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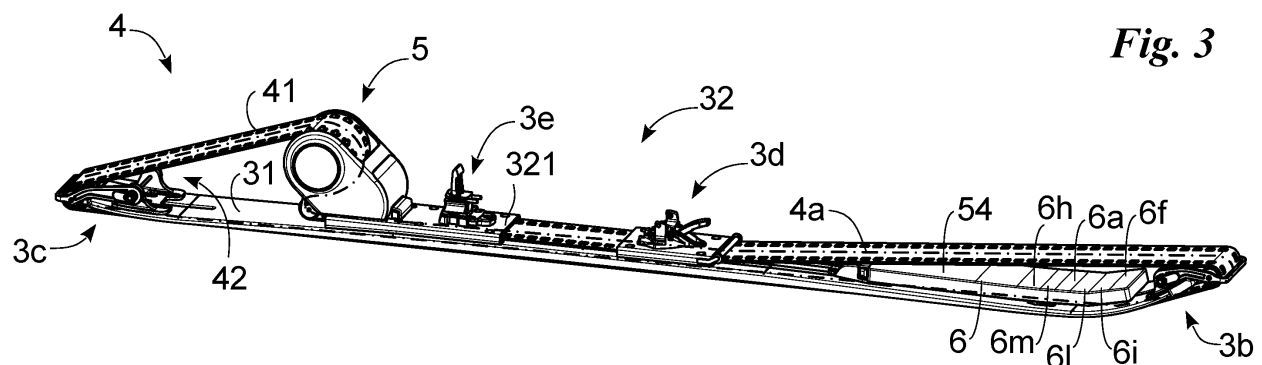
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(74) Representative: **Lunati & Mazzoni S.r.L.****Via Carlo Pisacane, 36****20129 Milano (IT)**(54) **IMPROVED SKIING EQUIPMENT**

(57) Skiing equipment (1) is provided, comprising two skis (3), each of which with a base body (31), a fastening group (32) of a binding (3d, 3e) to the base body (31); a track (4) closed around the base body (31); a mover (5) of the said track (4) around the base body (31);

sensors configured to detect a movement of said ski (3) relative to said ground (1a); and a control unit (6) of said mover (5) of each of said skis (3) and thus the sliding of said track (4) around said base body (31) based on said movement of said ski (3) relative to said ground (1a).

**Fig. 3**

Description

[0001] The present invention relates to skiing equipment of the type specified in the preamble of the first claim.

[0002] In particular, the equipment is usable for covering distances on grounds, particularly on a ground covered with snow. For example, the equipment subject of the present patent can be used for skiing such as ski mountaineering.

[0003] As is known, a ski is a long, flat tool worn on the feet to help sliding on snow.

[0004] Skis mainly consist of a sandwich of layers wherein, starting from the one distal to the surface in contact with the ground, there is an upper layer usually made of plastic, a torsion layer made of titanium or other similar material, a core mostly made of wood, a rubber pad, and a base made of graphite. This sandwich is laterally enclosed by two side rails, called flanks, and by steel edges in contact with the ground. Furthermore, since the sliding on snow is allowed by the formation of a thin film of water, wax, i.e., a layer of wax or other material used to raise the freezing point of water under the ski, is often applied to the base of the ski.

[0005] It is therefore obvious how skis are excellent for tackling downhill slopes but are difficult to use for climbing slopes.

[0006] For this reason, climbing slopes is performed by covering the ski base with sealskins capable of ensuring greater grip for the ski and thus moving forward and gripping while climbing.

[0007] Current sealskins are synthetic and adopt a first adhesive face capable of removably adhering to the ski base (the part in use in contact with the snow), and a second face covered with oriented textile fibers designed to interfere with the snow cover so as to slide forward without slipping backward.

[0008] The known technique described includes some important drawbacks.

[0009] In particular, sealskins are prone to easy deterioration and require frequent maintenance.

[0010] Another drawback is that skis with sealskins are difficult and extremely demanding and tiring to use, requiring considerable physical effort. They can therefore only be used by expert and particularly trained users.

[0011] Another significant drawback is that sealskins are difficult to apply to the ski.

[0012] To solve these drawbacks, some solutions have been identified involving the adoption of tracks to be applied onto the ski. In particular, WO2022262994A1, DE202012101242, and US20220203210 describe the adoption of two lateral tracks for each ski; US3964560A and WO2020216220 teach the making of a ski whose rear part differs from normal skis due to the introduction of a track.

[0013] However, these solutions have limited use due to the complexity of using these combinations of skis and tracks. Specifically, they present considerable difficulties

in controlling and controlling the track movement motors. Indeed, sports equipment integrating tracks into skis is usually used, always with relatively high difficulty, by particularly experienced users.

[0014] A not secondary drawback of these solutions is their construction complexity, high cost, and complex and specialized maintenance.

[0015] In this situation, the technical task underlying the present invention is to design skiing equipment capable of substantially overcoming at least part of the aforementioned drawbacks.

[0016] Within this technical task, an important object of the invention is to obtain skiing equipment that allows easily tackling an uphill climbing.

[0017] Another object of the invention is to create skiing equipment that is easy to use even for a not particularly experienced user.

[0018] A further important object of the invention is to create skiing equipment with increased construction simplicity and reduced cost.

[0019] The technical task and specified objects are achieved by skiing equipment as claimed in the annexed claim 1. Examples of preferred embodiments are described in the dependent claims.

[0020] The features and advantages of the invention are clarified below by the detailed description of preferred embodiments of the invention, with reference to the attached drawings, wherein:

Fig. 1 shows, to scale, skiing equipment in use according to the invention;

Fig. 2 illustrates, to scale, the skiing equipment according to the invention in a different moment of use;

Fig. 3 presents, to scale, an assembly of the skiing equipment;

Fig. 4 shows, to scale, a second view of the assembly of Fig. 3;

Fig. 5 highlights, to scale, a detail of the assembly of Fig. 3; and

Fig. 6 outlines a procedure implementable by the skiing equipment according to the invention.

[0021] In this document, the measures, values, shapes, and geometric references (such as perpendicularity and parallelism), when associated with words like "approximately" or other similar terms such as "substantially" or "essentially," are to be understood as within the limits of measurement errors or inaccuracies due to production and/or manufacturing errors and, above all, within a slight deviation from the value, measure, shape, or geometric reference associated with them. For example, such terms, if associated with a value, preferably indicate a divergence not exceeding 10% of the value itself.

[0022] Furthermore, when used, terms such as "first," "second," "upper," "lower," "main," and "secondary" do not necessarily identify an order, a priority of relation, or

relative position but may simply be used to more clearly distinguish between different components.

[0023] Unless otherwise indicated, terms like "perpendicular," "transversal," "parallel," or "normal" or other geometric positioning terms between geometric elements (e.g., axes, directions, and lines) are to be understood in reference to their mutual geometric position between the corresponding projections. These projections are defined on a single plane parallel to the one(s) on which said geometric elements lie. It is also noted that these geometric positioning terms are to be referred to in accordance with the skiing equipment when mounted and thus ready for use or in use.

[0024] The measurements and data reported in this text are to be considered, unless otherwise indicated, as carried out in International Standard Atmosphere ICAO (ISO 2533:1975).

[0025] Unless otherwise specified, as results from the following discussions, it is understood that terms like "processing," "computing," "determining," "calculating," or similar, refer to the action and/or processes of a computer or similar electronic calculating device that manipulates and/or transforms data represented as physical quantities, such as electronic quantities of registers of a computing system and/or memories, into other data similarly represented as physical quantities within computing systems, registers, or other information storage, transmission, or display devices.

[0026] With reference to the Figures, the skiing equipment according to the invention is generally indicated by the number 1.

[0027] It is configured to be used for covering distances on a ground 1a and particularly on a ground 1a covered with snow, suitably uphill and/or downhill. For example, the equipment 1 can be used for skiing, such as ski mountaineering.

[0028] The skiing equipment 1 defines a condition "in use" when worn by the user and in contact with the ground 1a.

[0029] The skiing equipment 1 comprises at least one pole 2 configured to come into contact with the ground 1a. Specifically, the equipment 1 comprises two poles 2 and, more precisely, in use, includes a first pole 2, for example, held by the user's left hand, and a second pole 2, for example, held by the user's right hand.

[0030] Each pole 2 can define a predominant development axis 2a.

[0031] Each pole 2 comprises a handle 21 configured to be held by the user; a tip 22 configured to come into contact with the ground 1a and specifically to be at least partially driven into said ground 1a; and a shaft 23 having at one end the handle 21 and at the other end the tip 22.

[0032] The shaft preferably develops along said axis 2a.

[0033] Preferably, the handle 21 can be removably fastened to the shaft 23 to allow the removal of the same handle 21 from the rest of the pole 2.

[0034] The skiing equipment 1 comprises at least one

ski 3 configured to rest on the ground 1a. Specifically, the equipment 1 comprises two skis 3 and, more precisely, in use, includes a first ski 3, for example, constrained to the user's left foot, and a second ski 3, for example, constrained to the user's right foot.

[0035] Each ski 3 (Figs. 3 and 4) defines a longitudinal direction 3a and two ends, specifically, a front end 3b and a rear end 3c.

[0036] The longitudinal direction 3a is preferably barycentric to the ski 3.

[0037] The ski 3 can also define a development surface, suitably barycentric to the ski 3 on which the longitudinal direction 3a lies.

[0038] The front end 3b and rear end 3c are defined according to the forward movement direction of the skiing equipment 1 and specifically of the ski 3 in use.

[0039] The ski 3 can include a base body 31 configured to come into contact with the ground 1a and thus slide thereon.

[0040] The base body mainly develops along the longitudinal direction 3a and thus defines it.

[0041] The base body 31 can include and thus define said ends 3a and 3b.

[0042] The body 31 can be substantially straight. It defines for the ski 3 a straight longitudinal direction 3a and a flat development surface.

[0043] Alternatively (as shown in Figs. 1 and 2), it may have ends curved upwards (i.e., away from the ground when the equipment 1 is in use), one end 3b or 3c, or both ends 3b and 3c with the same or different curvature. In this case, the direction 3a can define a straight central portion and those at the ends 3b and/or 3c curved; consequently, the development surface has a central flat part and curved end parts.

[0044] In use, the longitudinal direction 3a and thus the laying surface can be parallel to the ground at least at the central portion.

[0045] The section of the base body 31 can be any. For example, it can be constant and preferably have tapered ends 3b and 3c, or be sidecut, i.e. parabolic in shape: narrow in the center and wider near the suitably tapered ends 3b and 3c.

[0046] The structure of the base body 31 can be a sandwich. Specifically, the ski 3 comprises an upper layer and a lower layer mutually fastened, defining the structure of the base body 31. More precisely, it comprises one or more intermediate layers interposed between the upper and lower layers.

[0047] The lower layer is configured to be placed in use next to the ground 1a. It can identify said base.

[0048] Said layers can be made of one or more materials chosen from polymeric, resin, metallic (e.g., titanium), composite (e.g., carbon fiber), or wood material.

[0049] The ski 3 can comprise at least one edge extending for at least part and, in detail, for the entire length of the ski along the longitudinal direction 3a.

[0050] Suitably, it extends for at least the central part of said ski 3.

[0051] The edge can define a lateral edge of at least the lower layer and, in some cases, of the ski 3 in use facing and, in detail, in contact with the ground 1a.

[0052] Preferably, the ski 3 comprises two edges, each placed at a lateral edge of at least the lower layer. Each ski 3 can also comprise at least one fastening group 32 to the ski 3 (specifically to the base body 31) of at least one binding and, in detail, of only one binding. Preferably, the ski 3 comprises for each ski 3 at least one binding and, in detail, only one binding.

[0053] Each binding is configured to allow the user's footwear (specifically a boot) to be fastened to the base body 31 and thus to the ski 3. Each binding can include a tip portion 3d configured to engage at the boot tip and a heel portion 3e configured to engage at the boot heel.

[0054] The fastening group 32, together with the ski 3, defines a sliding channel for the track 4 (described below), which then slides for a section inside said channel.

[0055] The fastening group 32 can comprise at least one profile 321 fastened, suitably integrally, to the ski 3 and engaging the binding and extending along a portion of the longitudinal direction 3a, and particularly along part of the central straight portion of the longitudinal direction 3a. Said profile 321 can have a C-shaped cross-section to define, together with the ski 3, the aforementioned channel. Specifically, it comprises a single profile 321 engaging the tip portions 3d and heel portions 3e. Alternatively, it can comprise two profiles 321, a first profile 321 engaging the tip portion 3d and a second profile 321 engaging the heel portion 3e and separated along the longitudinal direction 3a by the first profile 321. The constraint of the tip and/or heel portions 3d and 3e to the profile 321 and thus to the fastening group can be done by screws or other known constraint means.

[0056] It is noted that the constraint point of the tip and/or heel portions 3d and 3e to the corresponding profile 321 can be varied to allow an adjustment of their mutual distance along the longitudinal direction 3a.

[0057] The skiing equipment 1, and specifically each ski 3, comprises a track 4 closed on itself and wound longitudinally around the ski 3 and, particularly, around the base body 31.

[0058] The track 4 entirely wraps around the base body 31.

[0059] When present, the track 4 is configured to come into contact with the ground, replacing the base body 31 and thus the ski 3.

[0060] The track 4 thus defines a development trajectory 4a (Fig. 1) of the track itself closed and enclosing the ski 3, i.e., it defines a closed path on a plane parallel to the direction 3a (specifically perpendicular to the laying plane) and substantially perpendicular to the section of the ski 3, enclosing the entire ski 3 within it. The development trajectory 4a defines a laying plane of the same trajectory 4a, suitably perpendicular to the laying surface.

[0061] Preferably, if barycentric, the development trajectory 4a and the longitudinal direction 3a lie on said laying plane.

[0062] In use, the development trajectory 4a and thus the laying plane are perpendicular to the ground 1a.

[0063] The track 4 can comprise a belt 41 wound longitudinally around the ski 3. Preferably, the belt 41 has two ends, and the track 4 comprises a hinge constraining the belt ends 41 together, closing on itself the belt 41 and thus the track 4.

[0064] The hinge is configured to constrain the ends of the belt 41, suitably allowing the ends at least a mutual rotation along an axis of rotation substantially perpendicular to the longitudinal direction 3a and particularly substantially perpendicular to the laying plane of the development trajectory 4a of the track 4. Furthermore, to allow the track 4 and, particularly, the belt 41 to slide around the base body 31, the track 4 can comprise at least one return block 42 of the track 4; each block is placed at an end 3b and 3c. The track 4, therefore, may provide a return block 42 at the front end 2b and a return block 42 at the rear end 2c. Each return block 42 can comprise an anchor 421 configured to be integrally constrained to the base body 31; a roller 422 for the sliding of the track 4 and specifically the belt 41; at least one arm 423 constraining the roller 422 to the anchor 421; and preferably a hinge 424 configured to allow the arm 423 and the roller 422 to rotate relative to the anchor 421 between an operative position and an inactive position.

[0065] In the operative position (Fig. 5), the roller 422 protrudes at least partially and in detail entirely from the base body 31; and an inactive position wherein the roller 422 is entirely superimposed on the base body 31.

[0066] The control of the track 4, the skiing equipment 1, and specifically each ski 3, can comprise a mover 5 for controlling the sliding of the track 4 around the base body 31.

[0067] The mover 5 can comprise a motor 51 and suitably a transmission 52 of the motion from the motor 51 to the track 4 and, particularly, to the belt 41.

[0068] The motor 51 is preferably electric. It can comprise a stator and a rotor defining the motion outputted by the motor 51 itself.

[0069] The transmission 52 can comprise at least one driving pulley configured to engage the track 4 and specifically the belt 41 to transmit the torque outputted by the motor 51 to the belt 41 and thus the track 4.

[0070] The transmission 52 can comprise a one-way clutch cinematically interposed between the motor 51 and the driving pulley and configured to allow the driving pulley to rotate in only one direction and prevent it to rotate in the other direction. The transmission 52 can also comprise a tensioner configured to keep the belt 41 under tension.

[0071] The tensioner can comprise a driven pulley on which the belt 41 runs and an actuator configured to press said driven pulley against said belt 41, ensuring correct tensioning.

[0072] The driven pulley can comprise supplementary teeth engaging the slots. Alternatively, it may be without said supplementary teeth.

[0073] The mover 5 can also comprise a frame 53 configured to constrain the transmission 52 to the motor 51 to allow and make the entire mover 5 integral with the rest of the skiing equipment 1 by constraining the motor 51 or the frame 53 to the ski 3 and specifically to the base body 31.

[0074] The frame 53 can be configured to define a housing chamber for at least part of the motor 51 and the possible transmission 52.

[0075] The mover 5 can comprise a battery 54 for powering the motor 51.

[0076] The skiing equipment 1 can comprise sensors for acquiring parameters and a unit 6 for controlling the mover 5 based on the parameters acquired by the sensors.

[0077] The sensors can comprise, for each ski 3, a forward movement sensor 6a configured to measure the forward speed (preferably in magnitude and suitably in direction) and suitably the acceleration of the ski 3 relative to the ground 1a. The forward movement sensor 6a can be integrally constrained to the ski 3 and, specifically, to the base body 31. It is, for example, interposed between the layers of the base body 31.

[0078] The forward movement sensor 6a can be of the inertial type or, alternatively, a geolocation sensor.

[0079] The sensors can comprise, for each ski 3, a sliding movement sensor 6b configured to measure the sliding speed (preferably in magnitude and suitably in direction) of the track 4 around the base body 31 and thus relative to the ski 3. The sliding movement sensor 6b can be configured to measure the sliding speed of the track 4 based on the speed outputted by the motor 51 and/or the transmission 52. For example, it can be configured to measure the rotation speed of the rotor of the motor 51 and/or the driving pulley of the transmission 52. The sliding movement sensor 6b can be constrained to the frame 53 and specifically housed within the chamber defined by said frame 53.

[0080] It is noted that, for optimal operation, the track 4 essentially performs "pure rolling" relative to the ground, and therefore the sliding and forward speeds must be similar and, in detail, substantially equal for optimal operation.

[0081] The sensors can comprise, for each pole 2, a thrust sensor 6c configured to measure the thrust force (i.e., pressure) applied by the pole 2 onto the ground 1a and thus the thrust given by the user through the pole 2.

[0082] In particular, the thrust sensor 6c is configured to detect the intensity and preferably the direction and orientation of said thrust force.

[0083] The thrust sensor 6c can be integrated into the pole 2. It is, for example, positioned at the handle 21 to detect the force applied by the user to the pole 2. Specifically, the thrust sensor 6c can be integrated into the handle 21 and thus removable from the pole 2 along with the handle 21.

[0084] Preferably, the thrust sensor 6c is configured to measure the thrust/pressure force applied by the pole 2

onto the ground 1a exclusively along the predominant development axis 2a.

[0085] The thrust sensor 6c can be piezoelectric and piezoresistive. It can also be of the strain gauge type.

[0086] It is noted that the thrust sensor 6c can be used to detect if the user is holding the pole 2.

[0087] The sensors can comprise, for each ski 3, at least one force sensor 6d configured to detect the contact force (i.e., contact pressure) between the boot and the ski 3, i.e., the thrust applied by the user to the ski 3 and specifically from the boot to the binding and thus from the fastening group 32 to the ski 3.

[0088] Thus, the at least one force sensor 6d can detect when the user, moving his leg and thus using his strength (not the one given by the mover 5), muscularly moves forward the ski relative to the ground 1a. In fact, while when the ski 3 is resting on the ground, it detects a contact force/pressure pressing the boot against the ski 3 and thus against the ground 1a, in the case of muscular forward movement of the ski 3 relative to the ground 1a, the at least one sensor 6d detects at most the force/pressure determining a contact force between the boot and the ski 3 in the opposite direction to the previous one. For convenience, the contact force/pressure bearing/pressing the boot against the ski 3, thus pressed against the ground 1a, is considered positive, and the one opposite to it is negative.

[0089] To this end, the sensors comprise, for each ski 3, a force sensor 6d configured to detect the contact force of the boot tip on the ski 3. In particular, the force sensor 6d can be placed at the tip portion 3d and, for example, constrained to the profile 321 (for example, the first one) between the same profile 321 and said tip portion 3d.

[0090] Optionally, the sensors comprise, for each ski 3, an additional force sensor 6d configured to detect the contact force of the boot heel on the ski 3. In particular, the force sensor 6d can be placed at the heel portion 3e and, for example, constrained to the profile 321 (for example, to the second one) between the said profile 321 and said heel portion 3e.

[0091] Preferably, the force sensor 6d is configured to measure said force. In detail, it is configured to detect the intensity and preferably the direction and orientation of the force applied by the binding to the ski 3.

[0092] The force sensor 6d can be piezoelectric and piezoresistive. It can also be of the strain gauge type.

[0093] The sensors can comprise an inclination sensor 6e configured to measure the position and, specifically, the inclination of the boot relative to the binding and thus to the fastening group 32 and specifically to the ski 3.

[0094] The inclination sensor 6e can be configured to measure the distance between the heel portion 3e and the boot.

[0095] The sensors can be configured to acquire parameters related to the position of each ski 3.

[0096] Specifically, they can be configured to acquire parameters related to the absolute position of each ski 3, i.e., their position relative to an absolute reference sys-

tem (such as the gravitational gradient and/or the ground 1a), thus allowing the unit 6 to calculate said absolute position of each ski 3. Thus, the sensors can comprise, for each ski 3, at least one inertial sensor 6f configured to detect a movement of the ski 3, suitably relative to the gravitational gradient (i.e., an absolute reference) and thus to the ground 1a.

[0097] The at least one inertial sensor 6f can comprise at least one accelerometer configured to detect and/or measure the linear acceleration of the ski 3; and/or at least one gyroscope configured to detect and/or measure the rotational acceleration of the ski 3.

[0098] The at least one inertial sensor 6f can be constrained to the ski 3 and specifically to the base body 31. It is, for example, interposed between the layers of the base body 31.

[0099] Alternatively or additionally, to the calculation of the absolute position, the sensors can be configured to detect the relative position between the skis 3, allowing the unit 6 to calculate said mutual position, i.e., the inclination and distance between the skis 3.

[0100] To this end, it can comprise, for each ski 3, at least one distance sensor 6g configured to measure the distance between the two skis.

[0101] The distance sensors 6g are configured to measure the distance between the same sensors 6g and thus between the skis 3. They can be optical, magnetic, or radio.

[0102] Preferably, the unit 6 comprises, associated with each ski 3, at least one inertial sensor 6f and only one distance sensor 6g suitably placed at the median point of the longitudinal direction 3a, i.e., equidistant from the ends 3b and 3c. In this case, the unit 6 determines the relative positioning between the skis 3 based on the distance between the skis at the sensor positioning point 6b and the orientation of each ski 3 suitably relative to the gravitational gradient (i.e., an absolute reference) and thus to the ground 1a.

[0103] Alternatively or additionally, for the calculation of said relative position, the sensors can comprise for each ski 3 two inclination sensors 6e spaced along the direction 3a. In this case, the unit 6 determines the relative positioning between the skis 3 based on the two distances between the skis 3 calculated at the positioning point of the sensors 6b.

[0104] The sensors can comprise at least one position sensor 6h configured to detect the geo-position of the skiing equipment 1.

[0105] The position sensor 6h is preferably fastened to a pole 2 and/or the ski 3.

[0106] The sensors can be configured to acquire environmental parameters, allowing the unit 6 to, for example, determine the conditions of the ground 1a at the time of the skiing activity.

[0107] In detail, the sensors can comprise at least one temperature sensor 6i configured to measure the air temperature at the ground 1a, i.e., near the equipment 1. The temperature sensor 6i can be constrained to a pole

2 (for example, to the shaft 23) and/or the ski 3 suitably distal to the mover 5.

[0108] The temperature sensor 6i can include MEMS technology.

[0109] The sensors can comprise at least one pressure sensor 6l configured to measure the atmospheric pressure at the ground 1a, i.e., near the equipment 1.

[0110] The pressure sensor 6l can be constrained to a pole 2 (for example, to the shaft 23) and/or the ski 3 suitably distal to the mover 5.

[0111] The pressure sensor 6l can include MEMS technology.

[0112] The sensors can comprise at least one humidity sensor 6m configured to measure the air humidity at the ground 1a, i.e., near the equipment 1.

[0113] The humidity sensor 6m can be fastened to a pole 2 (for example, to the shaft 23) and/or the ski 3 suitably distal to the mover 5.

[0114] The humidity sensor 6m can include MEMS technology.

[0115] It is noted that the sensors, as described, are preferably configured to detect and suitably measure a movement of each ski 3, suitably relative to the ground 1a; and the unit is configured to control the mover 5 to slide the track 4 around the base body 31 based on the movement of each ski 3 and, in detail, the ski 3 to which the track 4 is associated.

[0116] In particular, the unit controls the first ski 3 to a first sliding speed of the track 4 associated with the first ski 3 based on (precisely proportional to) the movement of the first ski 3 detected by the sensors and the second ski 3 to a second sliding speed of the track 4 associated with the second ski 3 based on (precisely proportional to) the movement of the second ski 3 detected by the sensors.

[0117] If the first movement is different than the second movement, the unit 6 controls a first speed different than the second speed. Alternatively, if the first movement is equal to the second movement, the unit 6 controls a first speed and a second speed equal to each other.

[0118] To detect and suitably measure a movement of each ski 3, the sensors comprise, for each ski, at least one of said force sensor 6d and said inertial sensor 6f. Preferably, it comprises both said sensors 6d and 6f.

[0119] The unit 6 is in data connection with the sensors and thus with each of these sensors through, for example, wired or wireless connection (it is highlighted that in this case, the unit 6 and the sensor placed in wireless data connection with it are equipped with an antenna implementing said wireless connection).

[0120] For example, in a first non-limiting embodiment, the skiing equipment 1 can comprise a single unit 6 integral with a first ski 3. Said unit 6 can be in wireless data connection with the thrust sensor 6c and/or any other sensor constrained to the pole 2 or the second ski 3; while it can be in wired data connection with any sensor constrained to the first ski 3.

[0121] In a second non-limiting embodiment, the

equipment 1 can comprise two units 6, each integral with one of the skis 3. Each unit 6 can be in wireless data connection with each sensor constrained to the pole 2 and in wired and/or wireless data connection with any sensor constrained to the same ski 3.

[0122] Finally, it is noted that, at least in said non-limiting embodiments, one or more of the temperature sensor 6i, pressure sensor 6l, humidity sensor 6m, and inertial sensor 6f can be integrated into the unit 6. For example, the unit 6 can be an electronic board optionally integrating one or more of the temperature sensor 6i, pressure sensor 6l, humidity sensor 6m, and inertial sensor 6f.

[0123] The unit 6 comprises at least one memory.

[0124] Said memory can comprise the length of each ski 3 and the positioning of each distance sensor 6g on said ski 3 and thus along said length.

[0125] The memory can comprise a meteorological database associating at least one skiing area, the physical map (suitably representing the ground conformation), and the meteorological history of said skiing area. Specifically, it comprises several skiing areas, each associated with a meteorological history of said skiing area.

[0126] The meteorological history can comprise one or more and, particularly, the entirety of the following meteorological information: precipitation, temperature, weather conditions (cloud presence), sunrise and sunset times, and wind. The history can comprise said meteorological information for at least one time frame. The unit 6 can thus identify for each point of the physical map the precipitation, sun exposure, and temperature trend during the time frame.

[0127] Said time frame envisages at least 6 hours, specifically 12 hours, more precisely 24 hours, and preferably at least 3 days.

[0128] The unit 6 can be in data connection with an external server to acquire the meteorological database.

[0129] The memory can comprise a ground database comprising several conditions of ground 1a, each associated with operating parameters of the motor 51 and thus the sliding speed of the track 4. The operation parameters can comprise a maximum speed and a maximum acceleration of the motor 51 and thus the track 4.

[0130] In addition, the ground database associates each condition of ground 1a with one or more environmental parameters. The environmental parameters can comprise temperature, preferably humidity, and more preferably still atmospheric pressure. Further additionally or alternatively, the ground database associates each condition of the ground 1a with a meteorological history.

[0131] The unit 6 can associate each ski 3 with a pole 2. Thus, there can be a first ski 3 associated with a first pole 2 and a second ski 3 associated with a second pole 2. This association can be predefined or performed by the unit 6 thanks to appropriate sensors configured to detect the distance between skis 3 and poles 2 and thus associating the ski 3 with the pole 2 at a shorter distance.

[0132] Finally, it is emphasized that the unit 6 and/or the sensors can be electrically connected to the battery 54 and thus powered by it. Alternatively, the skiing equipment 1 can provide one or more supplementary batteries for powering the sensors and/or the unit 6.

[0133] Finally, the skiing equipment 1 can comprise an interface in data connection with the unit and configured to allow the user to adjust/control the operation of the equipment 1 (e.g., the activation of the motor 51 and/or the sensors). This interface can be a personal device (such as a smartphone) configured to be constrained to the user of the skiing equipment 1 and in wireless data connection with each sensor.

[0134] The operation of the previously described skiing equipment 1 in structural terms defines a new control procedure 100 (schematically represented in Fig. 6) of the same skiing equipment 1. Said procedure can be controlled by the unit 6.

[0135] The control procedure 100 can comprise a phase of donning 110 of the skiing equipment 1.

[0136] In this phase 110, the user binds the boots to the ski 3, each suitably equipped with a track 4, and, in detail, the boot tip to the tip portion 3d and the boot heel to the heel portion 3e. At this point, the user can grip the poles 2 and is ready and begins the skiing activity, once the donning phase 110 has ended.

[0137] The control procedure 100 can comprise a setting phase 120 of the skiing equipment 1 according to the conditions of the ground 1a.

[0138] In the setting phase 120, the unit 6 identifies the conditions of the ground 1a in the ground database and thus imposes on the equipment 1 to operate according to the operating parameters of the identified ground condition. Therefore, in the subsequent phases, the unit 6 controls the track 4, imposing speeds and/or accelerations not exceeding the maximum speed and/or maximum acceleration identified.

[0139] In particular, in the setting phase 120, the sensors acquire environmental parameters. Specifically, the temperature sensor 6i detects the temperature, preferably the humidity sensor 6m detects the humidity, and, optionally, the pressure sensor 6l detects the atmospheric pressure. At this point, the unit 6 identifies the condition of the ground 1a in the ground database according to the acquired environmental parameters.

[0140] Alternatively or additionally, the position sensor 6h detects the position of the skiing equipment 1, and the unit 6 identifies the meteorological history of the position in the meteorological database. Then, the unit 6 searches in the ground database for the condition of the ground 1a associated with said meteorological history and, optionally, with one or more environmental parameters.

[0141] The control procedure 100 can comprise an implementation phase 130 of the skiing activity using the skiing equipment 1.

[0142] The control procedure 100 can comprise an acquisition phase 140 wherein the sensors detect one or more parameters and send them to the unit 6; and a

control phase 150 wherein the unit 6 controls the operation of the mover 5 based on one or more parameters acquired in phase 140.

[0143] The start of the acquisition phase 140 and thus the control phase 150 can be given by the user through said interface.

[0144] Phases 140 and 150 can be performed parallelly. Preferably, they are performed parallelly with the implementation phase 130.

[0145] In the acquisition phase 140, the sensors detect and suitably measure the movement of each ski 3, suitably relative to the ground 1a; and in the control phase 150, the unit controls the mover 5 to slide the track 4 around the base body 31 based on the movement of each ski 3. Specifically, in phase 150, the unit controls the first ski 3 to a first sliding speed of the track 4 associated with the first ski 3 based on (precisely proportional to) the movement of the first ski 3 detected by the sensors and the second ski 3 to a second sliding speed of the track 4 associated with the second ski 3 based on (precisely proportional to) the movement of the second ski 3 detected by the sensors. If the first movement is different than the second movement, the unit 6 controls a first sliding speed different than the second sliding speed. Alternatively, if the first movement is equal to the second movement, the unit 6 controls a first speed and a second speed equal to each other.

[0146] Specifically, in the acquisition phase 140, for each ski 3, the force sensor 6d measures the contact force between the boot and the ski 3. Preferably, the contact force delivered by the tip portion 3d and/or heel portion 3e on the fastening group 32 and thus on the base body 31 is detected. Simultaneously in the control phase 150, the unit 6 controls the mover 5 and specifically the motor 51 to adjust the sliding speed of each track 4 based on the contact force. Specifically, if the force sensors detect two different contact forces, the unit 6 controls a first sliding speed of the track 4 of the first ski 3 different than the second sliding speed of the track 4 of the second ski 3; otherwise, the unit 6 controls a first sliding speed equal to the second. Preferably, the contact forces are different if they differ by at least 20% and preferably by 5% suitably of the greater contact force value.

[0147] In detail, if the user alternately moves the lower limbs and thus the skis 3 during the implementation phase 130, he lifts a foot and, for example, a first ski 3. Therefore, in the acquisition phase 140, the force sensor 6d of the first ski 3 detects a contact force greater than that detected by the force sensor 6d of the second ski 3. Consequently, in the control phase 150, the unit 6 controls a first sliding speed of the track 4 of the first ski 3 to be less than the second sliding speed of the track 4 of the second ski 3.

[0148] Conversely, the unit controls the same sliding speeds of the two tracks 4 (e.g., zero speed) if the contact forces between the boot and ski 3 are not different (e.g., when the user, through the boots, presses both skis 3 against the ground 1a and does not push them forward)

preferably at least along a direction parallel to the ground 1a (said inclination being, for example, detected by the at least one inertial sensor 6f). As stated above, the contact forces can be detected as "not different" if they differ by less than 20% and preferably less than 5% suitably of the greater value.

[0149] Preferably, the unit 6 controls a sliding speed of the track 4 of the first ski 3 to be less than that of the track 4 of the second ski 3 if the force of the first ski 3 is substantially less than a minimum force suitably equal to 0 N.

[0150] Additionally or alternatively, in the implementation phase 130, the user can move the poles 2 to push himself pressing them against the ground 1a; in the acquisition phase 140, for each pole 2, the thrust sensor 6c measures the thrust force applied by the pole 2 on the ground 1a, and in the control phase 150, the unit 6 controls the mover 5 and specifically the motor 51 to adjust the sliding speed of each track 4 based on the thrust force. Specifically, if the thrust sensors 6c detect two different thrust forces, the unit 6 controls a first sliding speed to be different than the second sliding speed; otherwise, the unit 6 controls a first sliding speed equal to the second. Preferably, the thrust forces are different if they differ by at least 20% and preferably by 5% suitably of the greater value.

[0151] In detail, if the user alternately uses the poles 2 in the implementation phase 130, he presses, for example, the second pole 2 against the ground 1a to push himself forward, leaving the first pole suspended or otherwise not pressed against the ground 1a. Therefore, in the acquisition phase 140, the thrust sensor 6c of the second pole 2 detects a thrust force applied by the second pole 2 onto the ground 1a greater than the thrust force applied by the first pole 2 onto the ground 1a and detected by the other thrust sensor 6c; consequently, in the control phase 150, the unit 6 controls an increase in the sliding speed of the track 4 of the first ski 3 based on and precisely proportional to said thrust force. More specifically, in the acquisition phase 140, the at least one inertial sensor 6f of the second ski 3 detects the inclination of the second ski 3 and, as it is resting on the ground 1a, of the ground 1a, and the thrust sensor 6c of the second pole 2 detects the magnitude, direction, and orientation of said thrust force; thus, in the control phase 150, the unit 6 determines the fraction of the thrust force parallel to the ground 1a and thus controls an increase in the sliding speed of the track 4 of the first ski 3 based on and in detail proportional to said fraction of the thrust force. The unit 6 controls the same sliding speeds (e.g., zero) of the tracks 4 of the skis 3 if the thrust forces are not different (e.g., when both poles 2 are pressed by the user against the ground 1a) and preferably the contact forces are not different. It is noted that the unit 6 can store the parameters acquired in the acquisition phase 140, defining an activity history.

[0152] The control procedure 100 can comprise a monitoring phase 160 of the operation of the skiing equipment 1.

[0153] Phase 160 can be concurrent with phases 130, 140, and 150. Thus, it is performed during the implementation of the skiing activity, i.e., in real-time. The monitoring phase 160 can comprise an anti-slip sub-phase 161.

[0154] In the anti-slip sub-phase 161, the unit 6, if in a ski 3 detects a difference between forward speed and sliding speed, controls the motor 51 to adjust the sliding speed of each track 4 to match the forward speed. Specifically, if in a ski 3 the forward speed is less than the sliding speed (e.g., due to slipping of the track 4), the unit 6 controls the motor 51 of this ski 3 to slow down the sliding speed.

[0155] The anti-slip sub-phase 161 can be concurrent with phases 130, 140, and 150. The monitoring phase 160 can comprise an anti-crossing sub-phase 162 of the skis 3.

[0156] During the anti-crossing sub-phase 162, the unit 6 determines, based on the length of each ski 3 and the measurements detected by the at least one inertial sensor 6f and/or the at least one distance sensor 6g, the relative position of the skis 3. Specifically, the unit 6 identifies a correct position of the skis 3 or an incorrect position of the skis 3 and thus controls the deactivation of the motor 51, i.e., the stopping of the track 4, in the case of an incorrect position. Specifically, the position is incorrect if the skis 3 are inclined towards each other by an angle at least equal to 15° and preferably are overlapping.

[0157] The anti-crossing sub-phase 162 can be concurrent with phases 130, 140, and 150.

[0158] The monitoring phase 160 can comprise an anti-fall sub-phase 163.

[0159] During the anti-fall sub-phase 163, the unit 6 controls the deactivation of the motor 51 and thus the stopping of the track 4 if one or more of the forward movement sensors 6a, sliding movement sensors 6b, force sensors 6d, inclination sensors 6e, and the at least one inertial sensor 6f detect a parameter not conforming to the history and, specifically, differing from those in the history by at least 20% and preferably 5%.

[0160] The anti-fall sub-phase 163 can be concurrent with phases 130, 140, and 150. The control procedure 100 can comprise a phase of doffing 170 wherein the user detaches the boots from the skis 3 and releases the poles 2.

[0161] The skiing equipment 1 according to the invention and thus the procedure 100 implementable by it achieve significant advantages.

[0162] Indeed, the specific sensors adopted allow the skiing equipment 1 to be used simply and safely in any condition.

[0163] This aspect is determined by the possibility of adapting the operation of the equipment 1 to the conditions of the ground 1a. Indeed, the skiing equipment 1 can adapt its operation to the ground 1a, avoiding excessively high accelerations/speeds that could cause slipping and thus risky conditions for the user. This aspect is further enhanced by the monitoring phase 160 and, in particular, by each of the sub-phases 161, 162, and 163, which, by

monitoring particular operation parameters of the equipment 1, ensure always safe use. Such ease and safety of use of the equipment 1 are also given by the monitoring of the equipment operation, which allows both to avoid operation problems and to stop the equipment 1 in the event of falls or other problems.

[0164] Another advantage lies in the fact that, as described above, the equipment 1 can precisely detect the user's movements and thus assist and facilitate their movement. The skiing equipment 1 can therefore be used with high ease and substantially without risk by non-expert users.

[0165] The invention is susceptible to variants within the scope of the inventive concept defined by the claims.

[0166] For example, the thrust sensor 6c can be placed at the tip 22 to detect the thrust force applied by the tip 22 onto the ground 1a.

[0167] In another embodiment, said interface and said unit 6 can coincide in one of said personal devices, preferably in wireless data connection with each sensor.

[0168] In this context, all details are replaceable by equivalent elements, and the materials, shapes, and dimensions can be any.

Claims

1. Skiing equipment (1) comprising two skis (3) each of which comprising

- a base body (31) defining a longitudinal direction (3a),
 - at least one fastening group (32) to said base body (31) of a binding (3d, 3e) of a ski boot of a user
 - a track (4) closed on itself defining a development trajectory (4a) closed around said base body (31) and configured to rest on a ground (1a);
 - a mover (5) of said track (4) around said base body (31);
- characterized by** comprising
- for each of said skis (3)

- sensors configured to detect a movement of said ski (3) with respect to said ground (1a);

by comprising

- a unit (6) for controlling said mover (5) of each of said skis (3) and thus the sliding of said track (4) around said base body (31) based on said movement of said ski (3) with respect to said ground (1a);

and in that

- said two skis (3) comprise a first ski (3) and a second ski (3); wherein said sensors associated with said first ski (3) measure a first movement of

- said first ski (3);
 - said sensors associated with said second ski (3) measure a second movement of said second ski (3);
 - said unit (6) controls said track (4) of said first ski (3) to have a first sliding speed based on said first movement; wherein said unit (6) controls said track (4) of said second ski (3) a second sliding speed based on said second movement; and
 - said second sliding speed and said first sliding speed are equal to each other if said first movement is equal to said second movement and different to one another if said first movement is different than said second movement.
2. Skiing equipment (1) according to claim 1, wherein said sensors comprise at least one force sensor (6d) configured to measure the contact force between said fastening group (32) and said base body (31); and wherein if said force sensor (6d) associated with said first ski (3) measures that said contact force is different by at least 5% than the contact force measured by said force sensor (6d) associated with said second ski (3); said unit (6) is configured to control said mover (5) of said first ski (3) to have a first sliding speed of said track (4) around said base body (31) of said first ski (3) and said mover (5) of said second ski (3) to have a second sliding speed of said track (4) around said base body (31) of said second ski (3).
3. Skiing equipment (1) according to at least one preceding claim, comprising at least one pole (2) configured to come into contact with said ground (1a); wherein said sensors comprise for each of said at least one pole (2) a thrust sensor (6c) configured to measure the thrust force applied by said pole (2) onto said ground (1a); and wherein said unit (6) is configured to control the sliding of said track (4) around said base body (31) based on said thrust force.
4. Skiing equipment (1) according to claim 3, wherein said at least one pole (2) comprises a first pole (2) and a second pole (2); and wherein if said thrust sensor (6c) associated with said first pole (2) measures that said thrust force is different by at least 5% than the thrust force measured by said thrust sensor (6c) associated with said second pole (2); said unit (6) is configured to control said mover (5) control of said first ski (3) to have a first sliding speed of said track (4) around said base body (31) and said control of said mover (5) of said first ski (3) to have a second sliding speed of said track (4) around said base body (31).
5. Control procedure (100) comprising
 - said skiing equipment (1) according to at least one preceding claim,
 and **characterized by** comprising
 - an acquisition phase (140) wherein said sensors detect the movement of each of said skis (3) with respect to said ground (1a); and
 - a control phase (150) wherein said unit (6) controls each of said skis (3) to slide said track (4) around said base body (31) based on said movement of said ski (3) relative to said ground (1a).
6. Control procedure (100) according to the preceding claim, wherein said two skis (3) comprise a first ski (3) and a second ski (3); wherein in said acquisition phase (140) said sensors associated with said first ski (3) measure a first movement of said first ski (3) and said sensors associated with said second ski (3) measure a second movement of said second ski (3); wherein in said control phase (150) said unit (6) controls said track (4) of said first ski (3) to have a first sliding speed based on said first movement; wherein said unit (6) controls said track (4) of said second ski (3) to have a second sliding speed based on said second movement; and wherein said second sliding speed and said first sliding speed are equal to each other if said first movement is equal to said second movement and different to each other if said first movement is different than said second movement.
7. Control procedure (100) according to the preceding claim, said skiing equipment (1) according to claim 2; wherein in said acquisition phase (140) said force sensor (6d) associated with said first ski (3) measures said contact force different by at least 5% than the contact force measured by said force sensor (6d) associated with said second ski (3); and wherein in the control phase (150) said unit (6) controls said control of said mover (5) of said first ski (3) to have a first sliding speed of said track (4) around said base body (31) and said control of said mover (5) of said first ski (3) to have a second sliding speed of said track (4) around said base body (31).
8. Control procedure (100) according to the preceding claim, wherein in said acquisition phase (140) said force sensor (6d) associated with said first ski (3) measures said contact force different by less than 5% than the contact force measured by said force sensor (6d) associated with said second ski (3); and wherein in the control phase (150) said unit (6) controls said first sliding speed substantially equal to said second sliding speed.
9. Control procedure (100) according to at least one claim 5-8, comprising said skiing equipment (1) according to claim 2; wherein in said acquisition phase (140) said thrust sensor (6c) associated with said first

ski (3) measures said thrust force applied by said pole (2) onto said ground (1a); and wherein said unit (6) controls the sliding of said track (4) around said base body (31) based on said thrust force.

10. Control procedure (100) according to claim 9, comprising said skiing equipment (1) according to claim 3; wherein in said acquisition phase (140) said thrust sensor (6c) associated with said first pole (2) measures said thrust force different by at least 5% than the thrust force measured by said thrust sensor (6c) associated with said second pole (2); and wherein said unit (6) controls said mover (5) of said first ski (3) to have a first sliding speed of said track (4) around said base body (31) of said first ski (3) and said mover (5) of said second ski (3) to have a second sliding speed of said track (4) around said base body (31) of said second ski (3).

11. Control procedure (100) according to claim 9, wherein in said acquisition phase (140) said force sensor (6d) associated with said first ski (3) measures said contact force different by less than 5% than the contact force measured by said force sensor (6d) associated with said second ski (3), and said thrust sensor (6c) associated with said first pole (2) measures said thrust force different by less than 5% than the thrust force measured by said thrust sensor (6c) associated with said second pole (2); and wherein in the control phase (150) said unit (6) controls said first sliding speed substantially equal to said second sliding speed.

12. Skiing equipment (1) comprising two skis (3), each of which comprising

- a base body (31) defining a longitudinal direction (3a);
- a track (4) closed on itself defining a closed development trajectory (4a) around said base body (31) and configured to rest on a ground (1a);
- a mover (5) comprising a motor (51) for moving said track (4) around said base body (31);
- characterized by** comprising
- a ground database comprising several conditions of said ground (1a), each associated with operating parameters of said motor (51) and a temperature and humidity;
- a temperature sensor (6i) configured to detect the temperature near said skiing equipment (1);
- a humidity sensor (6m) configured to detect the humidity near said skiing equipment (1); and
- a unit (6) configured to

- identify in said ground database the condition of the ground (1a) associated with said temperature detected by said tempera-

ture sensor (6i) and said humidity detected by said humidity sensor (6m) and

- control said motor (51) based on said operating parameters associated with said identified ground condition.

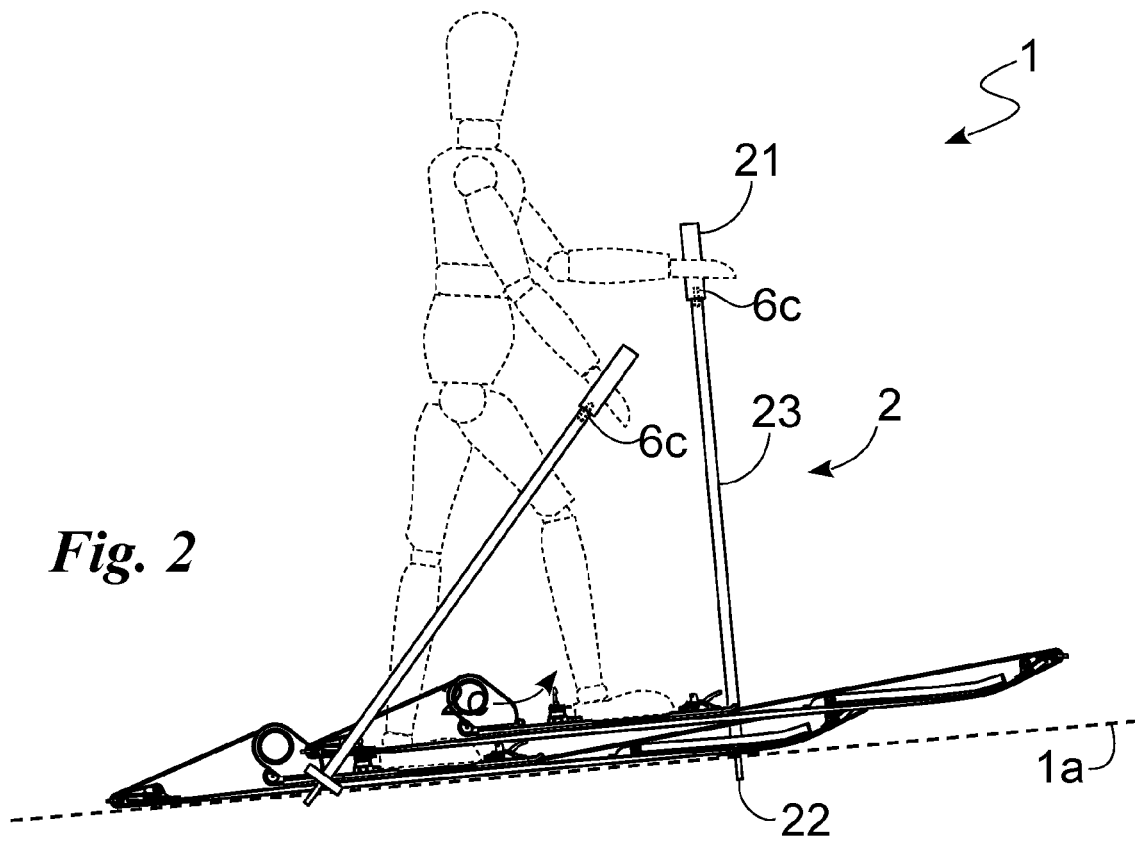
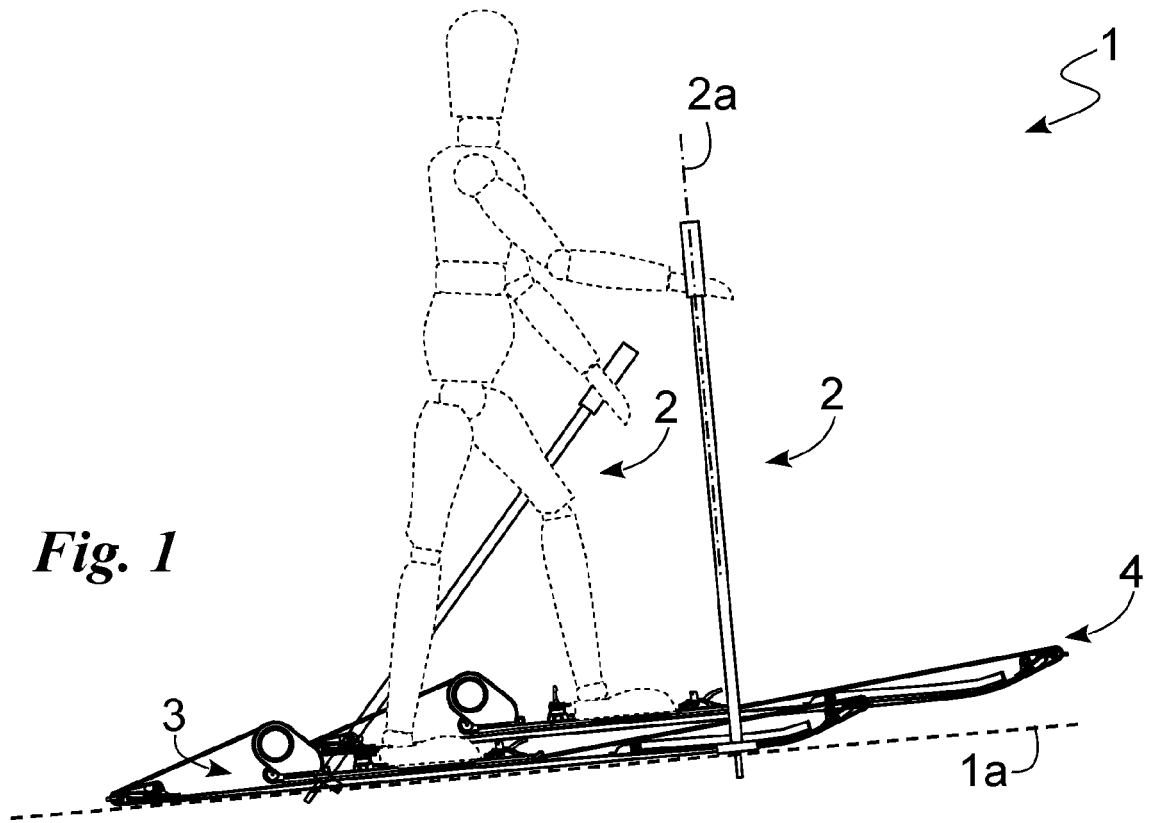
13. Skiing equipment (1) according to claim 12, wherein said operating parameters comprise a maximum speed and a maximum acceleration of said motor (51); and wherein said unit (6) is configured to control said motor (51), maintaining said speed and acceleration of said motor (51) respectively below said maximum speed and maximum acceleration.

14. Control procedure (100) comprising:

- said skiing equipment (1) according to at least one preceding claim,
- characterized by** comprising a setup phase (120) wherein
- said temperature sensor (6i) detects said temperature near said skiing equipment (1);
- said humidity sensor (6m) configured to detect said humidity near said skiing equipment (1); and
- said unit (6)

- identifies in said ground database the condition of the ground (1a) associated with said temperature detected by said temperature sensor (6i) and said humidity detected by said humidity sensor (6m) and
- controls said motor (51) based on said operating parameters associated with said identified ground condition (1a).

15. Control procedure (100) according to claim 14, comprising a position sensor (6h) configured to detect the geo-position of said skiing equipment (1) and a meteorological database associating each of several skiing areas with the meteorological history of said skiing area; and wherein said ground database associates each of said ground conditions (1a) with said meteorological history; and wherein in said setting phase (120) said unit (6) identifies in said meteorological database the meteorological history associated with said position and then in said ground database said condition of said ground (1a) associated with said meteorological history identified in said meteorological database.



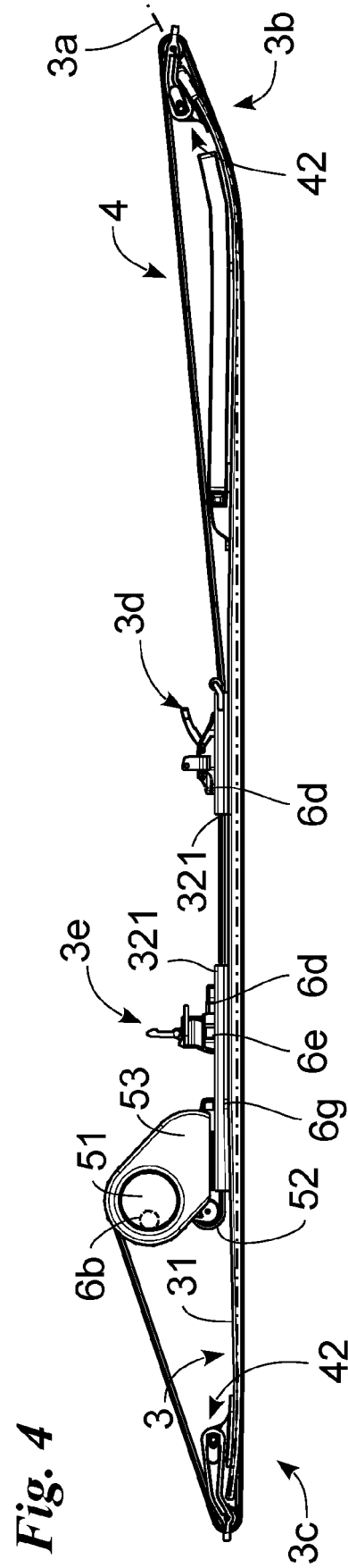
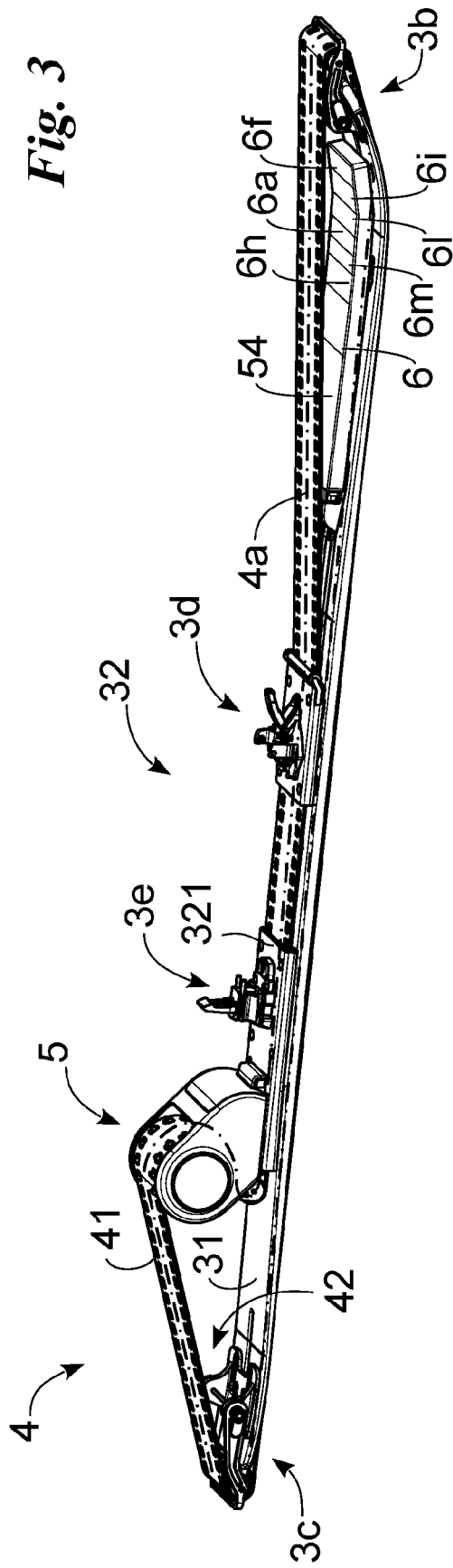


Fig. 5

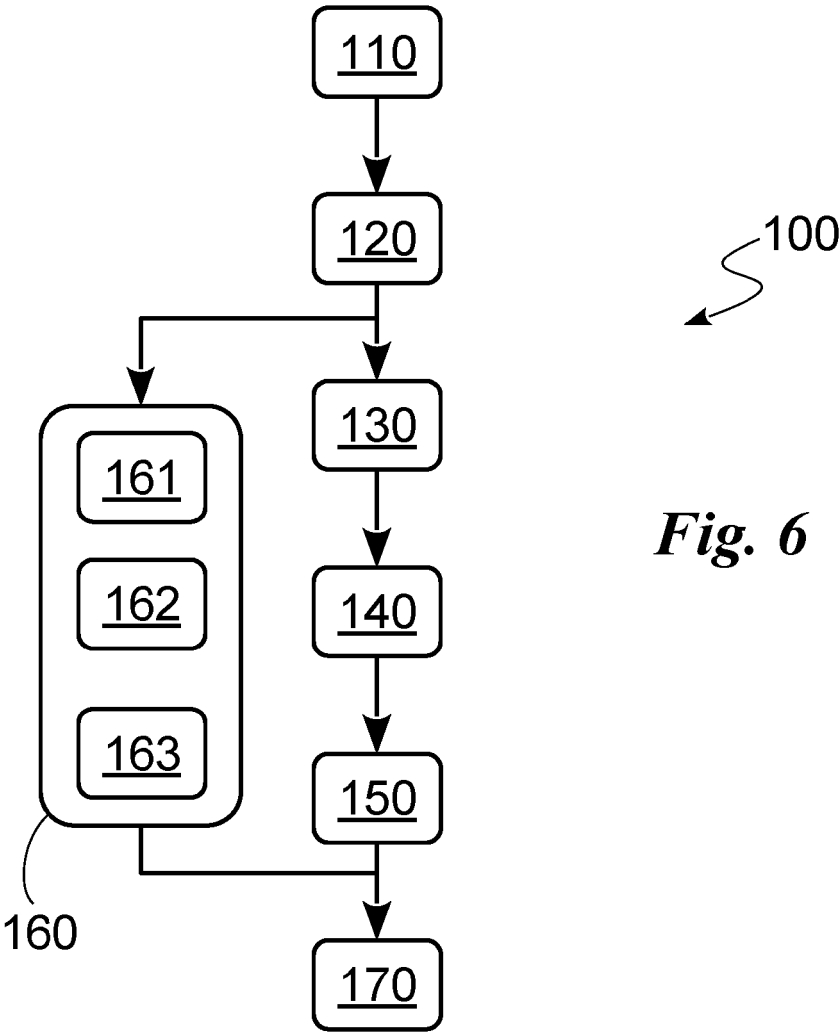
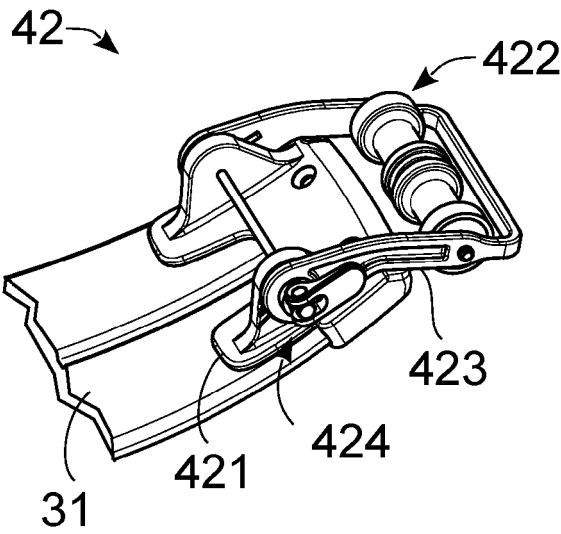


Fig. 6



EUROPEAN SEARCH REPORT

Application Number

EP 24 19 3260

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	WO 2015/161329 A1 (ABP PATENT NETWORK GMBH [AT]) 29 October 2015 (2015-10-29)	1, 5	INV. A63C5/035
Y	* page 13, line 16 - page 32, line 23;	12, 14	A63C5/08
A	figures 1, 3, 5, 6, 8, 13, 14 *	2-4, 6-11, 13, 15	A63C11/10 A63C9/08 A63C9/086 A63C5/06 A63C9/088
Y	----- CN 114 377 370 A (BEIJING INST MECH EQUIPMENT) 22 April 2022 (2022-04-22)	12, 14	
A	* claims 1, 5-9 *	13, 15	
A	----- US 2021/299547 A1 (NAUMOV BORIS VLADIMILENOVICH [RU] ET AL) 30 September 2021 (2021-09-30)	1-15	
	* paragraphs [0042], [0055]; figures 1, 5a, 5b, 5c *		
A	----- WO 2020/216220 A1 (SUN YINGUI [CN]) 29 October 2020 (2020-10-29)	1-15	
	* paragraph [0078]; figure 12 *		
A	----- DE 10 2015 014871 A1 (WENDT GERD JOACHIM [DE]) 18 May 2017 (2017-05-18)	1-15	TECHNICAL FIELDS SEARCHED (IPC) A63C
	* claims 1, 2; figure 1 *		

The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 31 December 2024	Examiner Murer, Michael
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	

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ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO.

EP 24 19 3260

5

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
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31-12-2024

10

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
WO 2015161329 A1	29-10-2015	AT 515765 A1	15-11-2015
		CN 106232191 A	14-12-2016
		EP 3148658 A1	05-04-2017
		JP 6619422 B2	11-12-2019
		JP 2017515624 A	15-06-2017
		US 2017113119 A1	27-04-2017
		WO 2015161329 A1	29-10-2015

CN 114377370 A	22-04-2022	NONE	

US 2021299547 A1	30-09-2021	RU 2735826 C1	09-11-2020
		US 2021299547 A1	30-09-2021

WO 2020216220 A1	29-10-2020	CN 111840969 A	30-10-2020
		CN 113950361 A	18-01-2022
		WO 2020216220 A1	29-10-2020

DE 102015014871 A1	18-05-2017	NONE	

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EPO FORM P0459

For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- WO 2022262994 A1 [0012]
- DE 202012101242 [0012]
- US 20220203210 A [0012]
- US 3964560 A [0012]
- WO 2020216220 A [0012]