to be performed in the exact order disclosed, unless explicitly stated.

BRIEF DESCRIPTION OF THE DRAWINGS

[0036] Aspects and embodiments are now described, by way of example, with reference to the accompanying drawings, in which:

Fig. 1 is a longitudinal section of a cross country ski arrangement according to a first embodiment and provided with a conventional cross country ski binding holding a ski boot.

Figs. 2a and 2b show details in enlarged scale of a portion of the longitudinal section shown in fig. 1, wherein the figures 2a and 2b illustrate the arrangement in two different operational modes.

Fig. 3 is a is an exploded view in perspective illustrating a cross country ski arrangement according to a second embodiment, wherein portions of the ski have been removed.

DETAILED DESCRIPTION

[0037] The aspects of the present disclosure will now be described more fully hereinafter with reference to the accompanying drawings, in which certain embodiments of the invention are shown.

[0038] These aspects may, however, be embodied in many different forms and should not be construed as limiting; rather, these embodiments are provided by way of example so that this disclosure will be thorough and complete, and to fully convey the scope of all aspects of invention to those skilled in the art. Like numbers refer to like elements throughout the description.

[0039] Figs. 1, 2a and 2b illustrates a cross country ski arrangement according to a first embodiment and a ski boot 1. The ski arrangement comprises a cross country ski 10, a binding apparatus 30 and a conventional cross country ski binding 20 which has been mounted to the binding apparatus 30.

[0040] The cross country ski 10 comprises an elongate ski body 11 which is delimited by an upper ski surface 12 and a lower ski surface 13 which is arranged to be in contact with the snow at skiing. The ski 10 extends longitudinally between a tail 14 and a ski tip 15 and the longitudinal direction from the tail 14 towards the tip 15 defines a forward direction.

[0041] The conventional binding 20 comprises a plate member 21 which is fixed onto the binding apparatus 30 and a connection device 22 which, as known in the art, allows the toe portion of the ski boot 1 to be removably fixed to the ski 10 while allowing the ski boot 1 to be pivoted in a vertical and longitudinal plane about a pivotal axis PA which is defined by a transverse rod (not shown) which is recessed from below in the front portion of the sole 2 of the boot 1. Fig. 2a schematically illustrates that the pivotal conventional foot angle interval CFA allowed by the conventional binding 20 may typically be about

0-70 °.

[0042] The binding apparatus 30 comprises an upper chassis section 40 and a lower chassis section 50. The upper chassis section 40 comprises an upper plate shaped portion 41 and a lower elongate structure 42, which in the shown example forms a fin-shaped portion of the upper chassis section 40. The length in the longitudinal direction of the ski 1 of the upper plate shaped portion 41 is essentially equal to the length of the conventional binding's 20 plate member 21 and its width in the transverse direction is essentially equal to the width of the ski 1 at its longitudinal mid-portion. The conventional bindings 20 plate member 21 is fixed to the upper surface of the plate shaped portion 41. The fin-shaped portion 42 is formed integral with the plate shaped portion 41 and extends downwardly from its lower surface. The fin-shaped portion 42 has a constant width in the lateral direction which is essentially smaller than the width of the plate shaped portion 41. The fin-shaped portion 42 further extends centrally, in the longitudinal direction and is arranged orthogonal to the plate shaped portion 41. The upper portion of the fin-shaped portion 42 is somewhat shorter in the longitudinal direction than its lower portion such that the fin-shaped portion together with the plate shaped portion 41 forms a forwardly and a rearwardly open recess. Further, the lower edge of the fin-shaped portion 42 exhibits a first contact surface 43.

[0043] The lower chassis section 50 comprises an elongate member 51 which, int shown example forms a box-like member. The box-like member 51 is recessed into an elongate grove 16 which is formed centrally from the upper surface 12 in a mid-portion of the ski's 10 body 11. The box-like member 51 comprises a bottom wall 52 which, at its upper surface exhibits a second contact surface 53. The box-like member 51 further comprises two mutually opposed and parallel side walls (not shown) which extends upwardly from respective side edges of the bottom wall 52. By this means the recessed box-like member 51 exhibits a constant U-shaped cross-section. The box-like member 51 also comprises a rear wall 54 and a front wall 55. At its upper mouth, the box-like member 51 exhibits a circumferential flange 56 which extends outwardly from the side walls, and the rear 54 and front 55 wall such that it bears against the upper surface 12 of the ski 10 around the recess 16 of the ski 10. A rear stop flange 57 protrudes forwardly from the upper edge of the rear wall 54 and a front stop flange protrudes rearwardly from the front wall 55. In the shown example the rear stop flange 57 is formed integral with the rear wall 54 whereas the front stop flange 58 is removably fixed to the front wall 55 by means of a fixation screw 59 for allowing insertion and removal of the upper chassis section's 40 fin-shaped portion 41 into the box-like member 51.

[0044] The binding apparatus further comprises a spring back means 60 which, in the example shown in figs. 1 and 2a-b, comprises an elongate leaf spring 61 exhibiting a front end portion 61 and a rear end portion 63. The front end portion is fixed to the upper surface 12 of the ski 10 by means of a bracket 64 which may be securely fixed to the upper surface 12 of the ski 10 by an adhesive. Alternatively it may be sufficient that the bracket is pressed onto the upper surface 12 of the ski by means of a clamping means 65 described below. The rear end portion 63 of the leaf spring 61 bears against the upper surface of the plate member 21 of the conventional binding 20. The rear end portion 63 is urged downwardly towards the plate member 21 by means of a clamping means 65 which holds a mid-portion of the leaf spring 61 at a fixed distance from the upper surface 12 of the ski 10. At the shown example, the clamping means 65 comprises a screw 66 which extends through holes in the leaf spring 61 and through a lower 67 and an upper 68 bushing and which is threadedly engaged with the body 11 of the ski 10.

[0045] In the example shown in figs. 1 and 2a-b, the upper chassis section 40 is formed as a single integral part for example by injection moulding of a polymer material. The lower chassis section 50 comprises an integral part comprising the bottom wall 52, the side walls, the rear 54 and front 55 walls and the circumferential flange 56 which may be formed by injection moulding of a polymer material. The lower chassis section further comprises the front stop flange 58 formed as a separate part, e.g. by injection moulding and the fixation screw 59. However, other materials may be used for forming the upper and lower chassis sections. Examples of such other materials are steel, aluminium and other metals as well as carbon fibre based materials and polymer materials formed by additive manufacturing such as 3D printing. At some embodiments, the upper portion of the upper chassis section may be formed by a first material and the lower fin-shaped portion by another material. Especially, it may be advantageous that at least the fin shaped portion and possibly the entire upper chassis section is formed of or comprises a material exhibiting a high elasticity modulus such as e.g. carbon fibre containing materials.

[0046] The lateral width and the longitudinal length of the recess 16 in the ski essentially corresponds to the outer dimensions of the box like member 51 such that the box like member is received in the recess 16 with a tight fit. Preferably, the box-like member is additionally fixed in the recess 16 by means of an adhesive. To this end it may be noted that extensive tests have shown that the recess needed to be formed in the ski for receiving the binding apparatus 30 does not to any appreciable extent negatively affect the properties such as the rigidity, the stiffness, or the resiliency of the ski.

[0047] The inner width between the side walls of the box like member 51 is essentially equal to the lateral width of the fin-shaped portion 42. Typically, the fin-shaped portion 51 is received in the box like member 51 with a close running fit or a sliding fit such that the upper chassis section 40 is allowed to roll relative to the lower chassis section 50 while still being supported in the

transverse direction for preventing sideways movement and wiggling of the upper chassis section. Preferably the materials forming the fin-shaped portion 42 and the box like member 51 are selected to present comparatively high strength and rigidity and low mutual friction.

[0048] In the shown example, the first contact surface 43, arranged at the upper chassis section 40 exhibits a rear curved portion 43a and a front planar portion 43b. The second contact surface 53, arranged at the bottom wall 52 is planar over its entire length. In the shown example the curvature of the curved portion 43 is constant with a radius of curvature of approx. 5 m and the curved portion 43a extends forwardly from the rear end of the first contact surface 43 approx. 3/7 of the total length of the first 43 and second 53 contact surfaces. The properties of the contact surfaces 43, 53 may however be varied depending on various conditions such as the skiing technique for which the ski is to be optimized, the weather and snow conditions and not the least to personal preferences of the skier.

[0049] The arrangement of the two contact surfaces 43, 53 where at least one exhibits a curved portion 43a allows the upper chassis section 40 and thereby the ski boot 1 to pivot relative to the lower chassis section 50 and the ski 1 by rolling contact motion between the first 43 and second 53 contact surface. By this means the first 43 and second 53 contact surfaces will, at each instance of the relative movement, be in mutual contact along a momentary contact region CR which moves longitudinally back and forth along the two contact surfaces 43, 53.

[0050] In fig. 2a it is illustrated how the binding apparatus has assumed its frontmost rolling position. At this position, the momentary contact region CR extends along the planar portion 43b of the first contact surface and a corresponding front portion of the planar second contact surface 53. This frontmost rolling position, where the momentary contact region is positioned at its front most position, constitutes the neutral position since the spring back means 60 with the leaf spring 61 acts downwardly on the front portion of the upper chassis section, thereby urging it to roll forwardly, i.e. clockwise as shown in the figures. When no external force, such as any force exerted by the skier, acts on the binding apparatus 30, the spring back means 60 returns and maintains the upper chassis section 40 at a pivotal position where the momentary contact region CR is in its frontmost neutral position. At this position the skier's foot assumes the foot pitch angle as defined herein. By selecting the geometries, especially of the contacts surface's (43, 53) frontmost portions, it is possible to set the foot pitch angle depending on the prevailing conditions and the skier's preferences.

[0051] Fig. 2b illustrates how the upper chassis section 40 and the boot 1 has been rolled backwards, against the resilient force exerted by the spring back means 60. By this means, the momentary contact region has been displaced rearwards to the rear ends of the first 43 and second 53 contact surfaces. As illustrated in fig 2b, the lower surface of a rear portion of the upper plate shaped portion 41 of the upper chassis section 40 has now come into abutment with an upper surface of the rear stop flange 57 of the lower chassis section, such that any further backward rolling is prevented. Hence, at the rearmost rolling position at this embodiment, a rearmost portion of the fin-shaped portion's 42 lower edge never makes contact with the bottom wall 52 of the lower chassis section 50, such that these rearmost portions of the lower edge and the bottom wall 52 do not form part of the first and second contact surfaces. At the rearmost rolling position shown in fig. 2b, the upper chassis section 40 and the ski boot 1 has been pivoted backwards, i.e. counter clockwise as seen in the figures over an angle of approx. 3°.

[0052] Fig. 3 is an exploded perspective view illustrating cross country ski arrangement according to a second embodiment. The arrangement comprises a cross country ski 110 having a body 111 delimited by a lower and an upper 112 surface. An upwardly open elongate recess 116 is arranged in a mid-portion of the body 111. Typically, the recess 116 may be approx. 250 mm long, 10 mm wide and 20 mm deep. Just as in the embodiment shown in figs. 1 and 2a-b, the arrangement further comprises a binding apparatus 130 comprising an upper chassis section 140, a lower chassis section 1150 and a spring back means 160.

[0053] At this embodiment, the upper chassis section 140 differs from the embodiment shown in figs. 1 and 2a-b in that a plate member of a conventional ski binding is formed integral with the upper chassis section 140 and forms a plate shaped portion 141 thereof. Hence at this embodiment it is not necessary to fix a separate plate member of a conventional binding to the upper chassis section 140. An elongate fin-like structure 142a, 142b extends downwardly from the plate shaped upper portion 141. The fin like structure comprises an upper fin portion 142a formed integral with the plate shaped portion 141 and a separate exchangeable insert 142b. The insert 142b may be attached to and removed from the lower section of the upper fin portion 142a by means of co-operating form locking means arranged at the front and rear ends of the fin portion 142a and the insert 142b. The transverse width of the insert 142 is equal to the width of the upper fin portion 142a. The lower edge of the insert 142b exhibits a first contact surface 143 at least a portion of which is curved.

[0054] Different inserts 142b where the first contact surface 143 exhibits varying curvatures and extensions of the curved portion may be provided. Thereby, the characteristics of the binding apparatus 130, such as the maximum rolling pivotal angle and the foot pitch angle, may readily be adapted depending on the conditions at hand and the skier's preferences, simply by selecting a suitable insert.

[0055] The binding apparatus 130 further comprises a lower chassis section 150 which greatly resembles the lower chassis section 50 shown in figs. 1 and 2a-b and

described above. The lower chassis section comprises a box like member 151 having a bottom wall which exhibits a planar upper surface which forms a second contact surface 153. Two mutually opposed and parallel side walls 151a, 151b extend upwardly from respective side edges of the bottom wall. The interior distance between the side walls 151a, 151b is essentially equal to the width of the fin shaped portion 142a and the insert 142b such that the fin-like structure 142a, 142b is transversely supported by the side walls 151a, 151b when received in the box like member 151. The box like member 151 further comprises a rear wall, a front wall and a peripheral flange 156 which extends outwardly from the upper edges of said walls and which bears against the upper surface 112 of the ski 110. A rear stop flange 157 is formed integral with the rear wall and a front stop flange 158 formed as a separate component is fixable to the front wall by means of s screw 159a and a nut 159b. The box like member 151 is snuggly received in the recess 116 of the ski 110 and additionally fixed therein by means of a suitable adhesive.

[0056] The spring back means 160 comprises two resilient rods 161a, 161b which extend in a V-shaped formation from between respective front and rear portions. The rods 161a, 161b may preferably be formed of or comprise a carbon fibre material. The rods 161a 161b are supported by an elongate bracket 168 which may be formed of an injection moulded polymer material. The rods 161a, 161b and the bracket 168 are fixed to the ski 110 by means of a clamping means 165 which comprises a screw 166a extending between the rods and through the bracket 168 and which is threadedly received in a screw bussing 166b securely fixed in a corresponding hole in the ski 110. The clamping means 165 further comprises a lower 167 and an upper 168 bushing which receives the screw 166 and which exerts a downwardly directed clamping force onto the rods 161a, 161b. By this means the rods 161a, 161b and the bracket are fixed to the ski 110 and the rods are pretensioned downwardly such that the front end of the rods and the bracket is pressed against the upper surface 0112 of the ski 110 and the rear end of the rods 161a, 161b and the bracket is pressed downwardly against a front portion of the upper chassis section's 140 plate shaped portion 141. This in turn results in, just as in the embodiment shown in figs. 1 and 2a-b, that the upper chassis section 140 is urged toward a neutral position where the momentary contact portion (not shown in fig. 3) is positioned at the front end portion of the first 143 and second 153 contact surfaces.

[0057] The aspects of the present disclosure have mainly been described above with reference to a few embodiments and examples thereof. However, as is readily appreciated by a person skilled in the art, other embodiments than the ones disclosed above are equally possible within the scope of the invention, as defined by the appended patent claims. For example,

Claims

1. A cross country ski arrangement, comprising

- a cross country ski (10, 110), which comprises a ski body (11, 111) delimited by a lower ski (13) surface arranged to glide on snow and an upper ski surface (12, 112) arranged opposite to the lower surface, which ski body (11, 111) exhibits a longitudinal direction extending from a tail (14) to a ski tip (15), and
- a binding apparatus (30, 130) which comprises
  - · an upper chassis section (40, 140) comprising a first contact surface (43, 143) having a front end and a rear end,
  - · a lower chassis section (50, 150) comprising a second contact surface (53, 153) having a front end and a rear end,
  - · wherein at least one of the first (43, 143) and second (53, 153) contact surfaces exhibits a curved portion, thereby allowing the upper chassis section (40, 140) to pivot relative to the lower chassis section (50, 150) by rolling contact motion between the first (43, 143) and second (53, 153) contact surface, such that a momentary contact region (CR) of the first (43, 143) and second (53, 153) contact surfaces moves back and forth in the longitudinal direction between the front and rear ends of the first (43, 143) and second (53, 153) contact surfaces, and
  - · a spring back means (60, 160) which is arranged to urge the momentary contact region (CR) to a neutral position between the front and rear ends of the first (43, 143) and second (53, 153) contact surfaces,

wherein at least a portion of the upper (40, 140) and the lower (50, 150) chassis sections are recessed into the ski body (11, 111) from the upper ski surface (12, 112) such that the first (43, 143) and second (53, 153) contact surfaces are arranged below the upper ski surface (12, 112).

2. A cross country ski arrangement according to claim 1, wherein the lower chassis section (50, 150) comprises an elongate member (51, 151) exhibiting a U-shaped cross section defined by a bottom wall (52) exhibiting the second contact surface (52, 152) and two mutually parallel side walls 151a, 151b) extending upwardly from respective side edges of the bottom wall (52).

3. A cross country ski arrangement according to claim 1 or 2, wherein the upper chassis section (40, 140) comprises an elongate structure (42, 142a, 142b)

arranged to be received in the lower chassis section (50, 150) and comprising a lower edge exhibiting the first contact surface (43, 143).

4. Across country skie arrangement according to claim 3, wherein the elongate structure (42, 142a, 142b) exhibits two mutually parallel and opposed side surfaces extending upwardly from the lower edge.

5. A cross country ski arrangement according to claim 4, wherein the distance between the two side walls (151a, 151b) of the lower chassis section (50, 150) is essentially equal to the distance between the two side surfaces of the elongate structure (42, 142) of the upper chassis section (40, 140).

6. A cross country ski arrangement according to any of claims 1-5, wherein the neutral position of the momentary contact region (CR) is arranged at the frontmost portions of the first (43, 143) and second (53, 153) contact surfaces.

7. A cross country ski arrangement according to any of claims 1-6, wherein the spring back means (65, 165) is arranged to pretension a front portion of the upper chassis section (40, 140) downwardly.

8. A cross country ski arrangement according to any of claims 1-7, wherein the spring back means comprises at least one elongate spring element such as leaf spring (61) or a resilient rod (161a, 161b).

9. A cross country ski arrangement according to any of claims 1-8, wherein the at least one curved contact surface (143) is arranged on an exchangeable insert (142b).

10. A cross country ski arrangement according to claim 8, wherein the exchangeable insert (142b) is arranged as a removable portion of the elongate structure (142a, 142b) of the upper chassis section (140).

11. A cross country ski arrangement according to any of claims 1-10, wherein the spring back means (65. 165) is adjustable for controlling the force by which the momentary contact region (CR) is urged towards the neutral position.

12. A cross country ski arrangement according to any of claims 1-11, wherein at least a portion of the curved portion of a contact surface (43, 143) has a radius of curvature of more than 1 m, preferably approx. 2-8 m and more preferably approx. 4-6 m.

13. A cross country ski arrangement according to any of claims 1-12, wherein at least a portion of the first (43, 143) and/or second contact surface exhibits curvature and length which are arranged such that the maximum rolling pivot angle is between 1-10 °, preferably between 2-5° and most preferably approx. 3°, when the momentary contact region moves between the front and rear ends of the first (43, 143) and second (53, 153) contact surfaces.

14. A cross country ski arrangement according to any of claims 1-13, further comprising a cross country ski binding (20) attached to the upper chassis section (40, 140) and arranged to allow a ski boot (1) to be pivotally fixed to the upper chassis section (40, 140).

15. A cross country ski binding apparatus (30, 130) comprising;

- an upper chassis section (40, 140) comprising a first contact surface (43, 143) having a front end and a rear end,
- a lower chassis section (50, 150) comprising a second contact surface (53, 153) having a front end and a rear end,
- wherein at least one of the first (43, 143) and second (53, 153) contact surfaces exhibits a curved portion, thereby allowing the upper chassis section (40, 140) to pivot relative to the lower chassis section (50, 150) by rolling contact motion between the first (43, 143) and second (53, 153) contact surface, such that a momentary contact region (CR) of the first (43, 143) and second (53, 153) contact surfaces moves back and forth in the longitudinal direction between the front and rear ends of the first (43, 143) and second ()53, 153 contact surfaces, and
- a spring back means (65, 165) which is arranged to urge the momentary contact region (CR) to a neutral position between the front and rear ends of the first (43, 143) and second (53, 153) contact surfaces,

wherein at least a portion of the upper 40, 140) and lower (50, 150) chassis sections are arranged to be recessed into a ski body (11, 111) of a cross country ski (10, no), from an upper ski surface (12, 112) such that the first (43, 143) and second (53, 153) contact surfaces are arranged below the upper ski surface (12, 112).

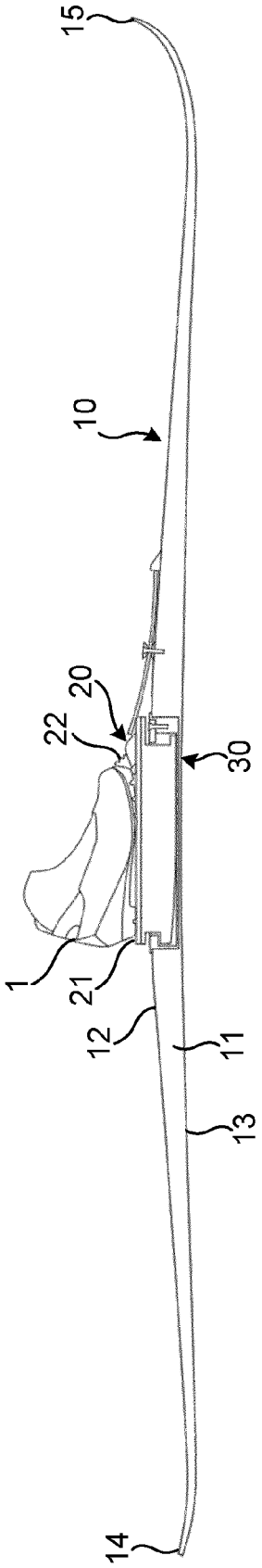
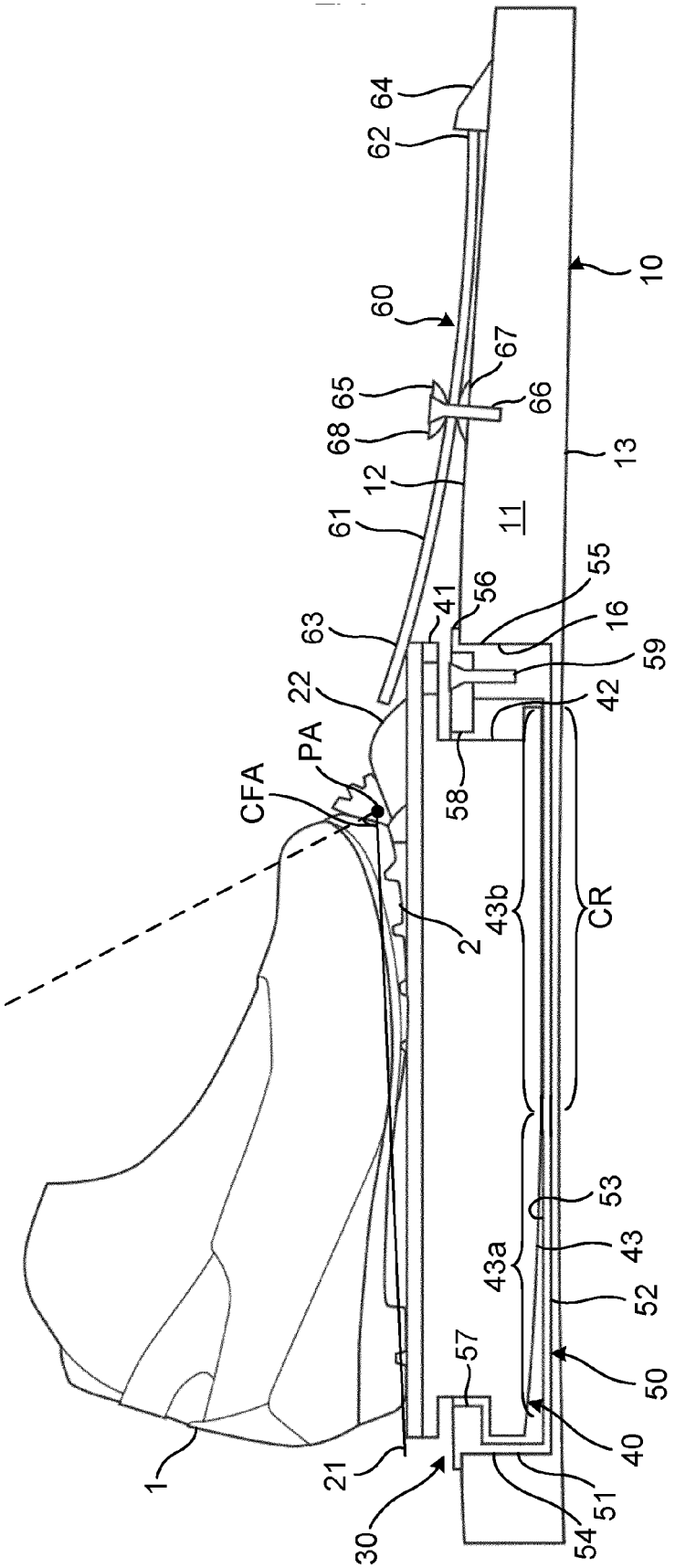


Fig. 1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42
PA
CFA
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43b
CR
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43a
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Fig. 2a

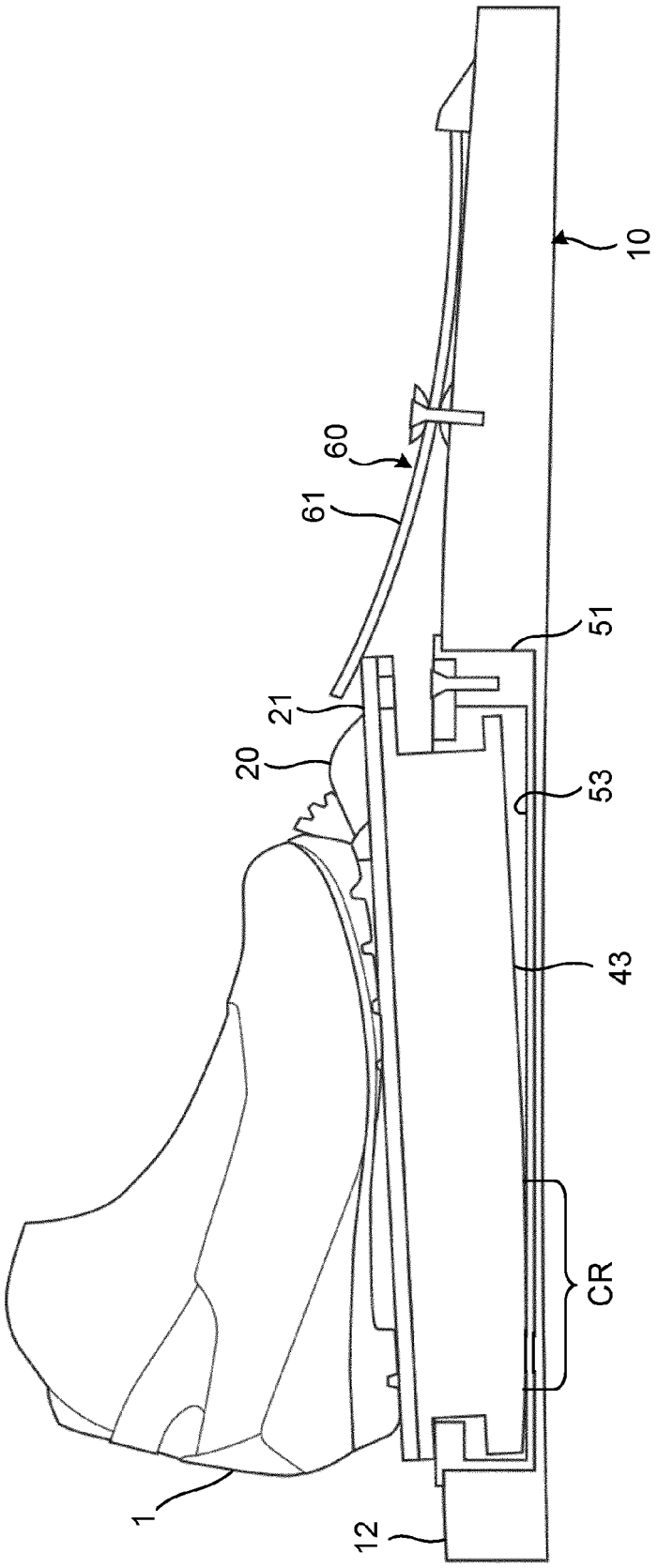
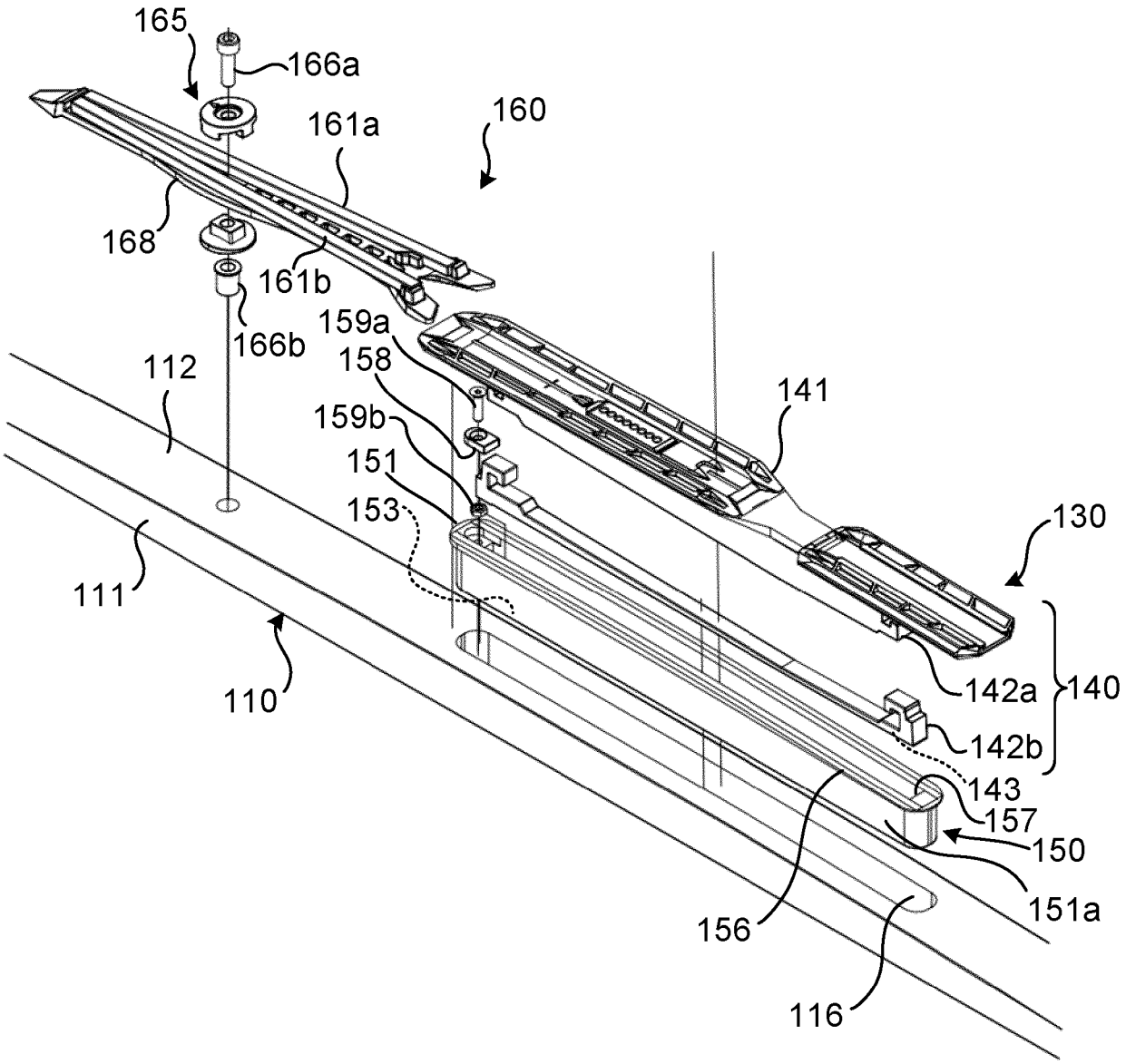


Fig. 2b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166a
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161a
168
161b
159a
166b
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142b
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151a
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Fig. 3

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EUROPEAN SEARCH REPORT

Application Number
EP 23 20 3399

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A63C

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	28 March 2024	Murer, Michael

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