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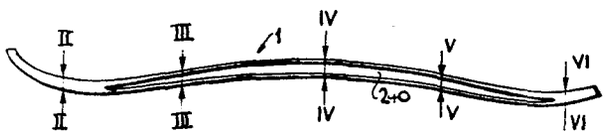
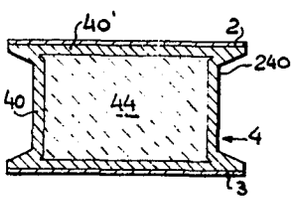
(54) Ski with increased moment of inertia and process for making it.

(57) In a process of making a ski core 4 of foamed resin, arrangement are taken to maximize cross-section growth of skin 40, 40′ of foamed core body 44. Such arrangement includes the provision of a "I" shaped beam 1, with side longitudinal depressions 240, providing a moment of inertia $I = BH^3 - ch^3$.





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Process and means for encreasing the resisting moment of a ski having a foamed resin core and ski, particularly cross-land ski obtained with such process and means.

This invention relates to a process for molding a resin ski core whereby skin growth is maximized providing a corresponding increase of its resisting moment. Maximization of skin growth is obtained by increasng the side wall surfaces affecting the skin thickness growth. Increase of surfaces affecting skin thickness growth involves provision of a ski core with side depressions. Of course, such side depressions involve a ski cross-section and weight reduction.

In the known art skis comprise an upper thickness and a bottom sole of high resisting material and a core of foamed resin e.g. of poliuretan therebetween.

When a known ski is subjected to bending, as happens during use, its core is stressed by complex forces. Consequently the core material must have suitable resisting and resilient features. Such features may be computed with usual formulae of the Art.

The origin of this invention springs from the observation that there is a remarkable difference between resilience calculated with usual formulae and resiliance measured by loading tests: calculated resilience is always higher then measured resilience. This observation encouraged the observer to study the cross-section of a ski and particularly its core cross-section. Being such ski core obtained by molding of a self foaming polymeric resin its cross-section is heterogeneous: material is less foamed

outside than inwardly. A core comprises an outer thickness of scarcely or even unfoamed polymery said "skin" or "cork" and by a heart highly foamed or expanded. This is due to lower temperature available outside during molding in view of cooling provided by die walls and ski soles. Due to this phenomenon a box like beam is obtained shaped as a cross-sectioned twofold "C". Thus when a ski is bent, as happens when it is in use, its cross-section slightly buckles like a bent tile. This phenomenon is of very small value but it is enough to explain the reason why the calculated structure stiffness is higher than the measured one.

Starting from this consideration the inventor, with ingenious perception, has conceived a process which maximizes the skin formation simply by providing two longitudinal depressions on ski core sides. In other words the sides are kept partially closer to the ski axis. According to the present invention the core side walls, made of scarcely foamed or denser material, which are kept closer to the ski axis provide a stronger connection between the upper and bottom layers or sole comprising a twofold "I" box like beam. Coeteris paribus it is possible to obtain alternately a stiffer or a lighter ski. Moreover with unchanged sole width a lighter ski may be obtained due to lower core cross-section. Of course less material employed means a cheaper ski at parity of stiffness and width of the ski. Finally with depressed sides a reduced friction with snow is obtained.

For a better understanding of the present invention reference may now be made to the accompanying drawings which

show a possible embodiment thereof in a diagrammatic and merely illustrative fashion.

Figure 1 is a side view of a ski in accordance with the present invention.

Figure 2 is a cross-section, in an enlarged scale, of a ski, taken along line II-II of figure 1.

Figure 3 is a cross-section, in an enlarged scale, of a ski, taken along line III - III of figure 1

Figure 4 is a cross-section, in an enlarged scale, of a ski, taken along line IV-IV of figure 1.

Figure 5 is a cross-section, in an anlarged scale, of a ski, taken along line V-V of figure 1.

Figure 6 is a cross-section, in an enlarged scale, of a ski, taken along line VI-VI of figure 1.

Figure 7 is a cross-section of a process die to provide the ski of figures from 1 to 6.

Figure 8 is a cross-section sketch wherein the sides of a conventional ski are ideally put together for purpose of comparison with:

Figure 9 which is a similar cross-section sketch wherein the skin sides of a cross-country ski according to the present invention are ideally put together for purpose of comparison with convention ski of figure 8. It will be appreciated that the central common part was eliminated.

With reference to figure from 1 to 9 of the drawings a ski comprises conventionally on upper layer 2, a sole 3 and a core 4. Core 4 is made of foamed resin and when the material is being molded it expands more inside at 44 and less ouside at 40. Thus the core 4 comprises an outer layer 40' of less expanded polymeric material or skin and an inner

body 44 of much more expanded polymeric material. This seems to be due to lower temperature reached during molding by that material contacting the cool die walls. The core 4 of known ski is exactly rectangular consequently skin 40' provides a kind of rectangular tube.

According to an embodiment of the present invention the sidewalls 140 of die cavity 144 of are widened by making them convex which, in term of molded ski, provides longitudinal side depressions. Such widening of die sidewalls encrease correspondingly heat transfer and of course skin growth. The surface encrease is considerable, e.g. higher than 50%. Consequently the exceding 50% of heat transfer relative to a lower quantity of polymeric material provide an encreased growth not only in skin extension but even in its thickness. For comparison figure 8 and 9 show the joined side skins respectively of a conventional or known ski and of a ski according to the present invention. It will be appreciated that the corresponding central sections are omitted.

Referring now to known ski whose semplified cross-section is shown in figure 8 assumed a cross-section width of 6 mm. corresponding to a skin thickness of 3 mm. and a height H of 24 mm. the moment of inertia of such known ski core is: $I=bH^3/12=6,912mm^4$.

Referring now to the ski according to the present invention whose semplified cross-section is shown in figure 9. Prudently assumed a skin thickness of 3 mm i.e. equal to that of a known ski core even if here is certainly higher and assumed a height H=24mm the moment of inertia is $I=BH^3-CH^3/12=16,145mm^4$ i.e. 2,33 times the moment of inertia

of a known ski core.

Of course this unexpected encrease of moment of inertia regards the ski polymeric resin core 4 and the benefit on the whole ski is much less evident.

However it will be appreciated that at parity of cross-section and weight a higher ski strenghtness is obtained; whereas at strenghtness parity 20 percent lighter ski is obtained.

As shown in the drawings depressions 240 extend along the ski lenght and at least along the stressed part of the ski.

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CLAIMS

1. A process for providing a ski with a foamed resin core comprising foaming in a die cavity an expandable resin between an upper and bottom sole or the like whereby an outer skin of less expanded foamed resin is formed due to heat dissipation through die walls, characterized in that the die cavity surfaces contacting the expanding resin foam are widened and correspondingly the cavity space of die reduced whereby to maximize heat dissipation and skin growth whereby a highest ratio expanded inner cross-section/outer skin cross-section is obtained.

2. A process, as claimed in claim 1, characterized in that the increase of skin thickness and the reduction of foam material is provided by shaping toward the die centre the side walls of the die cavity.

3. A process, as claimed in claim 2, characterized in that the shaping comprise a convexity of the side walls of the die cavity.

4. Means for encreasing the resisting moment of a ski foamed resin core characterized in that they are adapted to provide a process as claimed in claims from 1 to 3.

5. A die, as claimed in claim 4, characterized in that the vertical side walls of its cavity are convex whereby to provide molded skies with a double "T" cross-section and with a skin in the shape of a twofold "I".

6. Ski and particularly cross-country-ski, characterized in that it is obtained with a process as claimed in claims 1 to 3 and with means as claimed in claims 4 and 5.

7. Ski, as claimed in claim 6, characterized in that its resins core is "I" or twofold "T" cross-sectioned or in the

shape of a steel beam i.e. having a moment of inertia I= $BH^3-ch^3:12$ and that its core skin provides a twofold "I" cross-section.

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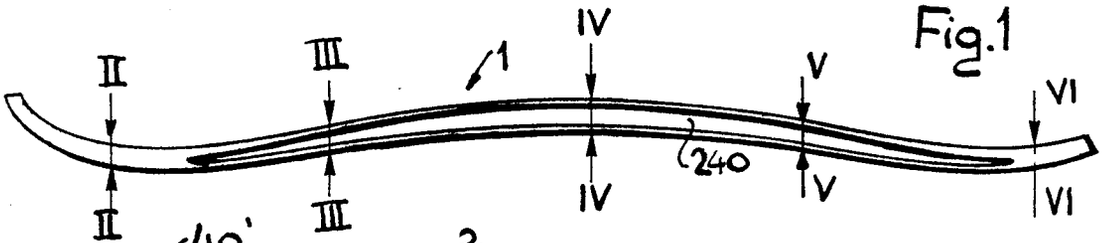

Fig.1

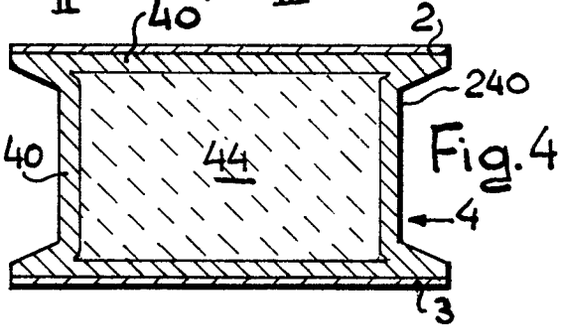

Fig.4

Fig.2

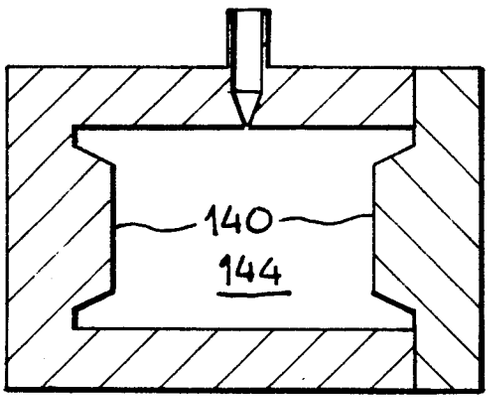

Fig.7

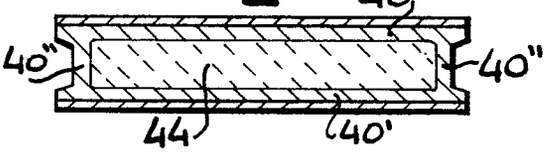

Fig.3

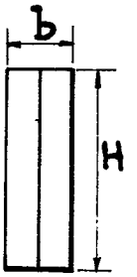

Fig.8

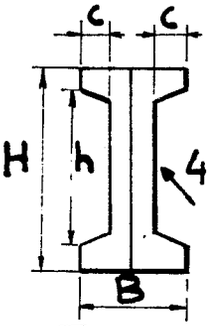

Fig.9

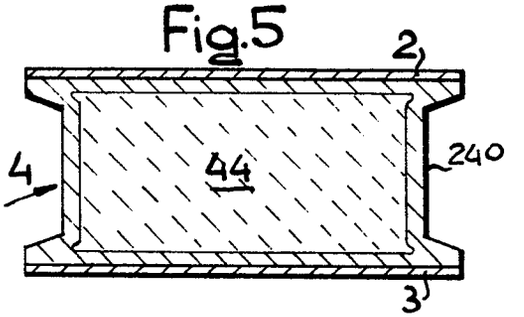

Fig.5

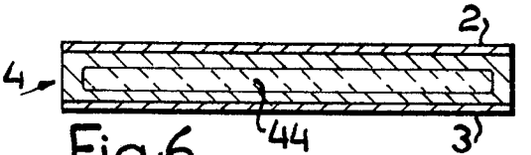

Fig.6

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EUROPEAN SEARCH REPORT

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Application number

EP 82 11 0019

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl. ³)
A	FR-A-1 467 183 (LES PLASTIQUES SYNTHETIQUES) *Figure 5*	1,6,7	A 63 C 5/12
A	DE-B-1 578 697 (ANGER)	7	
A	CH-A- 255 734 (LUNDBERG) *Figure 6*	7	
A	DE-A-1 728 372 (FRITZMEIER)		

TECHNICAL FIELDS SEARCHED (Int. Cl. ³)

A 63 C

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	15-02-1983	SCHLESIER K.G.W.P.

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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A : technological background
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E : earlier patent document, but published on, or after the filing date
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