The invention relates to a shell of a sports shoe, in particular a ski boot, comprising at least one shell part having at least one stiffening part, which has a higher stability than the other components of the shell parts. One or more spacers protrude from an interior surface of the stiffening part. A portion of the shell is formed from a relatively flexible plastic material compared to the stiffening part. Furthermore, a method for producing an above-mentioned shell of a sports shoe is described.
SHELL OF A SPORTS SHOE, IN PARTICULAR A SKI BOOT, AND A METHOD OF PRODUCING SUCH A SHELL

[0001] The invention relates to a shell of a sports shoe, in particular a ski boot, and a method for producing the shell of a sports shoe, in particular a ski boot, as it is described in the claims 1 to 14.

[0002] From prior art it is known to build such a shell from one or several shell parts being connected in an articulated way and comprising several components, with the components of the shell parts being preferably formed from different materials in order to particularly achieve shell parts providing high stability or dimensional stability.

[0003] Document GB 1 491 634 shows a shell of a sports shoe produced by an injection molding process and a method of making the shell. In order to increase the extension stiffness and fixedness of the elastic injection molding material of the shell, a porous, fabric-like insert is additionally integrated into the shell and the injection molding material shall penetrate and surround the insert during the production process. The porous insert is made of several layers of synthetic fabric or plastic foil and is placed exactly in the region of the sports shoe, where the highest stiffness and fixedness is required or provided. According to the shown method, at first the porous, fabric-like insert is mounted to the foot-shaped last, then the outer injection molding tool is placed on the last and the insert thereon and finally, the injection molding material, such for example polyurethane, is injected into the space between the last and the injection molding tool. In this case, the injection molding material should not only penetrate the porous insert, but also lift it slightly from the last with the result that the insert is surrounded by the injection molding material completely and a homogenous shell part is formed. Particularly the slight lifting of the insert from the foot-shaped last represents a procedural step which is hard to control, with the result that it cannot be always ensured that the insert is surrounded by the injection material completely. Due to the desired complete overmolding of the insert, it is furthermore possible to perform e.g. a simple position control of the insert for reasons of quality control, once the shell has been produced successfully.

[0004] Document EP 0 808 708 A1 discloses an injection molding method in particular for shell parts of a sports shoe, where at first an injection molding material being in its cured state relatively soft is inserted into the injection mold so as to create channels in the produced injection molded part. In a second procedural step, these channels, and also the thereto adjacent regions of the injection molded part of the relatively soft material are injection-overmolded by an injection molding material being relatively rigid in its cured state in order to increase the stability or the fixedness of the sports shoe. Due to the injection-overmolding beyond the region of the channels, the injection molding material being relatively rigid in its cured state can be prevented from seeping at the upper edges of the channels during the second manufacturing step, because it is not required to position the injection mold exactly at the upper edges of the channels in a sealing way, but it adjoins the injection molded part formed of relatively soft injection molding material face-to-face slightly beyond the channels. Thus, greater tolerances during positioning or dimensions of the injection molding tool or the injection molded parts are allowed, resulting in less defective goods being produced. The specific filling of the channels with the injection molding material being relatively rigid in its cured state during a second injection molding process puts nevertheless increased technical requirements on the machine used for the injection molding process.

[0005] The underlying objective of the present invention is to create a shell of a sports shoe, in particular a ski boot, which is pleasant and comfortable to wear on the one hand, and the shell of which allows quick and sporty going or moving on the other hand. Additionally, the objective of the present invention is to provide a method for producing such a shell of a sports shoe, in particular a ski boot, which can be performed in an easy way and provides an increased practical suitability at the same time.

[0006] The firstly mentioned objective of the invention is achieved by a shell of a sports shoe according to the features in claim 1.

[0007] According to the invention, the shell of a sports shoe, in particular of a ski boot, comprises one or more shell parts and furthermore, at least one of these shell parts comprises three-dimensional components, which are formed from a plastic material or metal having a defined stability or elasticity. At least one of these three-dimensional components of a shell part is formed as a stiffening part providing a higher stability than the other components of the shell parts. By corresponding arrangement of the stiffening part, the stability or dimensional stability in certain regions of the shell of a sports shoe is greatly increased. As a result, for example the stability of a front foot shell in the area of heel, ankle, sole and/or toes of a ski boot can be increased correspondingly. This allows a faster sportier going more accurately through the tracks, because a direct power transmission from the user’s foot via the more stable ski boot and a binding to the ski is achieved.

[0008] By embodying of the section not covered by at least one stiffening element of a shell part formed from a relatively flexible plastics with respect to the stiffening part, a sports shoe is created, which is convenient and comfortable to wear due to the flexibility of the shell in the sections not being covered by stiffening parts. Due to the fact that the stability of the shell of the sports shoe is achieved in a sufficient extent by the stiffening part(s) and the middle thickness of the shell can consequently be noticeably reduced compared to a shell not having stiffening parts, the weight of the shell of the sports shoe and consequently the total weight of the sports shoe is furthermore reduced. Advantageously is furthermore a alternative embodiment, which keeps the middle thickness of the shell essentially the same compared to a shell without stiffening parts, with the stability of the plastics relatively flexible compared to the stiffening part being however chosen lower than usual, with the result that on the one hand, a shell having sufficient stability is ensured by using the stiffening parts, and on the other hand, a very flexible composition is present in the sections not covered by stiffening elements, which also results in an increased wearing comfort.

[0009] Furthermore, a very homogenous interior surface of the shell results, because also at least sections of the interior surface of the at least one stiffening part are covered by the plastic material being relatively flexible compared to the stiffening part. The homogeneity of the interior surface is also not disturbed by the spacers being mounted to the interior surface of the stiffening part, because the end sections of the spacers, which are furthest from the interior surface of the stiffening part, extend flush with the interior surface of the plastics, which is arranged on the interior surface of the stiffening part and relatively flexible compared to the stiffening part. The
one or the several spacers protruding from the interior surface of the stiffening part allow in a very easy way for the stiffening part to be positioned correctly and reliably on a last during the injection molding process for producing the corresponding shell part. It is nevertheless also possible for the bearing surfaces of one or several spacers to be partially covered by the relatively flexible plastics.

[0010] Due to the shell according to the invention, a sports shoe is created, which is, on the one hand convenient and comfortable to wear, and on the other hand, allows a fast and sporty going. This is of particular advantage for a sports shoe, which is in its front shoe shell and/or the cuff equipped with one or more stiffening parts.

[0011] Of advantage is also an embodiment according to claim 2, because the mentioned composite material for the at least one stiffening part can be worked in an easy way, in particular using an injection molding process. By contrast to the very laborious manufacturing process, where a fabric essentially formed from parallel fibers, is surrounded by a plastic material and thus a fiber-reinforced plastics is produced, it is in the present case possible for the at least one stiffening part to be produced in one relatively easy injection molding process. In this case, a plurality of fibers being independent from each other, are added to the plastic material in a randomized arrangement, which are or will be surrounded by the plastic material. In addition to the simple workability of the composite material for the at least one stiffening part using a well-engineered injection molding process, said material has a very high modulus of elasticity of up to 12 GPa, preferably a modulus of elasticity of between 0.9 GPa and 1.5 GPa. Thus, high-tensile stiffening parts can be produced using said composite material.

[0012] Also of advantage are measures according to claim 3, because due to the minimum length of the fibers added to the plastic material a composite material is formed, which has a very high stability or a very high modulus of elasticity. Furthermore, by defining the maximum length of the fibers allowed to the plastic material it is achieved that this addition can easily be performed directly during the injection molding process for the production of the at least one stiffening part.

[0013] Also of advantage are measures according to claim 4, because due to the usage of a plastic material being relatively flexible compared to the stiffening part in the section of a part of the shell not covered by at least one stiffening part, a shell of a sports shoe is created, which has relatively flexible certain regions and the sports shoe is consequently convenient and comfortable to wear.

[0014] With respect to the measures according to claim 5 it is of advantage that very lightweight shell parts and consequently sports shoes having a very low total weight can be produced by using a very thin stiffening part, which nevertheless has a sufficient stability due to the used material.

[0015] Also of advantage are measures according to claim 6, because the total weight of the sports shoe is reduced at constant stability of the shell of the sports shoe due to the production of a relatively thin shell part compared to the shell parts known from prior art.

[0016] Practical tests with present, classically constructed shells of a ski boot comprising a front foot shell and cuff thereto connected in an articulated way and an appropriate new shell having stiffening parts within the front foot shell and the cuff have shown that in the concrete case of an essentially constant stability of the shell, the weight of the front foot shell could be reduced from 870 g to 795 g and the weight of the cuff could be reduced from 410 g to 370 g. Consequently, due to the construction of the shell according to the invention, a reduction of weight of at least approximately 10% compared to a classical construction of shell without stiffening parts can be achieved.

[0017] Of advantage are also measures according to claims 7 and 8, because the usage of such connection elements in the edge section of the at least one stiffening part results in a very stable connection between stiffening part and the relatively flexible plastics adjacent thereto. Thus, the probability that the stiffening part detaches from or breaks out of the shell part or the relatively flexible plastics under load is reduced.

[0018] Of advantage are furthermore measures according to claim 9, because the injection molding process for producing the shell part containing the stiffening part that can be seen from outside can thus performed in an eased and more reliable way. The reason is that the exterior surface of the stiffening part at least partially bears against the injection mold during the injection molding process, with the result that it is allowed for the stiffening part to be fixed safely in the injection mold together with the spacers at the interior surface. In this connection of special advantage is also the embodiment, at which essentially the entire exterior surface of the at least one stiffening part is well visible or well accessible from the outside of the shell part, because in this case, the stiffening part needs only to be injection-overmolded or back-molded only at one side, namely only at the interior side. Furthermore, a visible exterior surface of the stiffening part which can be seen at the exterior surface of the shell part increases the resistance or robustness of the exterior surface in the region of the stiffening part against mechanical affects. Additionally, the visible exterior surface gives the shell part and consequently the entire shell a very special appearance, with the result that a unique and unmistakable sports shoe is created and laying basis for the economic success.

[0019] Of advantage are furthermore the measures according to claim 10, because a sports shoe, depending on the case of usage, particularly in at least one of the mentioned areas needs an increased stability and this increase of stability can easily be achieved by the arrangement of one or more stiffening elements in these areas.

[0020] Very advantageous is furthermore an embodiment according to claim 11, because in many cases of application it is required for the shell of a sports shoe to have an increased stability in the lateral region from the area of the heel and the Achilles’ tendon in the direction towards the toe area to the inner and outer area of the ankle, with the result that a most direct possible power transmission from the foot or lower leg of the user of the sports shoe to the sports shoe is provided. This is particularly applicable for forward and backward movements as well as lateral movements of the user’s lower leg. A sole, which is stable in the region described, thus allows an exact guiding of the sports shoe or a piece of sports equipment connected thereto, for example a gliding board or a roller device during a movement.

[0021] Of particular advantage is also an embodiment according to claim 12, because the described, one-piece stiffening part causes a dimensional stiffened shell formation in the inner and outer ankle area and in the area of the heel or the Achilles’ tendon and similarly provides a relatively flexible formation of the shell in the inner and outer tarsus area, because the relatively flexible plastics forming the shell part there, is not covered by the stiffening part. Examinations show that when the foot is moved, particularly if the lower leg
is moved forward or is tilted back with respect to the foot, a lateral expansion of the foot in the area inner and outer tarsus is caused. For example with respect to the wear comfort it is thus advantageous if the shell of the sports shoe provides a relatively high flexibility in the area of the inner and outer tarsus. In order to not cause a too strong reduction of stability of the shell of the sports shoe due to recesses in the region of the inner and outer tarsus, it is furthermore of advantage if the edge section of the one-piece stiffening part underneath the areas of inner and outer tarsus extends diagonally downwards or diagonally in the direction towards the middle sole region and towards the toe area.

[0022] Advantageous is also an embodiment according to claim 13, because thus, a cuff for a sports shoe can be produced, which has a very stable back region and rear lateral region, and similarly, the remaining section of the cuff not being covered by the stiffening part is formed relatively flexible. As a result, the wear comfort of the sports shoe is increased without its characteristics with respect to stability or moving are negatively affected or the characteristics with respect to stability and moving are even improved.

[0023] The secondly mentioned objective of the invention is achieved by a method according to claim 14.

[0024] With respect to the measures according to claim 14 it is of advantages that the shell of a sports shoe is produced, the components of the shell parts of which have different, certain stability or elasticity and that consequently these characteristics can be adjusted exactly to the needs of the user corresponding to the intended purpose of the sports shoe. Furthermore, the usage of the one or more spacers protruding from the interior surface of a stiffening part is of advantage, because thus the at least one stiffening part can easily be positioned on a last in such a way that the outer end sections or bearing surfaces of the spacers, furthest from the interior surface of the stiffening part, bear against the surface of the last resulting in a clearance between the interior surface of the stiffening part and the surface of the last being created. The injection-back-molding of the at least one stiffening part with the result that the clearance between the interior surface of the stiffening part and the surface of the last is filled with relatively flexible plastic material is thus allowed in an easy and reliable way, because the spacers hold the stiffening part in position and e.g. a bearing of the interior surface of the stiffening part against the surface of the last is avoided. Such a bearing of the interior surface of the stiffening part against the surface of the last would have a negative effect on the injection-back-molding process, because it would particularly not be possible to apply sufficient flexible plastic material to the interior surface of the stiffening part.

[0025] It is furthermore of particular advantage that the end sections or bearing surfaces of the spacers bearing against surface of the last are not covered by the relatively flexible plastics and can consequently be seen and accessed at the interior surface of the shell part. Thus, a simple and reliable possibility to control the production quality is allowed, because the visible and accessible end sections or bearing surfaces of the spacers allow that the correct position of the stiffening part in or at the shell part of the sports shoe is controlled. It is in particular easy to check the correct position of the end sections or the bearing surfaces of the spacers and consequently the stiffening part and the end sections or bearing surfaces extending flush with the homogenous or constant interior surface of the shell of the sports shoe, which is very important.

[0026] To provide a clearer understanding of the invention, it will be explained in more detail below with references to examples illustrated in the appended drawings.

[0027] The drawings provide highly simplified, schematic illustrations as follows.

[0028] FIG. 1 the front foot shell of a ski boot having a stiffening part in the area of the heel and the ankle;

[0029] FIG. 2 an oblique view of a stiffening part for the area of the heel and ankle as it used with the front foot shell according to FIG. 1;

[0030] FIG. 3 a lateral view of the stiffening part of FIG. 2 for the area of the heel and ankle;

[0031] FIG. 4 a longitudinal section of the ski boot comprising the two shell parts front foot shell and cuff being connected in an articulated way, with the front foot shell separately shown in FIG. 1 having a stiffening part in the area of the heel and ankle and a stiffening part in the region of the sole and the cuff having a stiffening part in the back region and in the rear lateral regions;

[0032] FIG. 5 a cross-sectional view in the ankle area of the front foot shell of the ski boot of FIG. 4;

[0033] FIG. 6 an oblique view of the cuff of FIG. 4 having a stiffening part in the back region and in the rear lateral regions.

[0034] Firstly, it should be pointed out that the same parts described in the different embodiments are denoted by the same reference numbers and the same component names and the disclosures made throughout the description can be transposed in terms of meaning to same parts bearing the same reference numbers or same component names. Furthermore, the positions chosen for the purposes of the description, such as top, bottom, side, etc. relate to the drawing specifically being described and can be transposed in terms of meaning to a new position when another position is being described.

[0035] All value range specifications in the objective description should be taken as arbitrary ranges which encompass all subareas lying within these ranges, e.g. the specification 1 to 10 should be understood to encompass the full range starting from the bottom limit 1 and rising to the top limit 10, i.e. all subareas start with a bottom limit of 1 or more and with a top limit of 10 or less, e.g. 1 to 1.7, or 3.2 to 8.1, or 5.3 to 10.

[0036] As an exemplary embodiment of a shell 1 of a sports shoe, FIG. 1 shows a front foot shell 2 of a ski boot with a stiffening part 3 being integrated into the front foot shell 2. A ski boot of this kind typically comprises, as known per se, an inner shoe inserted into the shell 1, at least one tensioning or lashing mean or other components, which have not been shown for increase of clarity.

[0037] The FIGS. 2 and 3 show an oblique view and a lateral view of the stiffening part 3 of the front foot shell 2.

[0038] According to the shown exemplary embodiment, the stiffening part 3 is disposed in the heel area 10, area of Achilles’s tendon 11 and in the inner 12 and outer ankle area 13 of a front foot shell 2 of a ski boot. The section 6 of the front foot shell 2 not being covered by the stiffening part 3 is formed from a plastic material which is relatively flexible compared to the stiffening part 3. During the manufacturing of the front foot shell 2, in particular by means of an injection molding process, the stiffening part 3 is injection-back-molded with the relatively flexible plastic material, with the result that the interior surface 4 of the stiffening part 3 is at least in partially but preferably in large part covered by the relatively flexible plastic material.
In the shown exemplary embodiment, the exterior surface 14 of the stiffening part 3 is not covered by the relatively flexible plastic material. This is particularly functional, because amongst other things the injection molding process for producing the front foot shell 2, containing the stiffening part 3 is made easier and more reliable in terms of being successfully performed, because it is only required for the stiffening part 3 to be injection-back-molded or injection-overmolded on one side, namely the interior surface 4. During the injection molding process, the exterior surface 14 of at least partially bears against the injection mold, with the result that a safe fixation of the stiffening part 3 within the injection mold is provided. An exterior surface 14 visible at the outside of the front foot shell 2 furthermore increases the resistance or the robustness of the exterior surface in the region of the stiffening part 3 with respect to mechanical effects. Furthermore, the visible exterior surface 14 gives a very specific appearance to the front foot shell 2 and consequently to the entire shell, with the result that a unique and distinctive ski boot is created. As it can be taken from FIG. 4, it is generally also possible for the exterior surface 46 of a stiffening part 3 to be covered by a relatively flexible plastic material.

In order to allow the already produced stiffening part 3 to be easily, exactly and safely positioned on a last, which at least partially defines the interior of the front foot shell 2, the stiffening part 3 is equipped with several spacers 5 protruding from its interior surface 4, the end sections 7 or bearing surfaces 8 of which rest against the surface of the not shown last in the course of the manufacturing process. Thus, a clearance between the interior surface 4 of the stiffening part and the surface of the last is formed, which is filled with relatively flexible plastic material during the injection molding process. Once the injection molding process is completed, the entire surface 4 or the major part of the interior surface 4 of the stiffening part and the surface of the spacers 5, except from their bearing surfaces 8, are consequently covered by the relatively flexible plastic material. Due to the fact that these bearing surfaces 8 extend flush with the interior surface 9 of the plastic material disposed at the interior surface 4 of the stiffening part 3, the front foot shell 2 has a homogenous and constantly extending interior surface 9. In an alternative embodiment, the sections of the bearing surface 8 of the spacers 5 can be covered by the relatively flexible plastic material i.e. partially embedded into the relatively flexible plastic material.

With the exemplary embodiment shown, showing the foot shell 2 of a ski boot, preferably at least one piece of the stiffening part 3 is positioned in the heel area 10, area of Achilles’ tendon 11, and in the inner 12 and outer ankle area 13, with the result that particularly a good transmission of power and an exact transmission of motion of the user’s foot or the lower leg of a ski boot via the rear extension of sole 15 of the front foot shell 2 and via a binding in particular to a ski is present. Furthermore, the stiffening part 3 provides rear section of the front foot shell 2 with sufficient stability. Additionally, the stiffening part 3 is formed in such a way, that the apertures 17 in the inner 12 and outer ankle area 13 of the front foot shell 2, serving for the articulated connection of the front foot shell 2 and a cuff 18—FIG. 4—of the ski boot, are embodied within the area of the front foot shell 2 covered by the stiffening part 3, with the result that the apertures 17, as it is best to be seen in FIGS. 2 and 3, are also embodied in the stiffening part 3 in the inner 12 and outer ankle area 13.

According to the particularly advantageous embodiment in FIG. 1, the one-piece stiffening part 3 of the front foot shell 2 covers the lateral areas of the front foot shell 2 starting from the heel area 10 and the area of Achilles’ tendon to the inner 12 and outer ankle area 13. It is functional if the stiffening part 3 also covers the inner 19 and outer areas of ankle joint 20 of the front foot shell 2, with the result that an increased stability is given in these areas. In order to achieve that the front foot shell 2 at least partially allows a lateral expansion of the inner and outer tarsus of the foot of the user of the ski boot, which tarsus expands to both sides when the foot is moving, in particular when the lower leg is being moved or tilted forward with respect to the foot, in the inner 27 and outer tarsus area 28 of the front foot shell 2, a recess 29 is designed in the stiffening part 3. This recess 29 is achieved by a curved returning of the edge section 26—FIGS. 2 and 3 of the stiffening part 3 underneath the two ankle areas 12, 13 in direction heel area 10. The section of the front foot shell 2 in the region of the recess 29 of the stiffening part is thus formed from the plastics material being relatively flexible compared to the stiffening part 3, resulting in an increased flexibility of the front foot shell 2 in this region. In order to nevertheless achieve a sufficient increase of stability by the stiffening part 3 it is functional that the edge section 26 of the stiffening part 3 underneath the inner 27 and outer tarsus area 28 and thus underneath the recess 29 extends diagonally downwards or forward in the direction towards the middle section of the sole area 21 and the toe area 23 of the front foot shell 2.

According to a particular advantageous embodiment, the at least one stiffening part 3 of the front foot shell 2 is formed from a plastic material with a plurality of independent fibers 32 in a randomized arrangement—FIG. 2—in particular carbon fibers. Advantageously, this fiber reinforced, high-tensile plastics has a modulus of elasticity of up to 12 GPa, preferably a modulus of elasticity of 0.9 GPa to 1.5 GPa, so that the front foot shell 2 in its rear region is correspondingly dimensionally stiffened by the stiffening part 3.

Due to the fact that the numerous fibers 32 independently from each other are added to the plastic material of the stiffening part 3 in a randomized arrangement, it is according to an advantageous embodiment possible for the stiffening part 3 to be also produced by means of an injection molding process, where the fibers 32 are added to a plastic material before the front foot shell 2 is actually produced, in particular on the basis of injection molding. In order to allow for the numerous, independent fibers 32 to be added to the plastic material during the manufacturing process, in particular the injection molding of the stiffening part 3, in a randomized arrangement on the one hand, and effect for the produced stiffening part 3 to have a highest possible stability it is advantageous if the fibers 32 have an average length of 2 mm to 7 mm.

It is also advantageous if the section 6 not covered by the at least one stiffening part 3 is formed from a plastic material being relatively flexible compared to the stiffening part 3 and having a modulus of elasticity of 0.1 GPa to 0.8 GPa, preferably having a modulus of elasticity of 0.1 GPa to 0.4 GPa. Thus, a relatively flexible formation of the front foot shell 2 is achieved in the section 6 of the front foot shell 2 not covered by the stiffening part 2. Due to the usage of materials providing different properties, in particular different surface properties, it is furthermore possible to design components of shell parts, in particular stiffening parts 3, and components,
not covered by stiffening parts 3, of the front foot shell 2 having distinctive haptics. As a material for the relatively flexible plastic material in particular thermoplastic polyurethane (TPU) is used, which can also be used as a basic material for the production of the fiber-reinforced stiffening part 3.

[0040] According to an advantageous embodiment, the at least one stiffening part 3 of the front foot shell 2 has a thickness of 2 mm to 3 mm, preferably 2.5 mm. Such a relatively thin stiffening part 3, which is injection-back-molded with only a relatively thin layer of flexible plastic material in the further course of the production process, allows the production of a front foot shell 2, the shell thickness of which is reduced compared to the front foot shells known from prior art, with the result that a front foot shell 2 having a relatively lower weight can be produced at consistent or even increased stability.

[0047] The front foot shell 2 in the section covered by the at least one stiffening part 3 preferably has an average thickness of 3 mm to 7 mm, preferably of averagely 4 mm to 5 mm. As already mentioned, the wall thickness of the front foot shell 2 reduced compared to the prior art allows the production of a shell 1 of a ski boot, which has a reduced weight at constantly high stability values. With an alternative, advantageous embodiment, the wall thickness of the front foot shell 2 compared to prior art is not reduced, but the stability of the plastic material being relatively flexible compared to the stiffening part 3 is chosen lower than usual, with the result that the shell 1 of the ski boot at constant stability values in the section covered by the at least one stiffening part 3 has an increased flexibility in the section not covered by the stiffening part 3.

[0048] According to a particularly advantageous embodiment, which is best to be seen in FIGS. 2 and 3, the at least one stiffening part 3 has in its edge section 26 a connection element 33, with the result that a particular durable or stable connection between the stiffening part 3 and the thereto adjacent, relatively flexible plastic material is created. An additional improvement of the connection properties is achieved by embodying one or more apertures 34 between the inner and the exterior surface of the connection element 33, which apertures 34 are filled with relatively flexible plastic material during the production process of the front foot shell 2.

[0049] A still further increasing, if the durability or resistance of the connection between the at least one stiffening part 3 and the thereto adjacent, relatively flexible plastic material of the front foot shell 2 is achieved by the embodiment of at least one transverse element 35 in the edge section of the connection element 33.

[0050] From the FIGS. 4 and 5, illustrations of a longitudinal section and a cross-section of the shell 1 of the ski boot can be taken. In FIG. 4, also a cuff 18 of a ski boot is shown in longitudinal section, which is furthermore shown in a separate oblique view in FIG. 6. Further embodiments of stiffening parts 25, 43 can be taken from FIGS. 4 to 6, to which the basic explanations of the description of the stiffening part 3 above are applied analogously.

[0051] According to one of the advantageous embodiments shown in FIGS. 4 and 5, a stiffening part 43 is formed in the sole area 21 of the front foot shell 2 of the ski boot from the heel area 10 to the toe area 23. Spacers 44 at the interior surface 45 of the stiffening part 43 are made for the simple and exact positioning of the front foot shell 2. Different from the stiffening part 3, not only the interior surface 45 but also the exterior surface 46 of the stiffening part 43 is covered by the relatively flexible plastic material during this injection molding process. The stiffening part 43, which can be rigidly connected to the stiffening 3 in the heel area 10, can amongst other things be used to influence the bending properties of the front foot shell 2 along its longitudinal axis and to increase the stability and dimensional stability of the front foot shell 2. By means of the stiffening part 43, in particular the forces appearing in the front foot shell 2 of the ski boot shall be transmitted to a ski via the rear extension of sole 15 and a front extension of sole 16, particularly via a binding, in the most direct and targeted way possible.

[0052] According to an embodiment not shown it is also advantageous to dispose one or more further stiffening elements in the metatarsus area 22 and/or in the lateral or upper section of the toe area 23 of the front foot shell 2 in order to increase the stability of the front foot shell 2.

[0053] FIGS. 4 and 6 show a further, advantageous embodiment of a shell 1 according to the invention of a ski boot, where a stiffening part 25 is integrated into the cuff 18 of the ski boot, which stiffening part provides the shell 1 in the lower area of the lower leg 24 with an increased stability. The stiffening part 25 particularly increases the dimensional stability of the cuff 18 in its rear region and partially also in its rear lateral regions due to the special design of the stiffening part 25, as it is best to be seen in FIG. 6. The section 36 of the cuff 18 not covered by the stiffening part 25 is formed from a plastic material being relatively flexible compared to the stiffening part 25, with the result that the wear comfort of the ski boot is increased. Due to this fact, particularly relatively flexible flaps 42 can be formed at the cuff 18, which in connection with a not shown tensioning mean allow a simple closing free of clearance of the cuff around the lower leg of a user.

[0054] Furthermore, the stiffening part 25 reinforces both sides of the cuff 18 in the regions corresponding to the apertures 17 of the front foot shell 2, where also apertures 41 are embodied. The front foot shell 2 and the cuff 18 are connected in a flexible way via the connection elements in the apertures 17 and 41.

[0055] As indicated in FIG. 6, the stiffening part 25 is in the edge section 30 where the relatively flexible plastic material follows equipped with a connection element 31, with the result that a stable and durable connection between the stiffening part 25 and the relatively flexible plastic material of the section 36 of the cuff 18 not covered by the stiffening part 25 is provided. During the manufacturing of the cuff 18, particularly during an injection molding process, the exterior surfaces of the connection element 31 are covered by the relatively flexible plastic material. In order to achieve a particularly stable connection, the connection element 31 is furthermore equipped with apertures 40, which are filled with the relatively flexible plastic material during the injection molding process.

[0056] As FIGS. 4 and 6 show, the stiffening part 25 is at its interior surface equipped with a plurality of spacers 37, which are used for simply and exactly positioning stiffening part 25 on the last. Before the manufacturing of the cuff 18, the stiffening part 25 is positioned on a last in such a way that the end sections 38 of the bearing surfaces 39 of the spacers 37 rest against the last and a cavity results between the interior surface of the stiffening part 25 and the surface of the last. In the following injection molding process, this cavity is filled with the relatively flexible plastic material and also the section 36 of the cuff 18 not being covered by the stiffening part 25 is formed from the relatively flexible plastic material.
Once the injection molding process is completed, the end sections 38 or the bearing surfaces 39 of the spacers 37 are arranged flush with the interior surface of the cuff 18.

[0057] Particularly advantageous is also the combination of the stiffening parts 3, 25, 43 in a shell 1 of a sports shoe 1, in particular a ski boot, shown in FIG. 4. Due to the arrangement of the stiffening parts 3, 25, 43, a high stability of the shell 1 is provided in its rear and rear lateral section of the lower area of the lower leg 24, in the area of Achilles’ tendon, heel area 10, ankle area 12, 13 and area of ankle joint 19, 20 and in the sole area 21 to the toe area 23. All remaining regions of the shell 1 are formed from a relatively flexible plastic material, with the result that a sports shoe is created, which is convenient and comfortable to wear on the one hand and allows a quick and sporty moving or going on the other hand.

[0058] For the sake of good order, finally, it should be pointed out that in order to provide a clearer understanding of the device for converting energy, it and its constituent parts are illustrated to a certain extent out of scale and/or on an enlarged scale and/or on a reduced scale.

[0059] The embodiments illustrated as examples illustrate possible design variants of the shell of a sports shoe, and it should be pointed out at this stage that the invention is not restricted to the various embodiments specifically illustrated and instead, various combinations of the individual embodiments with one another are possible, these possible variations being within the reach of the person skilled in this field based on the technical teaching outlined in the invention. Accordingly, all conceivable variations which can be obtained by combining individual details of the embodiments illustrated and described are possible and fall within the scope of the invention.

[0060] The underlying objective and the solutions proposed by the invention may be found in the description.

[0061] Above all, the individual embodiments of the subject matter illustrated in FIGS. 1 to 3, 4 to 6 may be construed as independent solutions proposed by the invention in their own right. The objectives and associated solutions proposed by the invention may be found in the detailed descriptions of these drawings.

LIST OF REFERENCE NUMERALS

[0062] 1 Shell
[0063] 2 Front foot shell
[0064] 3 Stiffening part
[0065] 4 Interior surface
[0066] 5 Spacer
[0067] 6 Not covered section
[0068] 7 End portion
[0069] 8 Bearing surface
[0070] 9 Interior surface
[0071] 10 Heel area
[0072] 11 Area of Achilles’ tendon
[0073] 12 Inner ankle area
[0074] 13 Outer ankle area
[0075] 14 Exterior surface
[0076] 15 Rear extension of sole
[0077] 16 Front extension of sole
[0078] 17 Aperture
[0079] 18 Cuff
[0080] 19 Inner area of ankle joint
[0081] 20 Outer area of ankle joint
[0082] 21 Sole area
[0083] 22 Metatarsus area
[0084] 23 Toe area
[0085] 24 Lower area of lower leg
[0086] 25 Stiffening part
[0087] 26 Edge section
[0088] 27 Inner tarsus area
[0089] 28 Outer tarsus area
[0090] 29 Recess
[0091] 30 Edge section
[0092] 31 Connection element
[0093] 32 Fiber
[0094] 33 Connection element
[0095] 34 Aperture
[0096] 35 Transverse element
[0097] 36 Not covered section
[0098] 37 Spacer
[0099] 38 End section
[0100] 39 Bearing surface
[0101] 40 Aperture
[0102] 41 Aperture
[0103] 42 Flap
[0104] 43 Stiffening part
[0105] 44 Spacer
[0106] 45 Interior surface
[0107] 46 Exterior surface

1. A shell of a sports shoe comprising: one or more three-dimensional shell parts having a certain stability, at least one of the shell parts comprises a stiffening part having a higher stability than the other shell parts including an interior surface and a plurality of spacers protruding from the interior surface and the interior surface is at least partially covered by relatively flexible plastic material, the spacers having outermost end portions extending furthest away from the interior surface arranged substantially flush with the relatively flexible plastic material, but the outermost end portions of the spacers not being covered by the relatively flexible plastic material, such that the outermost end portions of the spacers can be seen at the interior surface of the shell part.

2. The shell of a sports shoe according to claim 1, wherein the stiffening part of a shell part is formed from a plastic material with a plurality of independent carbon fibers, added in a randomized arrangement, which material has a modulus of elasticity of up to 12 GPa.

3. The shell of a sports shoe according to claim 2, wherein the carbon fibers have an average fiber length of 2 mm to 7 mm.

4. The shell of a sports shoe according to claim 1, wherein the stiffening part is arranged to cover a section of the shell, and another section of the shell is formed from a plastic material being relatively flexibly compared to the stiffening part and having a modulus of elasticity of 0.1 GPa to 0.8 GPa.

5. The shell of a sports shoe according to claim 1, wherein the stiffening part has a thickness of 2 mm to 3 mm.

6. The shell of a sports shoe according to claim 1, wherein the stiffening part is arranged to cover a section of the shell having an average thickness of 3 mm to 7 mm.

7. The shell of a sports shoe according to claim 1, wherein the stiffening part includes an edge section and at least one connection element arranged at the edge section, the at least one connection element includes exterior surfaces surrounded by relatively flexible plastic material compared to the stiffening part.

8. The shell of a sports shoe according to claim 7, wherein the connection element in the edge section of the stiffening part is arranged to cover a section of the shell.
part has apertures between interior and exterior surface in the edge section, which are filled with the relatively flexible plastic material.

9. The shell of a sports shoe according to claim 1, wherein the stiffening part includes an exterior surface, and more than 70% of the exterior surface can be seen from the exterior surface of the shell and is not covered by the relatively flexible plastic material.

10. The shell of a sports shoe according to claim 1, wherein the sports shoe comprises a heel area, an ankle area, an ankle joint area, a sole area, a metatarsus area, a toe area, and a lower leg area, the stiffening part comprises a plurality of stiffening parts and are arranged to at least partially cover the heel area, the ankle area, the ankle joint area, the sole area, the metatarsus area, the toe area and/or the lower area of the lower leg of the sports shoe.

11. The shell of a sports shoe according to claim 1, wherein the shell comprises a rear and lateral region, the stiffening part is arranged to stabilize the rear and lateral regions.

12. The shell of a sports shoe according to claim 11, wherein the stiffening part essentially covers the inner and outer ankle area and that the edge section of the stiffening part underneath the two ankle areas returns in direction of the heel area in a curved way, so that the inner and outer tarsus areas of the stiffening part remain recessed or not covered and thus, the sections of the shell part there are only formed from the plastic material being relatively flexible compared to the stiffening part and that the edge sections of the stiffening part underneath the inner and outer tarsus areas extends diagonally downwards or forwards in the direction towards the middle section of the sole area and towards the toe area of the shell part.

13. The shell of a sports shoe according to claim 1, wherein the stiffening part at least partially covers the rear side and the rear lateral regions of the lower area of the lower leg, with the result that at least in the rear region and in the rear lateral regions of the shell part, a dimensionally stiffened shell formation is provided.

14. A method for producing a shell of a sports shoe, in particular a ski boot, with the shell being formed from one or more shell parts and at least one shell part being formed from compositing several three-dimensional components, which are each made of a plastic material or metal having a certain stability or elasticity and two of each of the shell parts are connected in an articulated or rigid way in order to form the shell of the sports shoe, characterized in producing at least one stiffening part, which forms a three-dimensional component of a shell part, which stiffening part has a higher stability than the other components of the shell parts and which stiffening part has one or more spacers protruding from the interior surface of the stiffening part, positioning of the at least one stiffening part on a last defining at least a part of the interior of the shell part in such a way that the outermost end portions of the spacers which are furthest away from the interior surface of the stiffening part rest against the surface of the last and thus, a clearance between the interior surface of the stiffening element and the surface of the last is created, injection-overmolding of a region or section of the surface of the last not covered by the at least one stiffening part with a plastic material being relatively flexible compared to the stiffening part and injection-back-molding of the at least one stiffening part with the plastic material being relatively flexible compared to the stiffening part, with the result that the clearance between the interior surface of the stiffening part and the surface of the last are filled by the relatively flexible plastic material and with the end portions of the spacers bearing against the surface of the last not being covered by the relatively flexible plastic material.

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