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(54) **Floor ball stick**

(57) A floor ball stick (1) comprising a shaft (3) and a blade (2). The blade (2) comprises a frame (4) that at least partially enclosing at least one rib (5). Said shaft (3) and said blade (2) are manufactured to form an inseparable component. Furthermore, a method for producing such a floor ball stick (1) is provided. In addition, there is provided a blade (2) for a floor ball stick (1) comprising a frame (4) at least partially enclosing at least one rib (5) and wherein at least a portion of said frame (4) of said blade (2) is hollow (13).

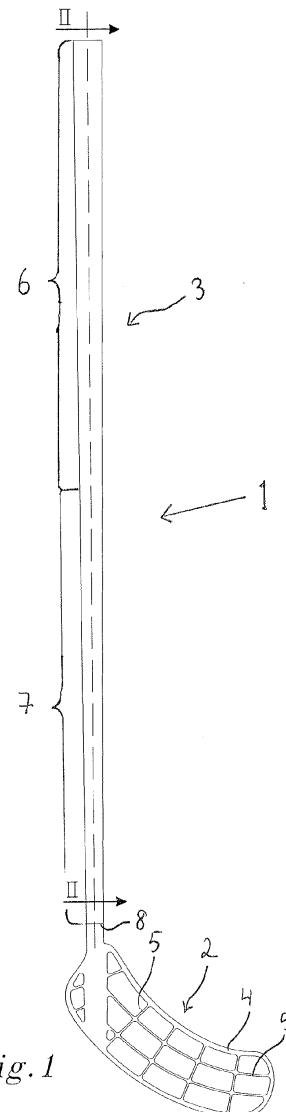


Fig. 1

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Description

TECHNICAL FIELD

[0001] The present invention relates to a floor ball stick comprising a shaft and a blade. The present invention also relates to a method for producing a floor ball stick. Furthermore, disclosure also relates to a blade for a floor ball stick.

BACKGROUND

[0002] In floor ball, a stick is used when playing. The stick normally comprises a shaft of a hollow tube structure and a blade attached at, or close to, one end of the shaft and a ball is propelled by the blade when using the stick. The blade is detachable mounted to the shaft at, or close to, the end of the shaft that is intended to be closest to the ground or floor when using the stick. It is of importance to keep the weight down without sacrificing the mechanical properties of the floor ball stick, which mechanical properties may include strength and rigidity/flexibility. The sticks are therefore typically made of plastics and composite materials.

[0003] A known floor ball stick of the above-mentioned type is disclosed in US 2009/0264229, which comprises a shaft of an elongated hollow tube and a blade. The blade is detachable mounted on the shaft, wherein the lower end of the shaft is inserted into a hole of a cylindrical pipe attachment means of the blade. The blade may also be attached by means of a screw or similar.

[0004] WO 02/34341 A1 discloses a floor ball stick, which comprises a shaft being detachable mounted by the use of screw and a locking device to lock the blade and the shaft securely. The floor ball stick also provides a way of providing a floor ball stick, wherein an angle between the blade and the shaft may be adjusted to fit the player using the stick. However, the floor ball stick requires a number of components for its assembly.

[0005] Although the prior art floor ball sticks to some extent may alleviate the problems of floor ball sticks relating to keeping the weight down without sacrificing any properties such as mechanical properties of the floor ball stick, there is still a great need for further improvements of the floor ball sticks, so as to be comfortable and safe to use, and to provide strength and rigidity/flexibility to the floor ball stick while keeping the weight down.

SUMMARY

[0006] In view of known floor ball sticks there is an object to provide an improved and/or alternative floor ball stick with low weight while providing strength and desired rigidity/flexibility.

[0007] The object is wholly or partially achieved by a floor ball stick according to appended claim 1, a method according to claim 7 and a blade according to claim 12. Embodiments are set forth in the appended dependent

claims, in the following description and in the drawings.

[0008] According to a first aspect, there is provided a floor ball stick comprising a shaft and a blade, said blade comprising a frame at least partially enclosing at least one rib. Said shaft and said blade are manufactured to form an inseparable component.

[0009] By such a floor ball stick there is provided a way of secure attachment of the blade to the shaft while keeping the weight down and without sacrificing any mechanical properties of the floor ball stick such as strength and rigidity/flexibility. As the aspect relates to a floor ball stick it should be born in mind that such a stick should be short and having low weight as compared to an ice hockey stick, for example. The shaft should have some flexibility that is preferably selected for the player using the stick. The frame and rib arrangement of the blade provides low weight and appropriate aerodynamics to the floor ball stick. The blade may be curved to fit either a right-hand or left-hand player. Furthermore, the blade may be of soft to hard material depending on the type of player using the stick. It also possible to adjust any angle between the blade and the shaft during fabrication of the floor ball sticks. In conclusion, there is provided a floor ball stick that is comfortable and safe to use for a player.

[0010] According to an embodiment, said shaft and said blade may be made of the same group of materials. Preferably said shaft and said blade are made of the same material.

[0011] By such an arrangement of materials there is provided floor ball stick with appropriate mechanical properties and weight, and which stick that is easy to produce.

[0012] According to an embodiment, said shaft and/or said blade may be made of a composite material, said composite material preferably comprising reinforcing fibres, such as carbon, glass and/or Kevlar® (poly para-phenylene terephthalamide), embedded in a resin.

[0013] The resin may be a thermosetting material such as epoxy, polyester, vinyl, phenolic, and polyimide.

[0014] The use of a composite material provides a floor ball stick with the appropriate mechanical properties such as strength, while keeping the weight down.

[0015] According to an embodiment, at least a portion of said frame of said blade may be hollow.

[0016] This provides a low weight blade that has appropriate mechanical properties such as flexibility and strength, in particular when a composite material as mentioned above is forming the blade.

[0017] According to an embodiment, said blade may comprise a plurality of ribs at least partially enclosed by said frame, a connection area between a first and a second rib of said plurality of ribs comprising a connection radius, said connection radius being equal to or greater than 3 mm, preferably equal to or greater than 5 mm.

[0018] The arrangement provides appropriate mechanical properties and aerodynamics to the blade, while keeping the weight down.

[0019] According to an embodiment, at least a portion

of at least one rib of said plurality of ribs may be lined with a shock absorbing material, said shock absorbing material being different from the material of said rib. Said shock absorbing material may preferably comprise an elastomer such as rubber, silicon, thermoplastic elastomer (TPE), or the like.

[0020] The shock absorbing material provides the possibility of adjusting the softness of blade portions that are to be in contact with a floor ball. A soft blade material provides a good ball control while a harder material provides help to increase the power behind a shot. According to a second aspect, there is provided a method for producing a floor ball stick comprising a shaft and a blade, said blade comprising a frame at least partially enclosing at last one rib. The method comprises:

- placing a formable material into a blade mould cavity;
- curing said formable material in said blade mould cavity in order to obtain a cured blade;
- connecting a cured shaft to at least a portion of said cured blade;
- applying attachment material for attaching together said cured shaft and said cured blade, and
- curing said attachment material in order to obtain a floor ball stick.

[0021] The method provides a way for producing a floor ball stick as an inseparable component and the advantages thereof as discussed above. More than one formable material may be used. For example, a first formable material may be used for providing the frame and a second formable material for providing the rib (-s). All parts may be made of similar or the same formable materials, such as composite materials described herein. The curing may be thermal curing.

[0022] According to one embodiment, said blade mould cavity may comprise a frame portion cavity and a rib portion cavity, said method further comprises:

- providing an expandable element in said frame portion cavity before curing said formable material, and
- providing that said expandable element is expanded when curing said formable material such that an at least partially hollow frame is obtained.

[0023] According to an embodiment, said expandable element may comprise an inflatable element and said step providing that said expandable element is expanded comprises a step of inflating said inflatable element.

[0024] This provides a way of providing the blade with a hollow frame portion and the advantages thereof.

[0025] According to an embodiment, said attachment material may be the same material as the formable material and/or a material comprising carbon fibres.

[0026] The use of such material provides a floor ball stick with the appropriate mechanical properties such as strength, while keeping the weight down. The material is also compatible with the materials of the shaft and the

blade.

[0027] According to an embodiment, said method may further comprise:

- 5 applying a material layer, preferably shrink tape and/or a pre-peg layer, around the connection between said shaft and said blade before curing said attachment material.

10 **[0028]** The applying of such a material layer provides additional strength and/or appearance to the floor ball stick and the attachment of the blade to the shaft. The shrink tape may be a layer of oriented polypropylene. The material layer may form a part of the attachment material as such. In particular, the use of attachment material layer comprising carbon fibres around the connection between said shaft and said blade before curing said attachment in combination with a shrink tape of oriented polypropylene material may form an alternative attachment material.

15 **[0029]** A pre-peg layer may then be understood as a layer of pre-impregnated composite fibres, such as fibres of carbon, glass and/or Kevlar® (poly paraphenylene terephthalamide), provided with a matrix component, such as the resin.

20 **[0030]** According to a third aspect, there is provided a blade for a floor ball stick, comprising a frame at least partially enclosing at least one rib. At least a portion of said frame of said blade is hollow.

30 **[0031]** According to an embodiment, said blade may be made of one or more composite materials. Each composite material preferably may comprise reinforcing fibres, such as carbon, glass and/or Kevlar® (poly paraphenylene terephthalamide), embedded in a resin.

35 **[0032]** According to an embodiment, said blade may comprise a plurality of ribs at least partially enclosed by said frame and a connection area between a first and a second rib of said plurality of ribs comprising a connection radius. The connection radius may be equal to or greater than 3 mm, preferably equal to or greater than 5 mm.

40 **[0033]** According to an embodiment of said blade, at least a portion of at least one rib of said plurality of ribs is lined with a shock absorbing material, said shock absorbing material being different from the material of said rib, said shock absorbing material preferably comprising an elastomer such as rubber, silicon, TPE, or the like.

45 **[0034]** The invention will now be described in more detail with reference to embodiments and figures.

50 BRIEF DESCRIPTION OF THE DRAWINGS

[0035]

55 Figure 1 schematically illustrates a floor ball stick. Figure 2 is a schematic longitudinal cross-sectional view through a shaft of the floor ball stick in figure 1, taken along the line II-II.

Figure 3 schematically illustrates blade for a floor

ball stick.

Figure 4 is a transversal cross-sectional view through the blade in figure 3, taken along the line IV-IV.

Figures 5a-c illustrate possible ways of connecting a shaft to a blade.

Figure 6 shows a blade and an attachment of the blade to an end of a shaft of a floor ball stick.

Figure 7 shows a mould for a shaft of a floor ball stick, the mould being its open state with two mould halves.

Figure 8 shows a mould for a blade of a floor ball stick, the mould being its closed state

DETAILED DESCRIPTION OF EMBODIMENTS

[0036] The present disclosure relates to a floor ball stick 1 as illustrated in figure 1. In the following, embodiments of such floor ball stick 1, parts thereof and a method for producing the floor ball stick 1 will be further illustrated. The present disclosure also relates to an aspect of the invention relating to a blade 2 for a floor ball stick 1.

[0037] Figure 1 shows a floor ball stick 1 according to one embodiment of the present invention. The floor ball stick 1 comprises a blade 2 and a shaft 3, wherein the blade 2 comprises a frame 4 enclosing a number of ribs 5. The shaft 3 has in its longitudinal direction two regions, an upper region 6 and a lower region 7. The lower region 7 is intended to be closest to the ground or floor when using the stick 1, while a person using the stick 1 usually has his/her grip in the upper region 6. A blade 2 is attached to the shaft 3 in the lower region 7 close to a lower end 8 of the shaft 3. The shaft 3 and said blade 2 may as will be described herein below be manufactured to form an inseparable component.

[0038] In figure 2, a longitudinal cross-section taken along the line II-II of the shaft 3 of the floor ball stick 1 in figure 1 is illustrated. The illustrated shaft 3 comprises a hollow tube with a transversal cross-section that is circular. The skilled person will appreciate that the shaft 3 may have any other form, such as a hollow tube comprising a transversal cross-section that is oval, that is suitable for a floor ball stick 1.

[0039] The shaft 3 may be made of a composite material. The composite material may, for example, comprise reinforcing fibres, such as carbon, Kevlar® (poly paraphenylene terephthalamide) and/or glass, embedded in a resin as, for example, exemplified herein below.

[0040] In figures 3 and 4, an embodiment of a blade 2 for use with the floor ball stick 1 of figure 1 is illustrated. Figure 3 schematically illustrates blade for a floor ball stick. Figure 4 is a transversal cross-sectional view through the blade in figure 3, taken along the line IV-IV.

[0041] The illustrated blade 2 has an elongated shape with a first and a second surface surrounded by an upper and a lower longitudinal edge 9, 10 as well as a first and a second short side edge 11, 12. The skilled person will appreciate that the blade 2 may have any form that is

suitable for a floor ball blade 2 and that the blade 2 comprises at least one rib 5 enclosed by a frame 4. The frame 4 forms the upper and lower longitudinal edges 9, 10 as well as the first and second short side edges 11, 12.

[0042] At least a portion the blade 2 is made hollow 13. According to one embodiment and as illustrated in figure 4, said frame 4 of said blade 2 is partly or wholly made hollow 13. The illustrated blade 2 also comprises a plurality of ribs 5 at least partially enclosed by said frame 4. There are longitudinal and transversal ribs 5 that perpendicularly intersect each other. In this way there is provided a connection area 14 between a first and a second rib 5 of said plurality of ribs 5. According to one embodiment, the connection area 14 comprises a connection radius, said connection radius being equal to or greater than 3 mm, preferably equal to or greater than 5 mm. According to one embodiment, each two opposite fillets at the connection area 14 are spaced apart at a distance being equal or greater than 3mm.

[0043] Furthermore, the blade 2 comprises a connection portion for attachment to the shaft 3. The connection portion 15 is arranged close to the first short side edge 11 and the upper longitudinal edge 9 in a bridging portion there between. In the blades known in the art, the connection portion comprises an opening into which the lower end of the shaft is inserted attached by means known in the art so as to form a separable component.

[0044] According to embodiments of the manufacturing of the present floor ball stick 1, the joining and attachment of the blade 2 to the shaft 3 is carried out in a different way than for the floor ball stick 1 as is known in the art, so as to form the floor ball stick 1 as an inseparable component. As shown in figures 3 and 5a, the blade 2 may comprise a shaft connection portion 15 having an outer (circular) shape that in a form fit manner matches the inner (circular) shape of the hollow shaft opening at the lower end 8 of the shaft 3. The connection portion may also be tapering in a frusto-conical fashion towards its upper free end 16. The connection portion may be inserted into said shaft opening of the lower end 8. An annular stop surface 17 close to the shaft connection portion 15 may be arranged with larger diameter than said shaft opening at the lower end 8. The annular stop surface 17 provides an edge portion that may be in contact with a lower end edge of the shaft 3, when the connection portion 15 is fully inserted into the said shaft opening and hollow portion close to the lower end 8 of the shaft 3. In this way there is provided a secure insertion of the connection portion 15 into the hollow shaft 3.

[0045] The shaft connection portion 15 of the blade 2 may be a portion with an opening 18 into which, for example, a lower end portion 19 of the shaft 3 may be inserted (see figure 5b)

[0046] Alternatively, a connection piece 20 may be used for connecting the shaft 3 and the blade 2 to each other (see figure 5c). The connection piece 20 may be formed with two opposing end portions 21, 22, wherein one 21 may be inserted into an opening of the hollow

lower end portion of the shaft 3 and wherein one end portion 22 may be inserted into an opening 18 arranged in the shaft connection portion 15 of the blade 2. The connection piece 20 may be of plastics and/or a composite material, and may be of the same group of materials or the same materials as the blade 2 and/or the shaft 3 as discussed herein.

[0047] The shaft 3 and the blade 2 may be permanently attached to each other by applying an attachment material 23 to the overlapping portions of the blade 2 and the shaft 3 (see figure 6), between overlapping material portions thereof and/or around the overlapping material portions, and then curing thereof. This will be described in more detail herein below, when describing embodiments of the method for producing the floor ball stick 1.

[0048] The blade 2 may be made of a composite material as compared to known blades of plastics of polyethylene or polypropylene. The composite material may comprise reinforcing fibres, such as carbon, Kevlar® (poly paraphenylene terephthalamide) and/or glass, embedded in a resin as exemplified herein below.

[0049] Said blade 2 may be made of the same group of materials or materials as the shaft material.

[0050] At least a portion of at least one rib 5 of said plurality of ribs 5 may be lined with a shock absorbing material, said shock absorbing material being different from the material of said rib (-s) 5. Said shock absorbing material may comprise an elastomer such as rubber, silicon, TPE, or the like.

[0051] In the following, embodiments of a method for manufacturing a floor ball stick 1 as an inseparable component, such as the floor ball stick 1 illustrated in figure 1 with a shaft 3 and a blade 2 will be described in more detail.

[0052] If using a formable material, the shaft 3 and the blade 2 for a sport stick 1 could separately be made in two different moulds 24, 25 like the ones showed schematically in figures 7 and 8. As shown in figure 7, the mould for the shaft 3 is shown in its open state, so that the two halves 26, 27 of the mould, i.e. a first half 26 and a second half 27 could be seen. The mould 25 for the blade is shown in its closed state (see figure 8).

[0053] As an example, the mould 24 that is intended for making the shaft 3 is in figure 7 shown as a mould 24 for one shaft 3 at the time, but any number of shafts, including 1, 2, 3, 4 and 8 could be made at the same time by using multiple cavities. Similarly, the mould 25 for making the blade 2 may also be arranged for making any number of blades. When the first and second halves 26, 27 of the mould 24 for a shaft 3 are closed during moulding, a channel 28 in the first half 26 together with the corresponding channel 29 in the second half 27 will form a mould cavity. The first and second halves 30, 31 of the blade mould may be arranged so that mould cavity is substantially provided by the first mould half 30, while the second mould half 31 only serves as a lid for closing the mould cavity (see figure 8). The geometrical form of a mould cavity reflects the geometry of the shaft 3 or

blade 2, which is intended to be produced in the mould. Each mould further comprises at least one inlet 32, 33, where air can enter into the cavity. If more than one shaft 3 or blade 2 is intended to be produced at the same time it is preferred to use a number of inlets 32, 33, at least one for each channel or cavity.

[0054] The invention also relates to a method to produce a floor ball stick 1 as an inseparable component like the one illustrated in figure 1. The method may comprise separately forming the shaft 3 and the blade 2 in a suitable method as the method including the so called compression moulding. Following the curing of the shaft 3 and the blade 2, the cured shaft 3 is connected to said cured blade 2 via the shaft connection portion 15, 15' as described above. An attachment material 23 is applied for attaching together said cured shaft 3 and said cured blade 2, followed by curing said attachment material 23 in order to obtain a floor ball stick 1. The attachment material may be applied on 23 and/or between overlapping material portions of the blade 2 and the shaft 3. The attachment material may also be applied on portions adjacent to the overlapping material portions to further secure the attachment. The attachment material 23 may be a formable material of plastics and/or be of the same group of material or the same material as the formable material for making the blade 2 and/or the shaft 3, such as the materials exemplified herein below.

[0055] The method of forming a shaft 3 using compression moulding comprises a number of steps. First an intermediate material is prepared. Reinforcing fibres, such as carbon, Kevlar® (poly paraphenylene terephthalamide) and/or glass, are embedded in a resin. Typically the resin is a thermosetting material such as epoxy, polyester, vinyl, phenolic, and polyimide. The fibre composition may comprise 0 to 100 % by weight of glass fibres, e.g. 20 to 80 % (by weight) glass fibre and 20 to 80 % (by weight) carbon fibres, or 50 % each of carbon and glass fibres. The carbon fibre could, purely as an example, have around 12,000 Filament and a tensile modulus of 23,500 gkf/mm². The glass fibre could, purely as an example, have a fibre diameter (um) of 13.3 +/- 0.6 (K), and a linear mass density, Tex (g/km) of: 1071 +/- 47. The intermediate material is typically prepared in the form of sheets.

[0056] The next step of forming the shaft 3 is to form a tubular structure. A cover is applied to a core (mandrel), e.g. a wood, steel, ABS plastic or composite material core covered by a nylon bag (nylon bladder) (not shown). This cover is covered by a layer or a plurality of layers made of the intermediate material. If a plurality of layers is used, the layers could be arranged so that the reinforcing fibres therein have different orientation from one another. The layers could for example be wound on the core as strips.

[0057] When the tubular structure is ready, the core is removed and the rest of the structure is moved to a mould 24 as the one illustrated in figure 7, in order to attain the desired shaft 3 by applying heat and air pressure. Air

fittings are applied to the interior of the tubular structure through the inlets 32. The two halves 26, 27 of the mould 24 are closed and the mould 24 is placed in a platen press. While heating the mould 24, the tubular structure is pressurized from the inside. The material of the tubular structure compresses and the tubular structure is forced to adapt to the geometrical form of the mould cavity. At the same time, the heat cures the intermediate material. The temperature and pressure depend on the material used but could, purely as an example, be about 150 to 155°C, e.g. 155 °C, with a curing time of 30 min and an air pressure which gradually is increased to 15 bar.

[0058] When the curing is ready, the shaft 3 formed by the tubular structure is cooled and the mould 24 is opened and the shaft 3 taken out for further processing such as grinding, lacquering and/or attachment to the blade 2.

[0059] The method of forming the blade 2 using compression moulding is in many aspects similar to the method of forming the shaft 3. The blade 2 is made by placing a formable material into the blade 2 mould cavity formed by the first and second mould halves 30, 31 as illustrated in figure 8. The mould cavity comprises a frame portion cavity and a rib portion cavity (not shown). The mould 25 is arranged so that the first mould half 30 contains substantially said mould cavity for forming the blade 2. The second mould half 31 substantially serves as a lid closing the mould cavity during the curing of the blade 2. This arrangement provides a way of pre-form the blade 2 in the first mould half 30 before the second mould half 31 is used for closing the mould cavity.

[0060] The method comprises making the blade 2 by curing said formable material in said blade 2 mould cavity in order to obtain a cured blade 2.

[0061] The moulding method is arranged so that at least a portion the blade 2 is made hollow 13. According to one embodiment and as illustrated in figure 4, said frame 4 of said blade 2 is partly or wholly made hollow 13.

[0062] The blade 2 mould cavity may also be geometrically arranged so that the blade 2 comprises one or plurality of ribs 5 that are at least partially enclosed by a frame 4 (not shown). According to one embodiment, the connection area 14 comprises a connection radius, said connection radius being equal to or greater than 3 mm, preferably equal to or greater than 5 mm. According to one embodiment, each two opposite fillets at the connection area 14 are spaced apart at a distance being equal or greater than 3mm.

[0063] Accordingly, said blade 2 mould cavity may comprise a frame portion cavity and a rib portion cavity and the method for producing such a blade 2 may comprise the following steps for providing a frame 4 that is partly or wholly made hollow 13: i) providing an expandable element in said frame portion cavity before curing said formable material, and ii) providing that said expandable element is expanded when curing said formable material such that an at least partially hollow frame 4 is obtained.

[0064] Said expandable element may comprise an in-

flatable element and said step providing that said expandable element is expanded comprises a step of inflating said inflatable element. The use of the expandable element is similar to the method steps for providing the hollow shaft 3 as described above using a nylon bag as an inflatable element.

[0065] Thus, according to embodiment, the method of forming a blade 2 using compression moulding comprises a number of steps. First an intermediate material is prepared. Reinforcing fibres, such as carbon, Kevlar® (poly paraphenylene terephthalamide) and/or glass, are embedded in a resin. Typically the resin is a thermosetting material such as epoxy, polyester, vinyl, phenolic, and polyimide. The fibre composition may comprise 0 to 100 % by weight of carbon/carbon fibres, preferably 50 to 100 % (by weight) carbon/carbon fibres. The carbon fiber could, purely as an example, have 12,000 Filament and a tensile modulus of 23,500 gkf/mm². The glass fibre could, purely as an example, have a fibre diameter (um) of 13.3 +/- 0.6 (K), and a linear mass density, Tex (g/km) of: 1071 +/- 47. The intermediate material is typically prepared in the form of sheets.

[0066] The next step of forming the blade 2 is to form a pre-frame structure. A cover is applied to a core, e.g. ABS plastic core covered by a nylon bag. The core with the nylon bag may normally designed according to the dimensions of cross section and the proper length for operation needs. This cover is covered by a layer or a plurality of layers made of the intermediate material. If a plurality of layers is used, the layers could be arranged so that the reinforcing fibres therein have different orientation from one another. The layers could for example be wound on the core as strips. The strips may be longer than the final frame portion, thereby securing a completely formed frame 4, wherein the excess material may be removed after moulding by cutting.

[0067] When the pre-frame structure is ready, the core is removed and the rest of the pre-frame structure is moved to the first mould half 30 as the one illustrated in figure 8, and placed in the frame cavity portion therein (not shown), in order to attain the desired frame 4 when applying heat and air pressure through the air inlet and into the nylon bag.

[0068] The next step is to place an intermediate material filler, being of the intermediate material type as mentioned above, in portion cavities, such as the rib portion cavity, so as to form blade portions other than the frame 4. The intermediate material may be of the same or similar material as the one used for the frame 4 or different material from the material used for the frame 4. The material is applied in the mould to form a unitary blade 2 after curing. Air fittings are applied to the interior of the tubular structure through the inlets 33. The two halves 30, 31 of the mould 25 are closed and the mould is placed in a platen press. While heating the mould 25, the tubular frame structure is pressurized from the inside. The material of the tubular structure compresses and the tubular structure as well as other blade portions are forced to

adapt to the geometrical form of the mould, wherein a single blade 2 unit is formed. At the same time, the heat cures the intermediate material. The moulding temperature and pressure depend on the material used but could, purely as an example, be around 150 to 155°C, preferably around 150 °C, with a curing time of about 30 min and a final air pressure of around 8 to 15 bar.

[0069] According to an embodiment, the blade 2, in particular the rib (-s) 5, may also be formed so as to include a foam agent, such as EVA (Ethylene Vinyl Acetate) or PU (PolyUrethane), so as to reduce the weight of the blade 2. The foam material may, wholly or partly, replace the intermediate filler material used for the rib (-s) 5, around which an intermediate material layer, such as a pre-peg layer (-s), is wrapped.

[0070] At least a portion of at least one rib 5 of said plurality of ribs 5 may also be lined with a shock absorbing material, said shock absorbing material being different from the material of the rib 5. Said shock absorbing material may comprise an elastomer such as rubber, silicon, TPE, or the like. The skilled person appreciates that the shock absorbing material may be applied by spraying said material on the rib (-s) 5, for example, while the portions of the blade 2 that should not be lined with the shock absorbing material may be covered by a masking tape or the like. The shock absorbing material may be applied before connecting the blade 2 to the shaft 3 or in a step following the connection and/or attachment of the blade 2 and the shaft 3.

[0071] In summary, the blade 2 and the shaft 3 are formed separately by, for example, a moulding method, and after curing and cooling the formed items 2, 3, they are connected to each other. As discussed herein above, the cured shaft 3 and the cured blade 2 are connected and attached together by applying an attachment material 23 to the shaft 3 and blade 2 in a connection portion thereof and curing said attachment material in order to obtain a floor ball stick 1. The attachment material may be applied between and/or around 23 overlapping material portions of the connection portion.

[0072] Said shaft 3 and said blade 2 may be made of the same group of materials, preferably said shaft 3 and said blade 2 are made of the same material. The attachment material 23 may also be of the same group of material or the same material as the formable material for making the blade 2 and/or the shaft 3, as described herein above. Alternatively, or as a complement to another attachment material 23, a carbon fibre material 23, 34 may be wrapped around the blade 2 and the shaft 3 before curing. In addition, a shrink tape 23, 34 of oriented polypropylene may also be wrapped around the carbon material layer before curing.

[0073] The curing of said attachment material 23 in order to obtain a floor ball stick 1 may be performed in a mould cavity, which may be the same as the mould cavity for the blade 2 or a separate mould and mould cavity designed for the attachment of the blade to the shaft (not shown). The mould cavity may adopt the form of the con-

nected portion, e.g. a form similar to the shaft 3.

[0074] The curing temperature of said attachment depends on the material used and the amount of material used, but could, purely as an example, be around 150 to 155°C, preferably around 150 °C, with a curing time of about 10 to 15 min and a final air pressure of around 8 to 15 bar.

[0075] In order to provide additional mechanical strength and appearance to the floor ball stick 1, the method may further comprise applying a material layer 34 around the connection between said shaft 3 and said blade 2 before curing said attachment material 23; preferably shrink tape and/or a pre-peg layer of, for example, the type described herein, e.g. the above-mentioned layer (-s) 23, 34 of a carbon fibre material, the layer (-s) 23, 34 being a complement or alternative to the attachment material 23, around which an oriented polypropylene layer 23, 34 is provided. In view of this disclosure, the skilled person will appreciate other types of shrink tapes than the oriented polypropylene type that may be used.

[0076] According to one aspect, there is provided a blade 2 for a floor ball stick 1, which may be any one of the blades as described herein above that is adapted for connection to shaft 3 so as to form an inseparable component. The blade may also be arranged to be mounted to a shaft as is known in the art, e.g. by having an opening into which the shaft may be inserted and wherein the shaft is fixated to the blade by means such as screws. In this way the inventive blade may be detachable mounted to a shaft.

[0077] According to the aspect, the blade comprises a frame that is at least partially enclosing at least one rib. At least a portion of said frame of said blade is hollow.

[0078] According to an embodiment, said blade may be made of a composite material. The composite material may preferably comprise reinforcing fibres, such as carbon Kevlar® (poly paraphenylene terephthalamide), and/or glass, embedded in a resin.

[0079] According to an embodiment, the blade may also be made of a polymer material such as polyester or an olefin plastic, in particular when the blade is for use as a detachable mounting to a shaft.

[0080] According to one embodiment, the frame and the ribs may be made of similar materials, the same material or different materials.

[0081] According to an embodiment, said blade may comprise a plurality of ribs at least partially enclosed by said frame and a connection area between a first and a second rib of said plurality of ribs comprising a connection radius. The connection radius may be equal to or greater than 3 mm, preferably equal to or greater than 5 mm.

[0082] According to an embodiment of said blade, at least a portion of at least one rib of said plurality of ribs is lined with a shock absorbing material, said shock absorbing material being different from the material of said rib, said shock absorbing material preferably comprising an elastomer such as rubber, silicon, TPE, or the like.

[0083] According to another aspect, there is provided

a stick 1 comprising the blade.

[0084] Embodiments of the blade and a method of fabricating the blade have been described in more detail above in connection with the disclosure of the floor ball stick 1 and the method of fabricating such a floor ball stick 1.

[0085] It will be realized that the present invention is not limited to the embodiments described above and illustrated in the drawings; rather a person skilled in the art will recognise many alterations and modifications that can be performed within the frame of the scope of protection of the appended claims.

Claims

1. A floor ball stick (1) comprising a shaft (3) and a blade (2), said blade (2) comprising a frame (4) at least partially enclosing at least one rib (5), **characterized in that** said shaft (3) and said blade (2) are manufactured to form an inseparable component.
2. The floor ball stick (1) according to claim 1, wherein said shaft (3) and said blade (2) are made of the same group of materials, preferably said shaft (3) and said blade (2) are made of the same material.
3. The floor ball stick (1) according to claim 1 or 2, wherein said shaft (3) and/or said blade (2) are made of a composite material, said composite material preferably comprising reinforcing fibres, such as carbon, glass and/or poly paraphenylene terephthalamide, embedded in a resin.
4. The floor ball stick (1) according to any one of the preceding claims, wherein at least a portion of said frame (4) of said blade (2) is hollow (13).
5. The floor ball stick (1) according to any one of the preceding claims, wherein said blade (2) comprises a plurality of ribs (5) at least partially enclosed by said frame (4), a connection area (14) between a first and a second rib (5) of said plurality of ribs (5) comprising a connection radius, said connection radius being equal to or greater than 3 mm, preferably equal to or greater than 5 mm.
6. The floor ball stick (1) according to any one of the preceding claims, wherein at least a portion of at least one rib (5) of said plurality of ribs (5) is lined with a shock absorbing material, said shock absorbing material being different from the material of said rib (5), said shock absorbing material preferably comprising an elastomer.
7. A method for producing a floor ball stick (1) comprising a shaft (3) and a blade (2), said blade (2) comprising a frame (4) at least partially enclosing at last

one rib (5), said method comprising:

- placing a formable material into a blade mould cavity;
- curing said formable material in said blade mould cavity in order to obtain a cured blade (2);
- connecting a cured shaft (3) to at least a portion of said cured blade (2);
- applying attachment material (23) for attaching together said cured shaft (3) and said cured blade (2), and
- curing said attachment material (23) in order to obtain a floor ball stick (1).

8. The method according to claim 7, wherein said blade mould cavity comprises a frame portion cavity and a rib portion cavity, said method further comprises:
 - providing an expandable element in said frame portion cavity before curing said formable material, and
 - providing that said expandable element is expanded when curing said formable material such that an at least partially hollow (13) frame (4) is obtained.
9. The method according to claim 8, wherein said expandable element comprises an inflatable element and said step providing that said expandable element is expanded comprises a step of inflating said inflatable element.
10. The method according to any one of claims 7 - 9, wherein said attachment material (23) is the same material as the formable material and/or a material comprising carbon fibres.
11. The method according to any one of claims 7 - 10, wherein said method further comprises:
 - applying a material layer (23, 34), preferably shrink tape and/or a pre-peg layer, around the connection between said shaft (3) and said blade (2) before curing said attachment material (23, 34).
12. A blade (2) for a floor ball stick (1), comprising a frame (4) at least partially enclosing at least one rib (5), **characterized in that** at least a portion of said frame (4) of said blade (2) is hollow (13).
13. The blade (2) according to claim 12, wherein said blade (2) is made of one or more composite materials, each composite material preferably comprising reinforcing fibres, such as carbon, glass and/or poly paraphenylene terephthalamide, embedded in a resin.

14. The blade (2) according to claim 12 or 13, wherein said blade (2) comprises a plurality of ribs (5) at least partially enclosed by said frame (4), a connection area (14) between a first and a second rib (5) of said plurality of ribs (5) comprising a connection radius, said connection radius being equal to or greater than 3 mm, preferably equal to or greater than 5 mm. 5
15. The blade (2) according to any one of claims 12-14, wherein at least a portion of at least one rib (5) of said plurality of ribs (5) is lined with a shock absorbing material, said shock absorbing material being different from the material of said rib (5), said shock absorbing material preferably comprising an elastomer. 10 15

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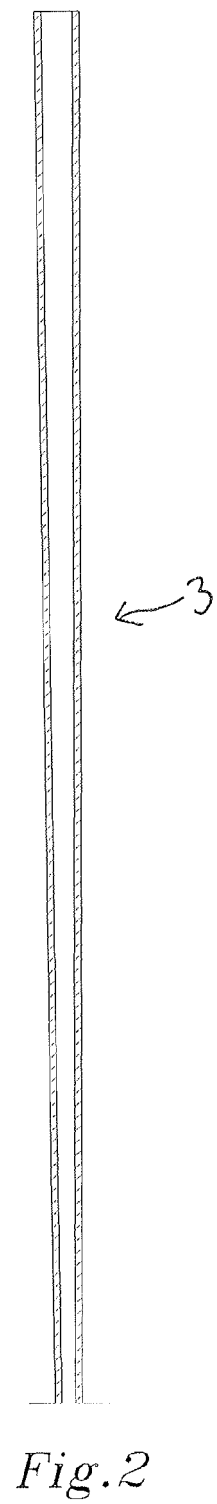
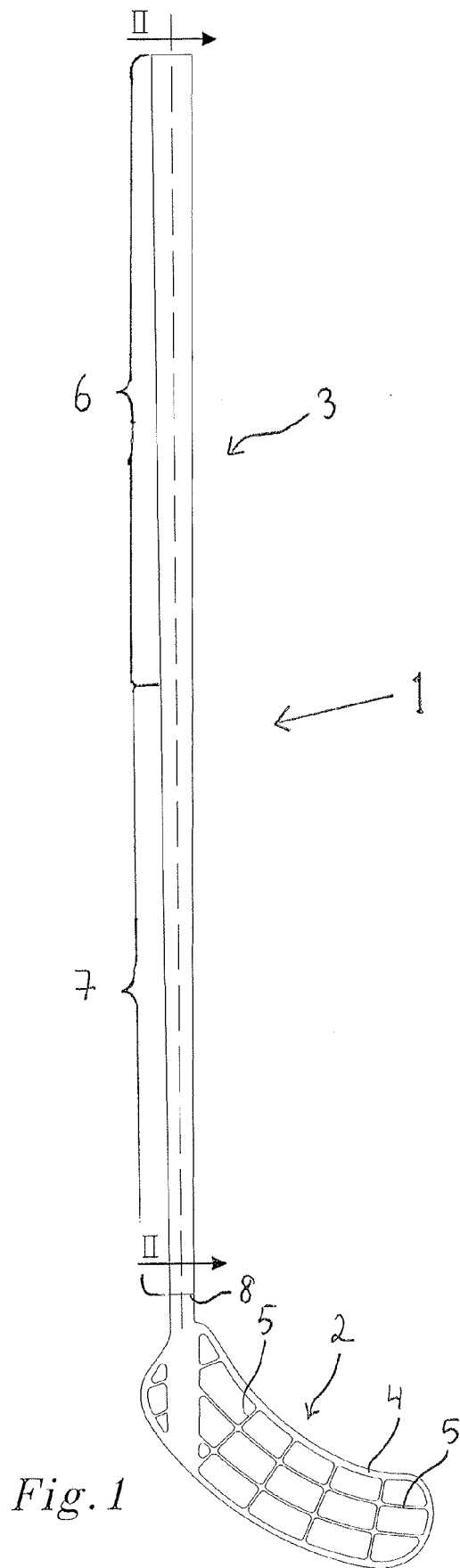
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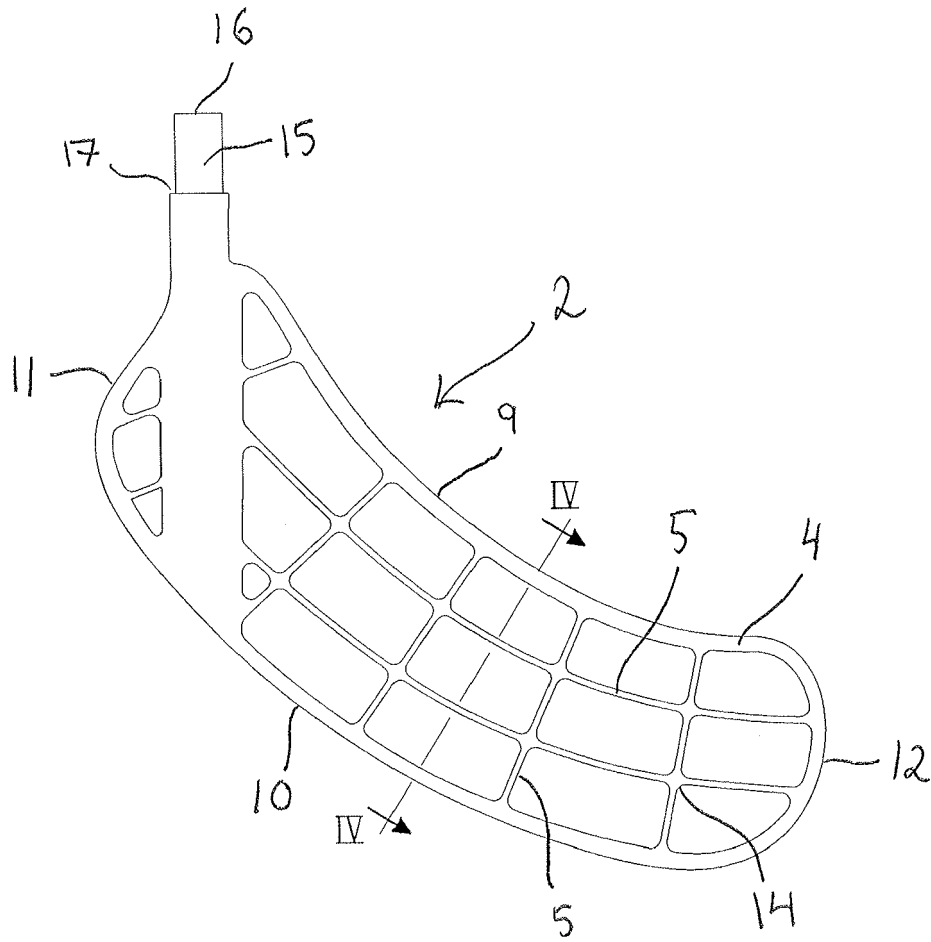


Fig. 3

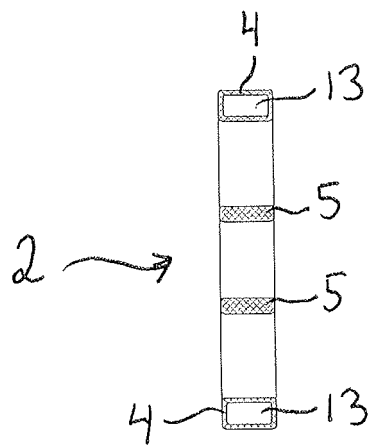


Fig. 4

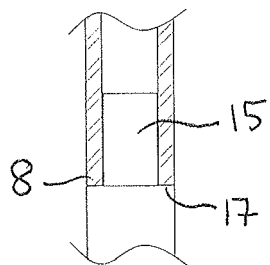


Fig. 5a

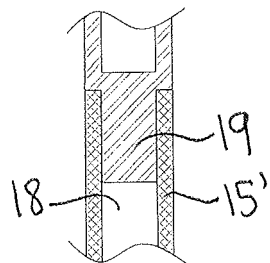


Fig. 5b

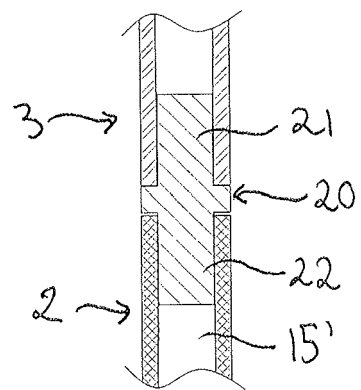


Fig. 5c

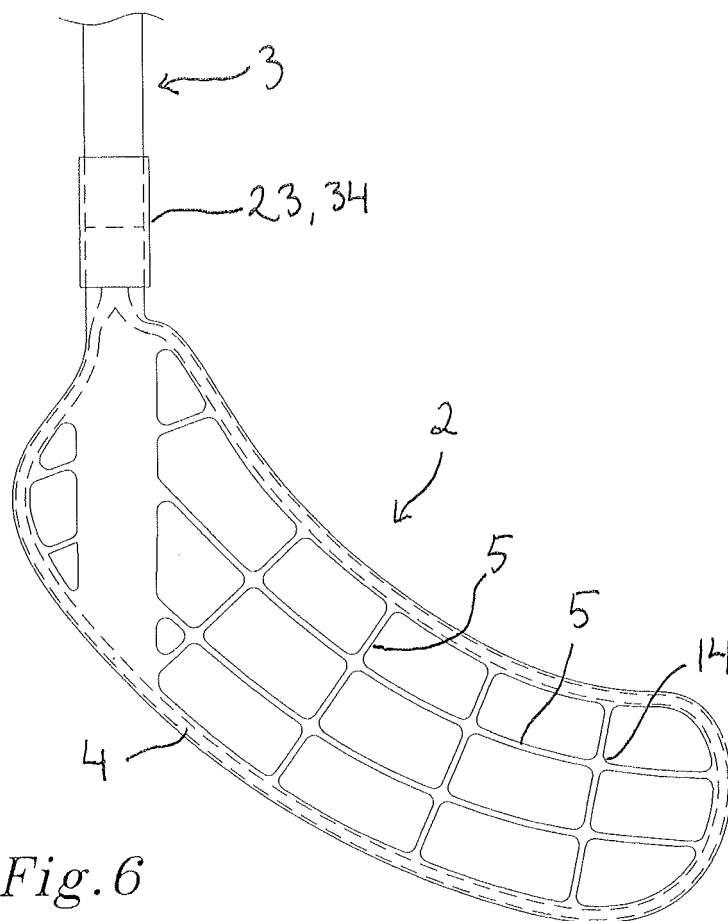
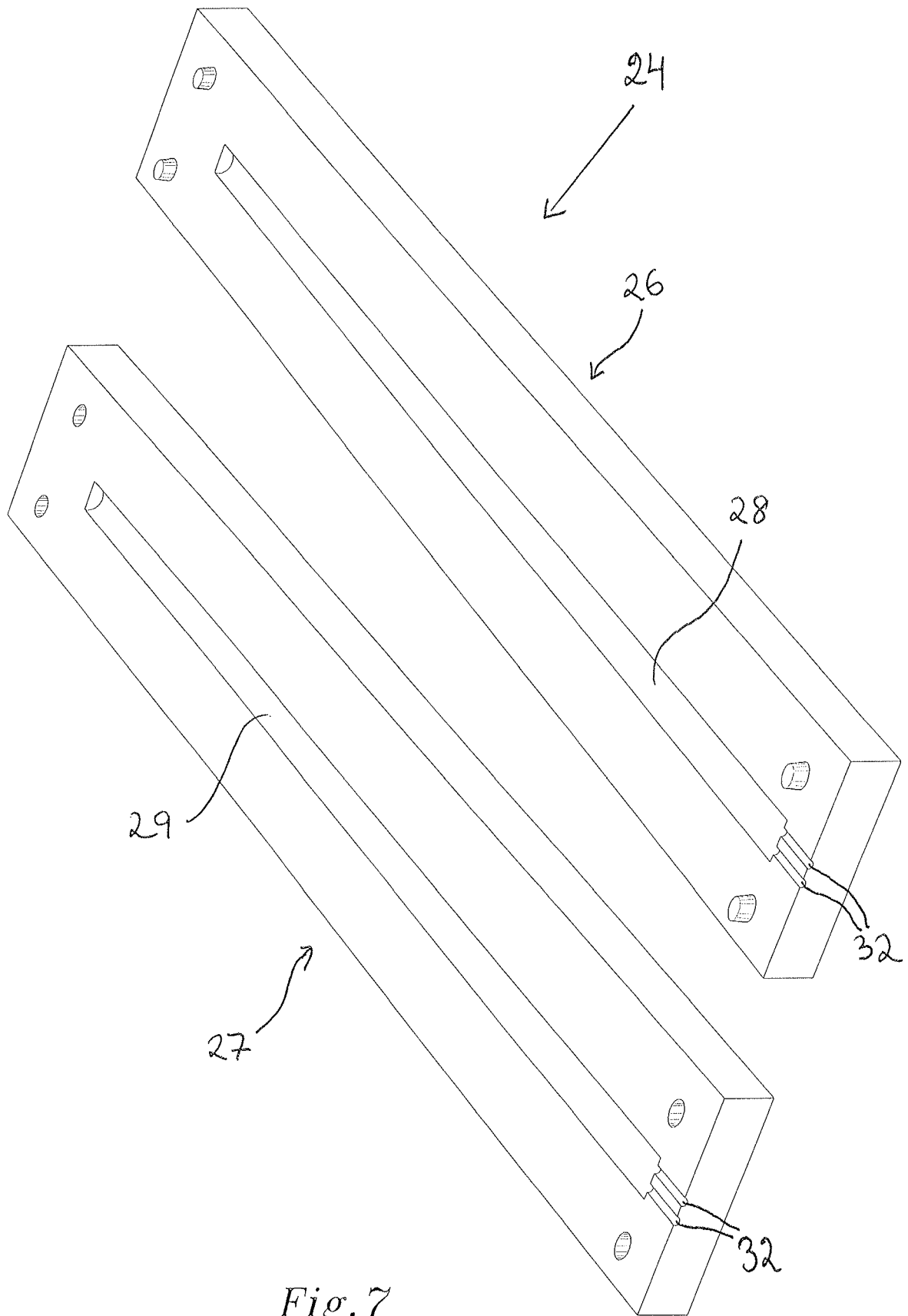


Fig. 6



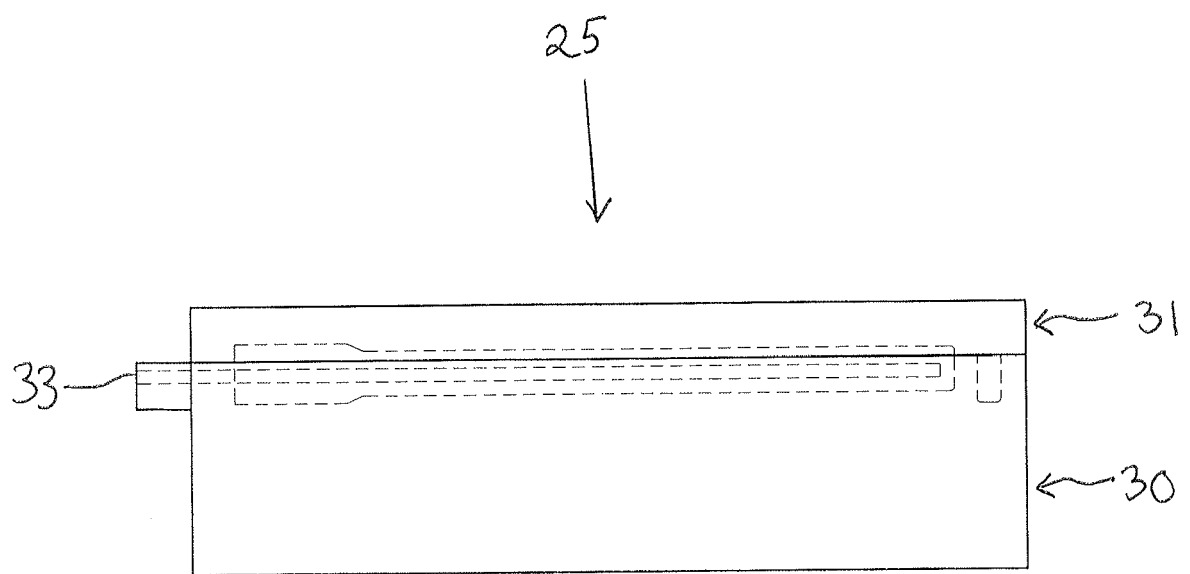


Fig. 8



EUROPEAN SEARCH REPORT

Application Number
EP 12 15 5549

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Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
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The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 31 October 2012	Examiner Tejada Biarge, Diego
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

EPO FORM 1503 03.82 (P04C01)



EUROPEAN SEARCH REPORT

Application Number
EP 12 15 5549

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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The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 31 October 2012	Examiner Tejada Biarge, Diego
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

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EPO FORM 1503 03.82 (P04C01)



Application Number

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CLAIMS INCURRING FEES

The present European patent application comprised at the time of filing claims for which payment was due.

☐ Only part of the claims have been paid within the prescribed time limit. The present European search report has been drawn up for those claims for which no payment was due and for those claims for which claims fees have been paid, namely claim(s):

☐ No claims fees have been paid within the prescribed time limit. The present European search report has been drawn up for those claims for which no payment was due.

LACK OF UNITY OF INVENTION

The Search Division considers that the present European patent application does not comply with the requirements of unity of invention and relates to several inventions or groups of inventions, namely:

see sheet B

☒ All further search fees have been paid within the fixed time limit. The present European search report has been drawn up for all claims.

☐ As all searchable claims could be searched without effort justifying an additional fee, the Search Division did not invite payment of any additional fee.

☐ Only part of the further search fees have been paid within the fixed time limit. The present European search report has been drawn up for those parts of the European patent application which relate to the inventions in respect of which search fees have been paid, namely claims:

☐ None of the further search fees have been paid within the fixed time limit. The present European search report has been drawn up for those parts of the European patent application which relate to the invention first mentioned in the claims, namely claims:

☐ The present supplementary European search report has been drawn up for those parts of the European patent application which relate to the invention first mentioned in the claims (Rule 164 (1) EPC).



**LACK OF UNITY OF INVENTION
SHEET B**

Application Number
EP 12 15 5549

The Search Division considers that the present European patent application does not comply with the requirements of unity of invention and relates to several inventions or groups of inventions, namely:

1. claims: 1-7, 10-15

Blade with ribs, at least one of the ribs being lined with a shock absorbing material which is different from the material of the rib.

2. claims: 1-5, 7-14

A method for producing a blade with ribs, whereby a blade mould cavity which comprises a frame portion cavity and a rib portion cavity is provided, whereby an expandable element in said frame portion cavity is provided before curing the formable material, so that an at least partially hollow frame is obtained.

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

EP 12 15 5549

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
The members are as contained in the European Patent Office EDP file on
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31-10-2012

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EPO FORM P0459

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

REFERENCES CITED IN THE DESCRIPTION

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