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(54) Ski with solar cells and electric and electronic devices.

(57) The ski structure has its top surface covered, wholly or in part, by photovoltaic cells, which by the effect of solar radiation, generate current which recharges a series of storage batteries located preferably at a rearward zone with respect to the bindings. The ski structure may also be provided with an electronic speed sensing device, which may be powered by the current generated by the solar cells and/or the storage batteries which are recharged by those same cells.

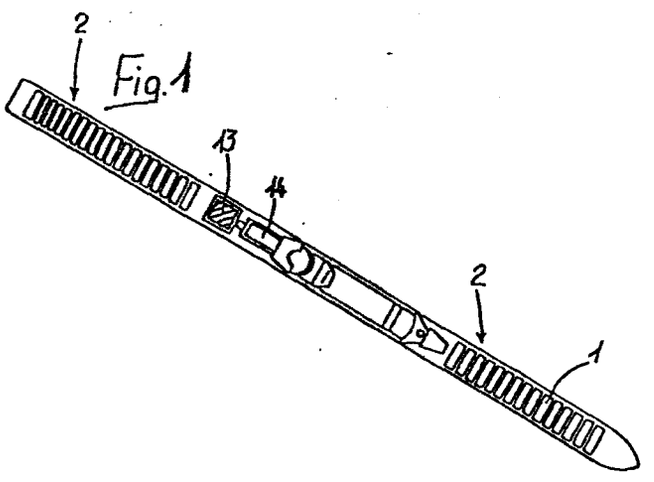

Fig.1

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"SKI WITH INDEPENDENT CURRENT GENERATION AND INTEGRATED ELECTRIC AND ELECTRONIC DEVICES TO THE SAFETY BINDERS AND THE BOOTS"

This invention relates to a ski with independent current generation, provided with integrated electric and electronic devices to the safety binders and the boots.

Previously known skis incorporate neither electric current generating means nor suitable means for its use.

All safety devices, or boot binders, are of a mechanical type, whilst only the boots are provided in some cases with electric means which only consist of internal electric resistance heaters.

On some boot binders there are still provided simple display means for the closure load, consisting of a transducer which senses the load on an elastic element and displays its value on a display.

It is the object of this invention to provide a ski having both electric current generating means and means of storing and utilizing that same current.

A consequent primary object is to provide skis with appropriate means of generating current controlled for a proper and advantageous operation.

Still another object is to provide a ski having both means of generating electric current and means of storing and utilizing that same current.

Still another object is to provide the ski with both electronic control means and service means as well

as electric and/or electronic safety means.

A not least object is to provide a ski having devices adapted to allow a safer and more comfortable use thereof.

These and other objects which will become clearer in the following technical description, are achieved by a ski characterized in that it comprises:

a) independent means of generating current, consisting of a plurality of solar cells disposed on the ski surface;

b) a series of electric storage batteries powered continuously by said current generating means and periodically, if required, by an external electric source;

c) means of conveying current to a boot provided with internal heating when said boot is connected to the ski safety binders;

d) means of control for the load transferred to the safety binders by the skier, and means for opening those same binders controllably;

e) means of sensing and memorizing the speed developed by the ski on the snow.

Further features and advantages of the invention will be apparent from the detailed description of a preferred embodiment given by way of illustration and not of limitation and illustrated in the accompanying drawing sheets where:

Figure 1 is a full view of a ski according to the invention;

Figure 2 is a sectional view of a ski portion

showing an arrangement of solar cells;

Figure 3 shows a portion of a longitudinal section of the same ski; and

Figure 4 diagrammatically illustrates the conformation of the electric part with current generation, storage of same and utilization.

With reference to the cited figures in a ski structurally made in the usual manner and globally indicated at 1, the upper surface is covered with a plurality of photovoltaic cells 2, which are suitably arranged in parallel strips 3 expediently arranged transversely to the ski length, and which may be of any suitable type, such as for example, photovoltaic cells of the "Philips" BPX 47/A or BPY 40-30 type.

The width of these strips of photovoltaic cells is conveniently reduced such that they are affected as least as possible by the bending stresses to which the ski is subjected.

For this reason said strips of photovoltaic cells 3 may be expediently mounted to a layer of relatively elastic material 4 which overlies the structure 5 of the ski.

Said strips of cells are then covered with a transparent layer 6 preferably made of a plastics resistant to shock and abrasion, such as for example, polycarbonate material or a synthetic resin.

That plastics may be glued or cast over the ski structure so as to form a single body with it incorporating also all the various electric wires or printed conductors which flow into the solar cells.

The combination of said solar cells is grouped in a plurality of separate groups of which in Figure 4 there are indicated three with the numerals 7,8 and 9.

Each of said groups 7,8 and 9 flow singly by means of electric wires into a control circuit 10 which has electronic devices adapted to verify the electric tension existing across each of the groups 7,8 and 9 to then effect either their putting in parallel or their putting in series or both such conditions by the sum of groups such that the voltage which appears at the output 11 is anyhow higher than the minimum charging voltage for the series of storage batteries 12.

It should be noted in fact that the solar cells have electric characteristics which are a function of both the illumination they receive and the operating temperature.

For this reason their voltage could drop below the charging values of the storage batteries 12, preventing in that case recharging of same.

Conveniently said storage batteries 12 are arranged in a container 13 attached preferably in a removable manner at a rearward position with respect to the heel piece 14 of the ski binding.

In the circuit shown in Figure 4 there is still provided an external recharging unit 15 which supplies the storage battery 12 with an external current source composed for example of the normal civil mains.

Thus it is possible to effect a precharge of the storage batteries 12 such that the solar cells have the sole function of sustaining this energy reserve as it

is being utilized.

In Figure 4 there are diagrammatically illustrated three utilizations for the electric energy produced by the solar cells and/or stored in the storage batteries 12.

In a first utilization by means of suitable conductors 16 and by means of electric contacts not shown but provided in the heel piece 14 of the ski binding, the electric current is sent to an electric resistance 17 placed below the insole of a ski boot 18 so as to heat the skier's foot.

The boot 18 will be provided of course with electric contacts adapted to cooperate with those provided in the heel piece of the ski binding 14.

Of course it is not necessary that the areas of contact by solely in the heel piece it being possible for these to be located at any area where the boot can make an electric connection.

A second embodiment evisages that both the heel piece indicated at 19 and the toe piece indicated at 20 where there is locked the ski boot 21 have one or more effort sensors respectively 22 and 23 adapted to sense the stress situations to which the boot is subjected in use.

The signals produced by said sensors are sent to a control and processing unit 24 on which there may be set some maximum admissible loads without damage for the skier.

In the instance that the values measured by the sensors exceed those foreseen loads, actuator means

connected to an electric power circuit 25 which utilized again current from the storage batteries 12 provide for opening the safety bindings with release of the boot. In this case the bindings shall have to be provided, for example with electro-mechanical means which, once released, release the mechanical devices which hold the boot locked.

In this case also in the boot itself there may be provided effort sensors, located for example in the high part of the footwear which send their signals to the same control unit 24 by means of electric contacts again provided either on the safety bindings or anyhow at areas where the boot comes into contact.

In this case the entire footwear and not only its rear or forward part may be controlled as a function of the efforts to which it is subjected thus making it possible to determine opening of the bindings and releasing of the boot in conditions of extreme safety for the skier.

In the control unit there may be also provided means of comparing actual loads to set data, provided with actuation delay, to prevent, for example, release of the skies by impulsive efforts of very short duration which anyhow could be absorbed without damage by the skier.

In practice, if the effort sensed is of very short duration and cancels immediately, the binding does not open despite the fact that the value of the effort itself may be of great magnitude.

The binding opens instead surely even for lower

efforts when that value is maintained for a time period deemed dangerous.

In a third form of utilization of the electric energy produced by the photovoltaic cells stored in the storage batteries 12, there is provided a device for controlling and measuring the speed of the skis with respect to the snow, composed for example of a frequency emitter 27 cooperating with a receive 28 which by exploiting the Doppler effect, allows measuring by a suitable processing unit 29 of the frequency variation and therefore the relative velocity between the ski 26 and the ground which is displayed on a display 30.

Conveniently in the unit 29 there is provided a memory capable of processing the speed parameters and of displaying successively on the display either the peak speed in a certain period or the average speed over the same period.

From what is described and illustrated one can derive the characteristics of the ski according to the invention which may be simply grouped in characteristics linked to the production and storage of electric energy as well as characteristics linked to the utilization of the same with service functions such as heating the foot and of control referred to the skier's safety and verification of performance.

More particularly the possibility of having an independent current generating source available, allows heating over very long periods of the footwear without the storage batteries being exhausted.

In addition to this the energy available is advantageoulsy utilized to control electronically the safety bindings to both check their proper closing and determine their opening in case of unusual or dangerous stresses.

As already illustrated, in addition to this, the skis may be provided with means of measuring both the peak and instantaneous and average speed which may be memorized and successively displayed.

From what is described and illustrated it is observed that all the objects set forth are achieved and that in addition to the examples made, many other electric or electronic devices may be applied to the ski supplying them with the available energy.

CLAIMS

1. A ski with independent current generation and integrated electric/electronic devices to the safety bindings and to the boots characterized in that it comprises:

a) independent means of generating current, comprising a plurality of solar cells arranged on the ski surface;

b) a series of electric storage batteries powered continuously by said current generating means and periodically, if required, by an external source;

c) means of conveying current to a boot provided with internal heating, as said boot is connected to the safety bindings;

d) means of controlling the load transferred on the safety bindings by the skier and means of controllably opening those same bindings;

e) means of detecting and memorizing the speed attained by the ski on the snow.

2. A ski according to Claim 1, characterized in that said solar cells are grouped into strips lying across the ski top face.

3. A ski according to Claims 1 and 2, characterized in that said solar cells rest on a layer of a relatively elastic material and are covered by a layer of a clear plastics resistant to shock, blows, and abrasions.

4. A ski according to Claim 1, characterized in

that said solar cells are connected electrically in several discrete groups, each of said groups being connected to a single control circuit which verifies the output voltage of each group carrying then out series/parallel connections such that the resulting voltage is at all times higher than the storage battery charging voltage.

5. A ski according to Claim 1, characterized in that said storage batteries are located in a container preferably removably attached to the ski.

6. A ski according to Claim 1, characterized in that said means of conveying current to a boot provided with internal resistance heater comprise electric contacts provided preferably on the safety bindings and adapted to interconnect with other contacts provided in that same boot.

7. A ski according to Claim 1, characterized in that said means of controlling the load transferred by the skier on the bindings comprise substantially electric and/or electronic load sensors arranged both on the toe piece and heel piece of the safety bindings and in the structure itself of the boot, the signal of said sensors being processed by a circuit of comparision with set data, said circuit controlling the electric and/or electromagnetic opening of the same bindings in case of preset values being exceeded.

8. A ski according to Claim 1, characterized in that said means of sensing and memorizing the speed attained by the ski comprise preferably a pair of Doppler effect emitter-receivers, located in the ski

insole, whose output signal, a function of the frequency variation is proportional to the relative speed of the implement with respect to the snow.

9. A ski according to Claims 1 and 8 characterized in that said speed as sensed and processed by an electronic control circuit is memorized as maximum and/or average and displayed, on control on an optical display.

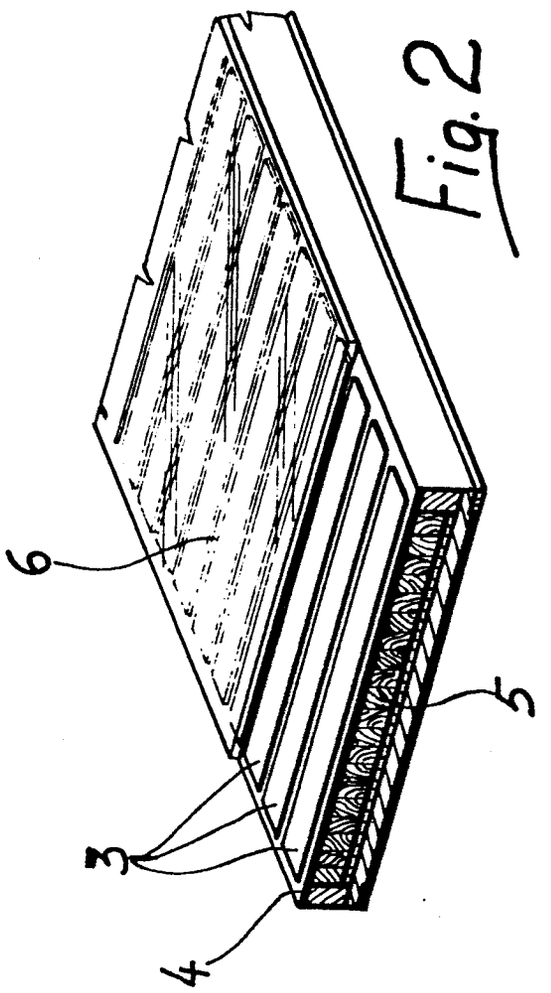

Fig. 2

Fig. 1

Fig. 3

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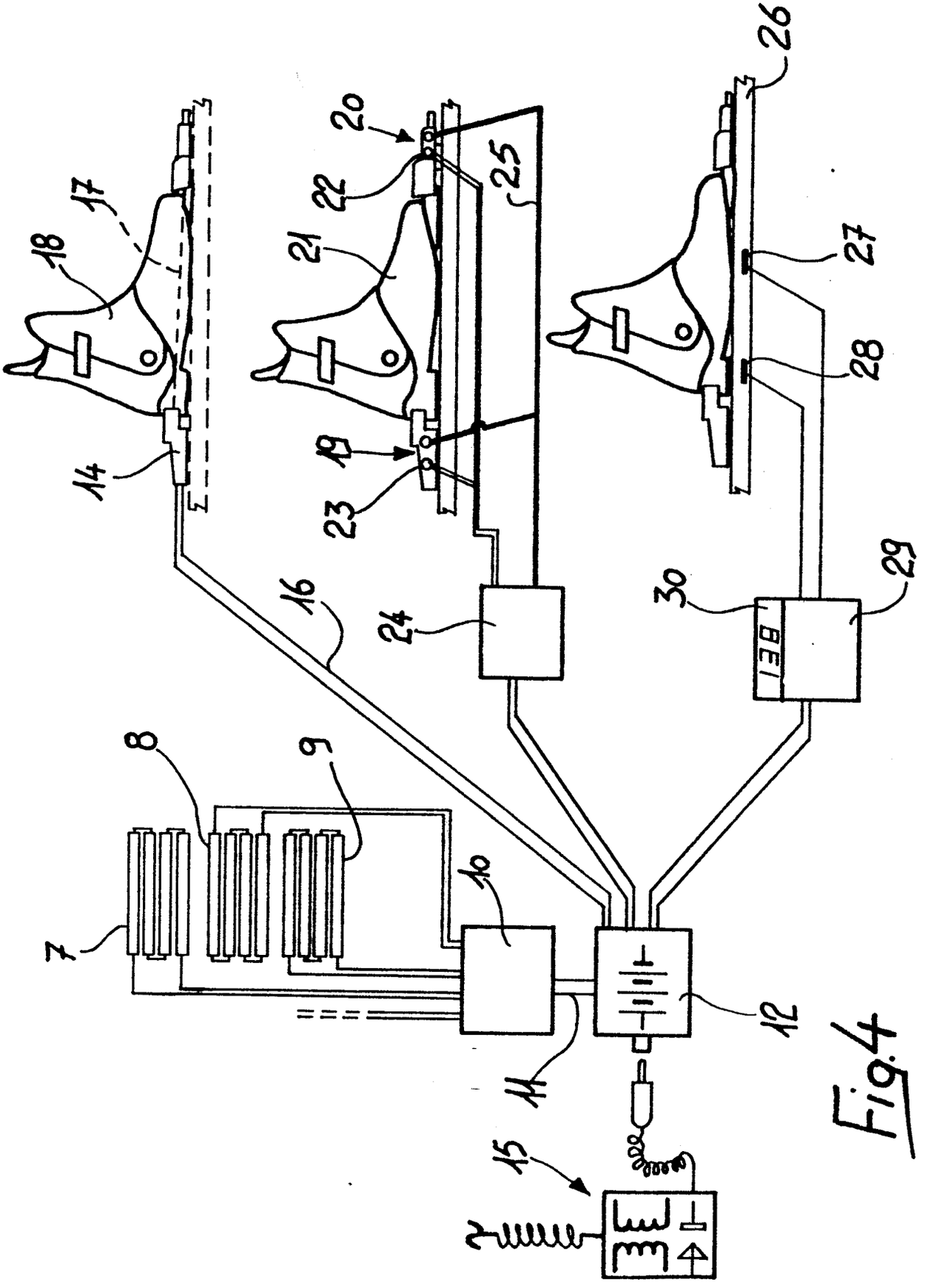

Fig.4