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(54) **PROTECTION ASSEMBLY**

(57) A protection assembly (100) for protecting a user is described. The assembly comprises a knee protector (12) configured to assume an active knee protection condition and a non-active condition or rest condition, a first actuator (13) connected to the knee protector in order to change a condition of said knee protector (12) from said active protection condition to said non-active condition and vice versa; first sensors (10a) configured to detect kinematic and/or dynamic and/or load data relating to the knee; a first control device (1c) connected to the knee protector and to the first sensors; a coupling and uncoupling device (18) for skis configured to connect in a de-

tachable manner or disconnect a ski boot to/from the respective ski; a second actuator (23) connected to the coupling and uncoupling device (18) so as to operate said coupling and uncoupling device (18) in order to release the boot from the respective ski. The first control device (1c) is configured to process and/or evaluate data received from the first sensors (10a) in order to emit a first signal for controlling or commanding at least one activation of the first actuator (13) and/or to emit a second signal for controlling or commanding at least one activation of the second actuator (23).

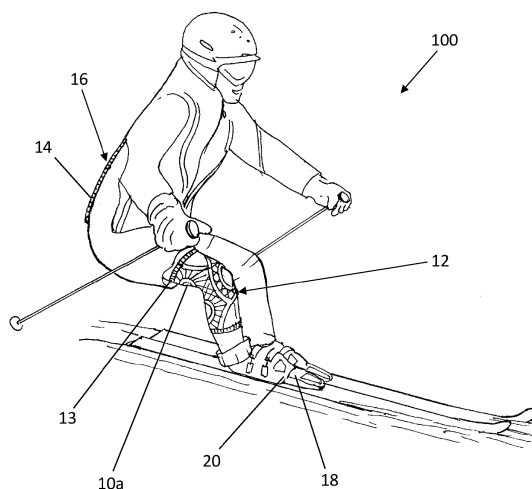


FIG. 1

Description

[0001] The present disclosure relates to a protection assembly for protecting a user during a skiing activity, which is able to protect the knee joint and preferably prevent any injuries to the knee and/or to the lower limbs, for example in the case of movements which are dangerous for the knee joints or in the event of impacts and/or falls, or which is able to avoid the consequences of an impact or fall while skiing. The present invention also relates to a ski apparatus.

[0002] As is well known, the activity of skiing involves numerous risks for the safety of the skier. For example, the high speeds may result in sudden changes in direction and/or speed, which may be damaging for the knees, as well as loss of control which in turn results in dangerous movements for the skier and/or falls or impacts, which may lead to injuries, also of a serious nature. In general, during the skiing activity, a skier may be exposed to movements, falls, impacts and/or loss of balance which may result in different types of injury and/or damage for the skier.

[0003] For this purpose, for example, it is known to use knee protectors which are able to protect the knees of a user from injuries which are caused for example by falls, impacts or loss of balance due to the dangerous conditions typically associated with the skiing activity.

[0004] The present disclosure is based on the recognition by the authors of the present disclosure that a drawback of the protectors according to the prior art lies in the fact each protector takes into consideration only a single factor, without taking into account the various factors and the different causes which arise during the skiing activity and which may result in injury or damage for the skier, in particular for the knees and/or the lower limbs.

[0005] For example, according to the prior art, release devices are used, these triggering the release of the boot from the ski depending on the mechanical stress at the interface between the boot and the ski, so as to prevent possible injury to the knee and/or to the lower limb.

[0006] A further drawback of the prior art consists in the fact that, in order to avoid an undesirable releasing action for an expert user, namely a user able to withstand higher stresses than a user at the learning stage, the release system may be fixed or locked more tightly, with the risk, however, that it is unable to release the boot from the ski in the event of actual necessity and thus increasing the probability of an injury for the user.

[0007] A technical problem forming the basis of the present disclosure consists in providing an assembly for protection of a user which is therefore able to overcome said drawback and/or achieve further advantages.

[0008] This problem is solved by a protection assembly according to the respective independent claim. This problem is also solved by a ski apparatus including an assembly, as described and claimed, and at least one ski.

[0009] Secondary characteristic features forming the subject of the present disclosure are defined in the cor-

responding dependent claims.

[0010] The present disclosure relates to a protection assembly for protecting a user, preferably during the skiing activity. The assembly comprises a knee protector configured to assume an active knee protection condition and a non-active condition or rest condition. For example, the active condition may envisage the presence of an inflated inflatable bag or inflated airbag for protecting the knee, while the non-active condition may envisage that the same inflatable bag or airbag is deflated or only partially inflated. Within the context of the present disclosure, reference will be made to the knee, but it is understood this refers to a single knee or to both knees.

[0011] It is to be understood that different active and non-active protection conditions may be envisaged, where for example the protector may include, or be formed by, a knee containing structure, and an active protection condition may be a condition of greater rigidity of the containing structure so as to limit the movements and/or the loads acting on the knee.

[0012] The assembly further comprises a first actuator connected to the knee protector for changing a condition of the knee protector from the non-active protection condition into the active condition and vice versa. For example, in the case where the protector includes an inflatable bag, a gas generator according to the prior art may be envisaged, said gas generator being configured to inflate a bag or airbag so as to cause the knee protector to pass from the non-active condition into the active condition. The gas generator is therefore to be understood as being a first actuator. In the case of the containing structure an actuator may be provided for making the containing structure more rigid, for example by means of suitable tie members.

[0013] The assembly also comprises first sensors configured to detect data relating to the knee or knees, said knee or knees data being kinematic and/or dynamic data and/or load data relating to the knee or knees. For example, the first sensors may detect and/or allow determination of the position, speed and/or accelerating force acting on the knee, or loads acting on the knee, preferably acting on the knee joint, so as to detect useful data regarding the safety state of the said knee. The first sensors may be arranged on a leg or thigh and/or on the knee of both the lower limbs, or on a single lower limb, or more generally on at least one of the lower limbs of a user, or may be arranged in the vicinity of other parts of the body of a user or of the equipment worn by the user, and be in any case suitably calibrated in order to detect conditions and/or data relating to the knee or knees.

[0014] The assembly also comprises a first control device connected to the knee protector and to the first sensors. Preferably, the first control device is operatively connected to the knee protector and to the first sensors, for example so as to favour the exchange of data and/or signals.

[0015] The assembly further comprises a coupling and uncoupling device configured to connect in a detachable

manner or disconnect a ski boot to/from the respective ski. In other words, the coupling and uncoupling device may disconnect the boot from the respective ski or may reconnect the boot in a detachable manner to the respective ski. Preferably, the coupling and uncoupling device may be configured to disconnect the boot directly from the ski or may be configured to disconnect a first portion of the boot, configured to be associated with the user, from a second portion of the boot, configured to be associated with the respective ski. In other words, the coupling and uncoupling device may disconnect the entire boot from the respective ski or may separate the second portion of the boot associated with the ski, for example a toe end of the boot, from the first portion of the boot associated with the user. The coupling and uncoupling device is preferably also configured so as to be able to reconnect the boot to the ski in the same way.

[0016] Alternatively, the boot may be disconnected from the ski by means of a reversible modification of the structure and/or the geometry of the boot.

[0017] Basically the coupling and uncoupling device is a device which allows the release of the user's foot, which is in turn associated with the boot, from the respective ski. The assembly also comprises a second actuator connected to the ski coupling and uncoupling device and configured to operate the latter in order to release the boot from the respective ski.

[0018] Furthermore, the first control device is configured to process and/or evaluate data relating to the knee or knees, received from the first sensors, and, on the basis of this data, to emit a first signal for controlling or commanding at least one activation of the first actuator and modifying the condition of the knee protector. Furthermore, the first control device is configured to emit a second signal for controlling or commanding at least at least one activation of the second actuator and releasing the boot from the respective ski.

[0019] In other words, the condition of the knee protector may be modified by means of a first signal which arrives from the first control device and the release of the boot from the respective ski may be realized by means of a second signal which is managed by the same first control device.

[0020] The main advantage of the assembly according to the present disclosure lies in the fact that the protection of a knee and/or a lower limb of a user may be optimized by means of a double control system, for both protection of the knee and release of the ski, and wherein the management of the signals for said double protection system is managed centrally by the first control device.

[0021] Further advantages, characteristic features and modes of use forming the subject of the present disclosure will become clear from the following detailed description of a number of preferred examples of embodiment thereof, provided by way of a nonlimiting example. It is nevertheless evident that each embodiment may have one or more of the advantages listed above; in any case it is nevertheless not necessary that each embod-

iment should have simultaneously all the advantages listed.

[0022] Reference will be made to the figures of the attached drawings in which:

- Figure 1 shows a side view of a protection assembly according to an embodiment of the present invention during use by a user;
- Figure 2 shows a back view of the protection assembly according to Figure 1;
- Figure 3 shows an operating diagram for a first mode of operation of a protection assembly according to an embodiment of the present invention;
- Figure 4 shows an operating diagram for a second mode of operation of a protection assembly according to an embodiment of the present invention.

[0023] With reference to the attached figures, the reference number 100 denotes overall a protection assembly for protecting a user comprising:

- a knee protector 12 configured to assume an active knee protection condition and a non-active condition or rest condition;
- a first actuator 13 connected to the knee protector for changing a condition of the knee protector 12 from the non-active protection condition into the active condition and vice versa;
- first sensors 10a configured to detect data relating to the knee or knees, wherein said knee or knees data is kinematic and/or dynamic and/or load data relating to the knee, such as speed, acceleration, position, force, moment or similar data;
- a first control device 1c operatively connected to the knee protector and to the first sensors;
- a coupling and uncoupling device 18 configured to connect in a detachable manner or disconnect a ski boot to/from the respective ski;
- a second actuator 23 connected to the coupling and uncoupling device 18 so as to operate the coupling and uncoupling device 18 in order to release the boot from the respective ski.

[0024] Moreover, the first control device 1c is configured to process and/or evaluate data received from the first sensors 10a and, on the basis of the data received from the first sensors 10a, to emit a first signal for controlling or commanding at least one activation of the first actuator 13 and modifying the condition of the knee protector 12 and/or to emit a second signal for controlling or commanding at least one activation of the second actuator 23 and releasing the boot from the respective ski. Preferably, the first sensors 10a are configured to detect data relating to a possible knee injury, in particular of the anatomical parts of the knee joint, such as the ligaments. In other words, the first sensors 10a may be configured to evaluate data relating to the knee joint, such as unnat-

ural movements and/or excessive loads so as to identify a dangerous or potentially damaging condition for the knee joint. Preferably, the assembly 100 comprises a second control device 2c associated with the boot or with the respective ski and configured to control or command at least one activation of the second actuator 23 and to release the boot from the respective ski. Moreover, preferably the first control device 1c is configured so as to be able to send the second signal to the second control device 2c in order to control or command at least one activation of the second actuator 23. In other words, the first control device 1c may send the second signal so as to control or command directly at least one activation of the second actuator 23 or may send the second signal to the second control device 2c so as to control or command at least one activation of the second actuator 23.

[0025] Preferably again, the coupling and uncoupling device 18 is a first coupling and uncoupling device 18 and the protection assembly 100 comprises a second coupling and uncoupling device 19 configured to connect in a detachable manner or disconnect another boot of a ski to/from the respective ski. Preferably, the protection assembly 100 also comprises a third actuator 33 connected to the second coupling and uncoupling device 19 and configured to operate the latter so as to release the other boot from the respective ski. Moreover, preferably, the protection assembly 100 comprises a third control device 3c associated with the boot or with the respective ski and configured to control or command at least one activation of the third actuator 33 and release the other boot from the respective ski. In other words, the third control device 3c may operate in a manner similar to the second control device 2c, so as to connect in a detachable manner or disconnect the other boot of one ski to/from the respective ski.

[0026] Preferably again, the assembly 100 comprises further sensors 14, 20 configured to detect kinematic and/or dynamic data of the user and/or a position of the user with respect to a reference position. Preferably, the first control device 1c is configured to process and/or evaluate data received from the further sensors 14, 20 and, on the basis of the data received from the further sensors 14, 20, to emit the first signal and/or the second signal. The further sensors may be placed in other parts of the body or the equipment worn, for example the ski, and/or boots and/or back protector. The first control device may therefore have access to data received from said further sensors.

[0027] Preferably, the further sensors 14, 20 are configured to detect data relating to a possible fall or risk of impact for a user. For example, the further sensors may be configured to evaluate kinematic and/or dynamic data relating to the user, such as sudden decelerations, sudden changes in position, etc.

[0028] Preferably, the second control device 2c and the third control device 3c are further configured to process and/or evaluate data received from the further sensors 14, 20 and, on the basis of data received from the

further sensors 14, 20, to control or command respectively at least one activation of the second actuator 23 and the third actuator 33.

[0029] In other words, the first control device 1c may process and/or evaluate data from the first sensors 10a and/or from the further sensors 14, 20 in order to emit the first signal and/or the second signal, while the second control device 2c and the third control device 3c may receive, in a first mode, said second signal or process and/or evaluate, in a second mode, data received from the further sensors 14, 20 in order to control or command respectively at least one activation of the second actuator 23 and the third actuator 33. For example, when the data from the further sensors 14, 20 is sufficient for activation of the second actuator 23 and the third actuator 33, the second control device 2c and the third control device 3c may operate directly the second actuator and the third actuator, respectively.

[0030] Preferably, the first control device 1c may transmit the second signal directly to the second actuator 23 and/or to the third actuator 33, for example by means of a wired connection or may transmit the second signal to the second control device 2c and/or to the third control device 3c which in turn command activation of the actuator 23 and/or the actuator 33, for example by means of a wireless connection.

[0031] According to a preferred embodiment, said further sensors comprise, and/or are, third sensors 14 positioned in a back region of a user and configured to detect kinematic and/or dynamic data of the user. Alternatively, the third sensors 14 may be associated with a back region of the user.

[0032] Preferably, the first control device 1c is configured to evaluate data received from the third sensors 14 and, on the basis of the data received from the third sensors 14, to emit the first signal and/or the second signal.

[0033] Preferably, moreover, the second control device 2c and the third control device 3c are configured to evaluate data received from the further sensors 14, 20 and/or their dedicated data transmission and/or processing units and, on the basis of the data received from the further sensors 14, 20, to control or command respectively at least one activation of the second actuator 23 and the third actuator 33.

[0034] In other words, the first control device 1c may evaluate data from the first sensors 10a and/or from the second sensors 20 and/or from the third sensors 14 in order to emit the first signal and/or the second signal, while the second control device 2c and the third control device 3c may receive, in a first mode, the second signal or evaluate, in a second mode, data received from the further sensors 14, 20 and/or from their dedicated data transmission and/or processing units in order to control or command respectively at least one activation of the second actuator 23 and the third actuator 33.

[0035] Preferably, the first sensors and/or the second sensors are potentiometers, inertial sensors or platforms, magnetometers, load cells and/or textile sensors.

[0036] Even more preferably, the third sensors 14 are potentiometers, inertial sensors or platforms, magnetometers and/or textile sensors.

[0037] Preferably again, the first sensors are configured to detect data relating to a possible injury of the knee, in particular of the anatomical parts of the knee joint, or to detect data relating to a condition which is potentially harmful or dangerous for the knee joint and/or the lower limb of a user.

[0038] Preferably, the second sensors 20 are positioned in the proximity of the boot or the coupling and uncoupling device or the ski, and are configured to detect data relating to a possible fall or risk of impact for a user. For example, the second sensors 20 may detect relating to a loss of balance of the user or to variations in speed and/or acceleration.

[0039] Preferably again, the assembly comprises a back protector 16 configured to protect at least partially a back region of a user. For example, the assembly may comprise a back protector 16 according to the prior art.

[0040] Preferably, the third sensors 14 are positioned in the back protector 16, for example inside it or along an external surface of the back protector 16.

[0041] The present invention also relates to a ski apparatus including an assembly according to any one of the embodiments described here, or as described here above, and at least one ski.

[0042] The subject of the present disclosure has been described hitherto with reference to preferred embodiments. It is to be understood that other embodiments relating to the same inventive concept may exist, these all falling within the scope of protection of the claims which are attached hereinbelow.

Claims

1. Protection assembly (100) for protecting a user, wherein said assembly (100) comprises

- a knee protector (12) configured to assume an active knee protection condition and a non-active condition or rest condition;
- a first actuator (13) connected to the knee protector for changing a condition of said knee protector (12) from said active protection condition to said non-active condition or rest condition, and vice versa;
- first sensors (10a) configured to detect data relating to the knee or knees, said data relating to the knee or knees including kinematic and/or dynamic and/or load data relating to the knee or knees;
- a first control device (1c) connected to the knee protector and to the first sensors;
- a coupling and uncoupling device (18) for skis configured to connect in a detachable manner or disconnect a ski boot to/from the respective

ski;

- a second actuator (23) connected to the coupling and uncoupling device (18) so as to operate said coupling and uncoupling device (18) in order to release the boot from the respective ski; wherein

the first control device (1c) is configured to evaluate data relating to the knee or knees received from said first sensors (10a) and, on the basis of said data relating to the knee or knees received from said first sensors (10a), it is configured to emit a first signal for controlling or commanding at least one activation of said first actuator (13) and modifying said condition of the knee protector (12) and/or to emit a second signal for controlling or commanding at least one activation of said second actuator (23) and releasing the boot from the respective ski.

2. Protection assembly (100) according to the preceding claim, comprising a second control device (2c) associated with the boot, or with the respective ski, or with the respective coupling and uncoupling device (18), and configured to control or command at least one activation of said second actuator (23) and release the boot from the respective ski, and wherein said first control device (1c) is configured to send said second signal to said second control device (2c) in order to control or command at least one activation of said second actuator (23).
3. Protection assembly (100) according to any one of the preceding claims, comprising further sensors (14, 20) placed in other parts of the body or of the equipment worn and configured to detect kinematic and/or dynamic data of the user and/or a position of a user with respect to a reference position, wherein said first control device (1c) is configured to evaluate data from said further sensors (14, 20) and is configured to emit, on the basis of said data from said further sensors (14, 20), said first signal and/or said second signal.
4. Protection assembly (100) according to the preceding claim in combination with claim 2, wherein said second control device (2c) and a third control device (3c) are configured to evaluate data from said further sensors (14, 20) and are configured to control or command, on the basis of said data from said further sensors (14, 20), at least one activation of said second actuator (23) and said third actuator (33), respectively.
5. Protection assembly (100) according to any one of the preceding claims in combination with claim 3, wherein said further sensors (14, 20) include third sensors (14) positioned in a back region of a user and configured to detect kinematic data and/or dy-

namic data of the user, or wherein said third sensors (14) are associated with a back region of the user.

6. Protection assembly (100) according to any one of the preceding claims in combination with claim 3, wherein said first control device (1c) is configured to evaluate data from said further sensors (14, 20) and, on the basis of said data from said further sensors (14, 20), to emit said first signal and/or said second signal. 5 10
7. Protection assembly (100) according to claim 6 in combination with claim 2, wherein said second control device (2c) is configured to evaluate data from said further sensors (14, 20) and, on the basis of said data from said further sensors (14, 20), is configured to control or command, respectively, at least one activation of said second actuator (23). 15
8. Protection assembly (100) according to any one of the preceding claims, wherein said first sensors (10a) are potentiometers, inertial sensors or platforms, magnetometers, load cells and/or textile sensors. 20 25
9. Protection assembly (100) according to any one of the preceding claims in combination with claim 3, wherein said further sensors (14, 20) are potentiometers, inertial sensors or platforms, magnetometers, load cells and/or textile sensors. 30
10. Protection assembly (100) according to any one of the preceding claims, wherein said first sensors (10a) are configured to detect data relating to a possible knee injury. 35
11. Protection assembly according to any one of the preceding claims in combination with claim 3, wherein said further sensors (14, 20) are configured to detect data relating to a possible fall or risk of impact for a user. 40
12. Protection assembly according to any one of the preceding claims in combination with claim 5, including a back protector (16) configured to at least partially protect a back region of a user and wherein said third sensors (14) are positioned in the back protector (16). 45
13. Protection assembly (100) according to the preceding claim, wherein said coupling and uncoupling device (18) is a first coupling and uncoupling device (18) and said protection assembly (100) comprises a second coupling and uncoupling device (19) configured to connect in a detachable manner or to disconnect another boot of a ski to/from the respective ski, and wherein said protection assembly (100) comprises a third actuator (33) connected to the sec- 50 55

ond coupling and uncoupling device (19) so as to operate said second coupling and uncoupling device in order to release the other boot from the respective ski and wherein the first control device (1c) is configured to evaluate the data relating to the knee or knees received from said first sensors (10a) and, on the basis of said data relating to the knee or knees received from said first sensors (10a), it is configured to emit a third signal for controlling or commanding at least one activation of said third actuator (33).

14. Protection assembly (100) according to the preceding claim, wherein said protection assembly (100) comprises a third control device (3c) associated with said other boot or with the respective ski and configured to control or command at least one activation of said third actuator (33) and to release the other boot from the respective ski, and wherein said first control device (1c) is configured to send said third signal to said third control device (3c) in order to control or command at least one activation of said third actuator (33).
15. Ski apparatus including a protection assembly according to any one of the preceding claims and at least one ski.

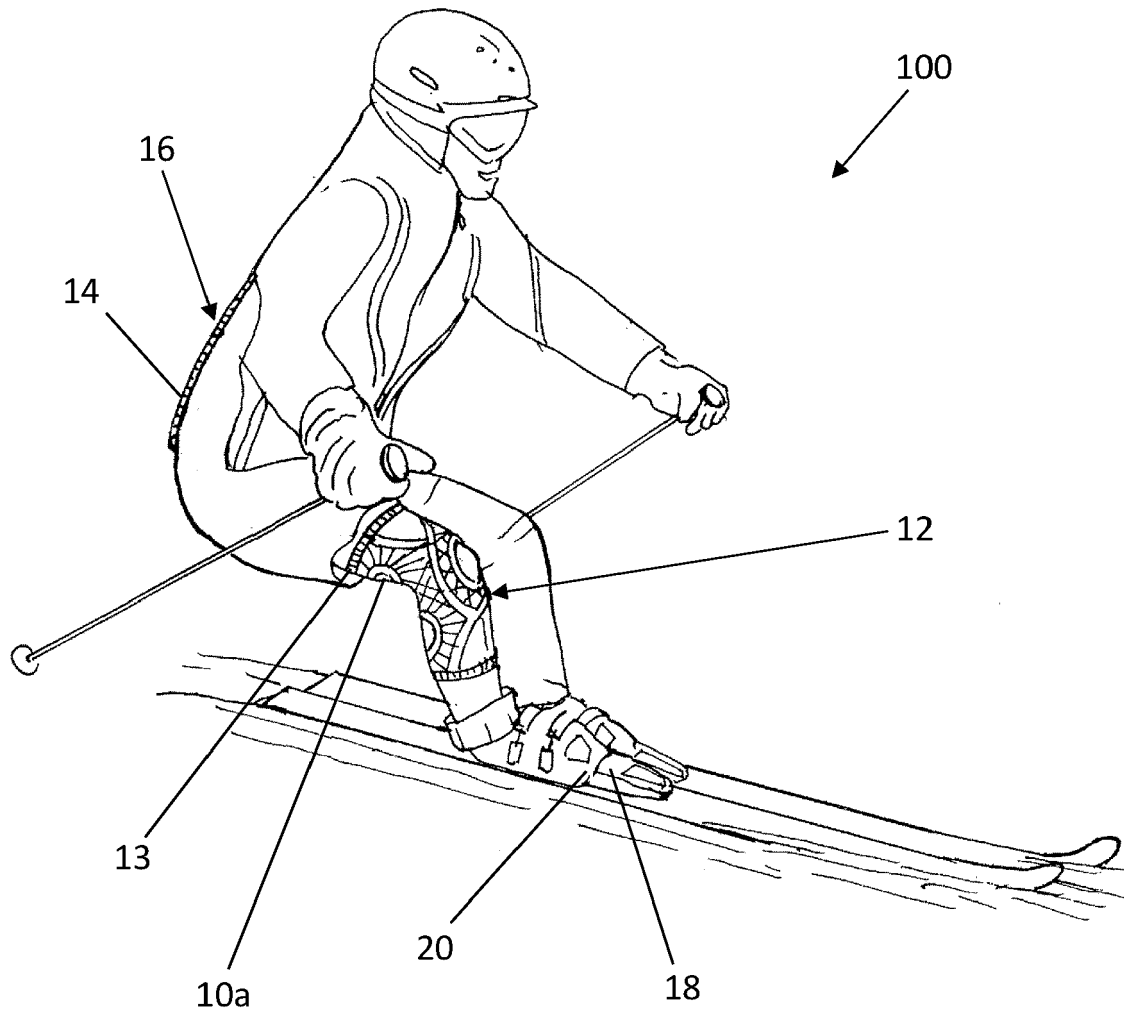


FIG. 1

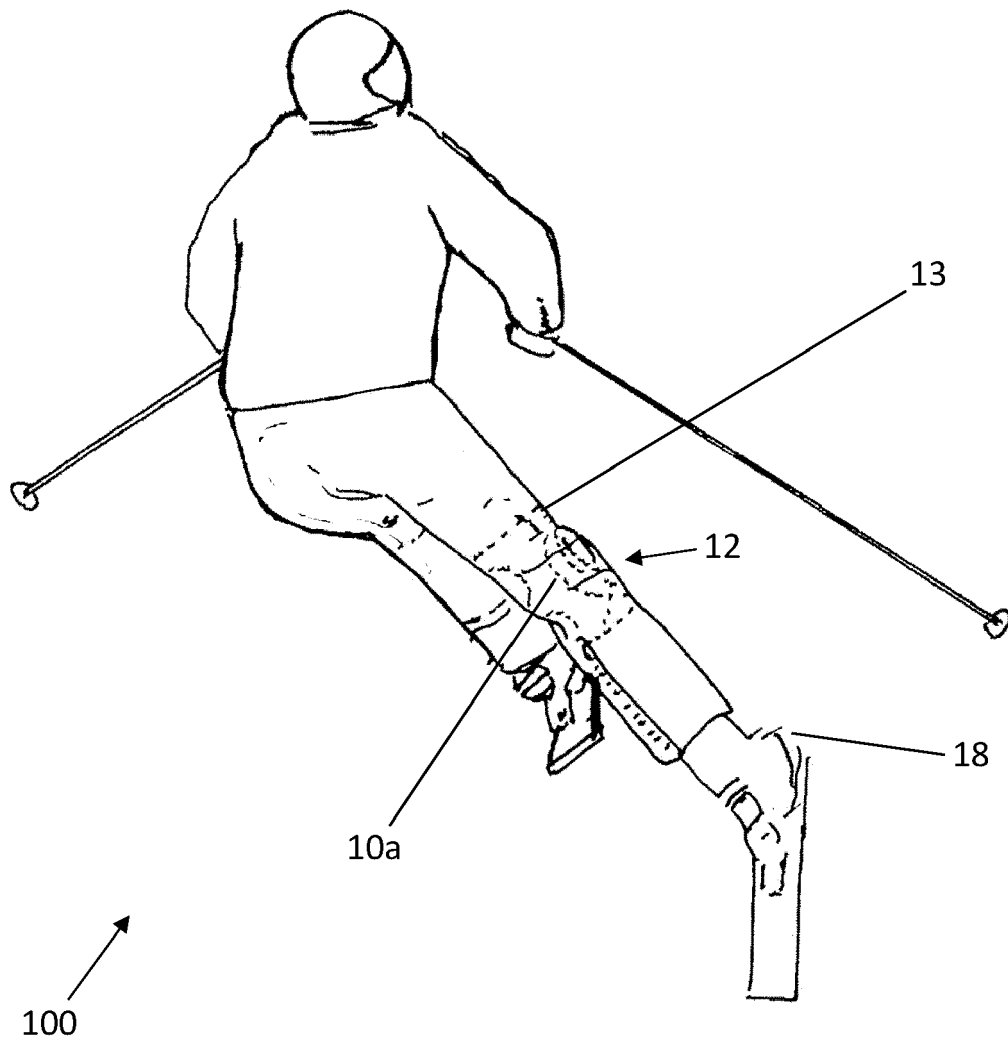


FIG. 2

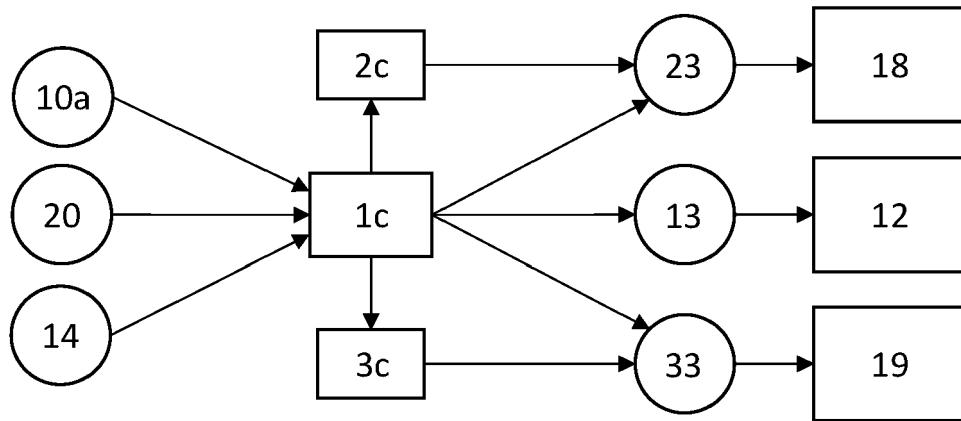


FIG. 3

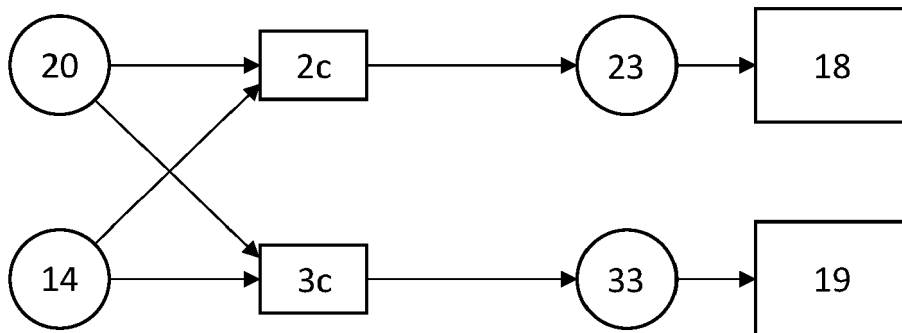


FIG. 4



EUROPEAN SEARCH REPORT

Application Number

EP 23 17 1827

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
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A	* paragraph [0022] - paragraph [0048]; figure 6 *	2-7, 9, 11-14	A63C9/088
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A	US 2021/370494 A1 (HURLEY GARRETT [US] ET AL) 2 December 2021 (2021-12-02) * paragraph [0036] - paragraph [0049]; figures 1-3 *	1-15	

TECHNICAL FIELDS SEARCHED (IPC)

A63C

The present search report has been drawn up for all claims

1

EPO FORM 1503 03:82 (P04C01)

Place of search

Munich

Date of completion of the search

27 September 2023

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
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 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

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

EP 23 17 1827

5 This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
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27-09-2023

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