(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) **EP 3 495 317 A1**

(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
12.06.2019 Bulletin 2019/24

(51) Int Cl.:
B68C 3/00 *(2006.01)* ***B68C 3/02*** *(2006.01)*

(21) Application number: **17206389.3**

(22) Date of filing: **11.12.2017**

(84) Designated Contracting States:
AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR
Designated Extension States:
BA ME
Designated Validation States:
MA MD TN

(71) Applicant: **Polymar SPRL**
1400 Nivelles (BE)

(72) Inventor: **Emmanuel, Guily**
6238 Liberchies (BE)

(74) Representative: **De Clercq & Partners**
Edgard Gevaertdreef 10a
9830 Sint-Martens-Latem (BE)

(54) **DURABLE AND RELIABLE STIRRUP**

(57) The present invention relates to a stirrup (1000) that provides for an improved durability, reliability, ergonomics and/or safety. It also relates to a method for producing said stirrup.

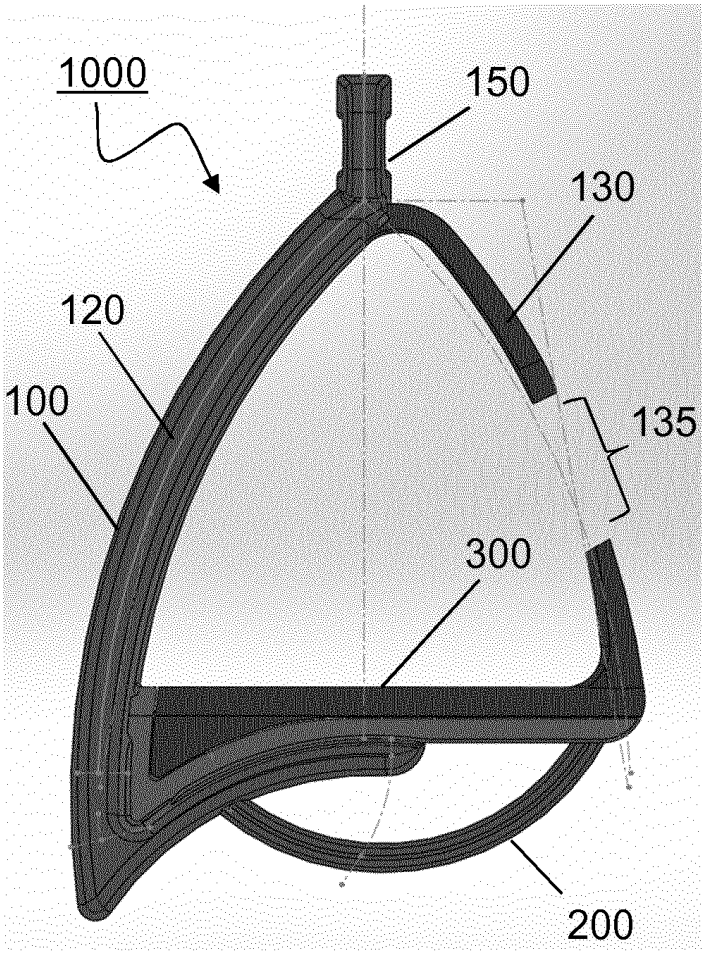

FIG. 2

EP 3 495 317 A1

Description

FIELD OF THE INVENTION

[0001] The present invention relates to a stirrup that provides for an improved durability, reliability, ergonomics and/or safety. It also relates to a method for producing said stirrup, and the use of said stirrup for horse riding.

BACKGROUND OF THE INVENTION

[0002] Stirrups are part of conventional horse mounting equipment and are typically positioned on both sides of the saddle. They are designed not only for assisting the rider in mounting and dismounting, but also for maintaining balance during riding. When the rider is seated in the saddle, the rider's feet rest on the foot platforms of the stirrups, typically located at a height for the feet to comfortably engage the stirrups. While riding, however, the rider alternates between a seated and a standing position, significantly changing the pressure exerted on each foot platform. During professional riding events in particular, the rider will constantly rest his or her entire weight on the stirrup.

[0003] In antiquity, stirrups were designed with a simple leverage system in mind. The foot platforms were each connected to a flexible strap (i.e. the stirrup leather), which was in turn connected to the saddle. These old designs were replaced by more modern stirrup irons, wherein the foot platform formed part of a triangular or arch-shaped (cast-iron) frame. These frames were similarly connected to a saddle via a stirrup leather. The frames offered numerous advantages, such as an improved balancing for the rider.

[0004] However, due to the leverage configuration of modern stirrups, in particular of single branch stirrups, the 90° angled corners of the stirrup's frame are focal points for stress. These focal points over time will suffer from material deterioration (e.g. repetitive wear, microcracks, etc.), causing the frame to eventually crack and break. As a result every stirrup has a limited lifetime and requires regular replacement. In particular during professional riding events, breakage of a stirrup is observed more frequently because of the very high forces exerted on the stirrups, for example during free jump competitions.

[0005] Due to the lack of any reliable wear indicator, properly judging whether a stirrup is about to break is almost impossible. However, any unexpected breakage can severely endanger both the rider's and the horse's safety, especially if the horse is moving at high speed (e.g. galloping) or landing from a jump. Indeed, there exist serious safety concerns associated with the use of stirrups. For example, the rider may lose his balance or his footing in one of the stirrups, which given the difficulty of regaining balance and/or catching a hanging stirrup during motion will most likely result in a fall. Moreover, during the fall the rider's foot may get caught by the stirrup, which will cause the rider to be dragged along by the horse. Furthermore, during riding significant tension is exerted on the rider's ankles and knees due to the legs' (unnatural) positioning in the stirrups. Each shock caused by e.g. a gallop or jump further increases the tension, causing injuries such as strains in the rider's muscles and tendons. A deteriorated stirrup may aggravate the occurrence of injuries when it is unable to properly absorb the shocks and/or when it cannot provide sufficient support for the rider's foot. There exist novel stirrup designs that aim to improve the rider's safety (e.g. Japanese stirrups with an open frame, tapaderos, and others) and comfort (e.g. hooks or branches to attach the rider's boot to the stirrup); however, these alternative designs are undesired or sometimes even forbidden at professional sports events. For instance, professional riders require a good communication with the horse through the rider's heel, which some designs inhibit. Additionally, other safety concerns may be raised, such as the rider slipping out of an open frame, or the stirrup getting entangled with the saddle. Moreover, much like the previously discussed stirrup frames, these novel designs still suffer from wear and breakage. In fact, certain (open) designs are even more prone to breakage.

[0006] Hence there exists a need to provide for an improved riding stirrup. It is desired that the riding stirrup provides an improved support, durability, comfort, (ergonomic) adaptability and/or reliability. It is further desired that the riding stirrup provides for a safe manner of usage, with a minimized risk of the foot becoming entangled in the stirrup. It is further desired that the riding stirrup still allows for good contact between the rider's heel and the barrel of the horse. The present invention addresses one or more of these needs.

SOME EMBODIMENTS OF THE INVENTION

[0007] In an aspect, the invention relates to a stirrup for horse riding. Preferably, the stirrup comprises:

- a first arch , optionally provided with a means for mounting the stirrup;
- a foot platform , disposed along the span of the first arch ; and
- a second, preferably inverted, arch that is arranged opposite of the first arch so that the foot platform is disposed in-between the first arch and the second arch. The stirrup also comprises at least one metal insert.

[0008] In some preferred embodiments, the metal insert is positioned at least partly within the first arch and at least partly within the second arch. Preferably the metal insert is positioned at least partly and preferably entirely within the inner section of the first arch and at least partly and preferably entirely within the inner section of the second arch.

[0009] In some preferred embodiments, the metal in-

sert is a curved elongated insert spanning from the apex of the first arch to the apex of the second arch.
In some preferred embodiments, the metal insert extends to the foot platform spanning along the second arch In some preferred embodiments, the metal insert has at least one curvature situated at an extremity of the first and/or second arch, wherein said curvature is adapted for supporting the adjacent arch and/or foot platform.

[0010] In some preferred embodiments, the curvature matches the shape of the adjacent arch.
In some preferred embodiments the metal insert is a curved elongated insert spanning from the apex of the first arch to the apex of the second arch and continuing along the second arch towards to the foot platform.

[0011] In some preferred embodiments, the metal is selected from the group comprising: (stainless) steel, aluminium, titanium and/or an alloy thereof; preferably the metal is (stainless) steel.

[0012] In some preferred embodiments, the metal insert is a planar metal insert.

[0013] In some preferred embodiments, the metal insert is a twisted planar metal insert, for example twisted under an angle from at least 0.5° to at most 50°, for example from 2° to 40°, for example from 3° to 30°, for example from 4° to 20°, for example from 5° to 10°.

[0014] In some preferred embodiments, the shape of the first and/or second arch is triangular, circular, elliptical, parabolic, horseshoe, spiral, and/or is a combination of such shapes; for example a C, G, €, or 6-shape.

[0015] In some preferred embodiments the foot platform comprises a shock absorber. Preferably the shock absorber is a passive shock absorbing material or an actively shock absorbing device, or a combination of both.

[0016] In some embodiments, the stirrup comprises a first stirrup-part coupled to a second stirrup-part. Preferably the stirrup comprises at least one first or second coupling element for coupling the first stirrup-part to the a second stirrup-part , preferably wherein the coupled first stirrup-part and second stirrup-part encapsulate the metal insert. More preferably, the stirrup forms one solid piece, preferably wherein the stirrup was injection-moulded around the metal insert.

[0017] In some embodiments, the second arch comprises a filler element in the free space within the second arch ; preferably wherein the filler element fills up the free space within the second arch partially or entirely.

[0018] In some preferred embodiments, wherein the stirrup is a polymeric stirrup comprising a thermoplastic polymer; preferably wherein the polymer is selected from the group comprising: polypropylene, polyethylene, polyamide; most preferably from polyamide.

[0019] In some preferred embodiments, the stirrup is an injection-moulded stirrup.

[0020] In some preferred embodiments, wherein the first arch comprises an interval and/or a hinging means, preferably adjacent to the means for mounting, preferably in the outer section.

[0021] In some preferred embodiments, the foot platform is disposed at an angle with the longitudinal direction of a foot placed upon the foot platform, wherein the angle is from at least 30° to at most 60°; preferably from 35° to 55°; more preferably from 40° to 50°; most preferably 42° to 47°; for example 45°.

[0022] In an aspect, the invention relates to a method for producing a stirrup, preferably a stirrup as described herein, and preferred embodiments thereof.

[0023] In some preferred embodiments, the method comprises the steps of:

- placing a metal insert in a mould; and,
- injection moulding a polymer into the mould around the metal insert; preferably overmoulding.

[0024] In some preferred embodiments, the method comprises the steps of:

- placing a metal insert in a mould; and,
- injection moulding a polymer into the mould around the metal insert ; preferably overmoulding; thereby forming a stirrup in one piece.

[0025] Preferably, the method thereby forms a first arch , optionally provided with a means for mounting the stirrup, a foot platform , disposed along the span of the first arch ; and a second, inverted, arch that is arranged opposite of the first arch so that the foot platform is disposed in-between the first arch and the second arch.

[0026] In some embodiments, the method comprises the steps of:

- injection moulding a polymer into a first mould forming a first stirrup-part;
- injection moulding a polymer into a second mould forming a second stirrup-part;
- inserting at least one metal insert onto or into the first or second stirrup-part; and,
- connecting the first stirrup-part to the second stirrup-part, preferably through the at least one first or second coupling element; thereby encapsulating metal insert within the stirrup.

[0027] In some embodiments, the first mould forms a first stirrup-part , the first stirrup-part partially comprising a first arch , optionally provided with a means for mounting the stirrup, a foot platform , disposed along the span of the first arch ; and a second, inverted, arch that is arranged opposite of the first arch so that the foot platform is disposed in-between the first arch and the second arch ; preferably wherein the first stirrup-part comprises at least one first coupling element.

[0028] In some embodiments, the second mould forms a second stirrup-part, the second stirrup-part partially comprising a first arch , optionally provided with a means for mounting the stirrup, a foot platform , disposed along the span of the first arch ; and a second, inverted, arch

that is arranged opposite of the first arch so that the foot platform is disposed in-between the first arch and the second arch; preferably wherein the second stirrup-part comprises at least one second coupling element.

BRIEF DESCRIPTION OF THE DRAWINGS

[0029] The following description of the figures of specific embodiments of the invention is merely exemplary in nature and is not intended to limit the present teachings, their application or uses.

[0030] The following numbering refers to: (1000) stirrup; (100) first arch; (120) inner section of the first arch; (130) outer section of the first arch; (135) interval; (150) means for mounting; (200) second arch; (220) inner section of the second arch; (230) outer section of the second arch; (250) filler; (300) foot platform; (400) metal insert; (450) coupling element.

FIG. 1 Illustrative representation of a stirrup (1000) according to an embodiment of the present invention.

FIG. 2 Illustrative representation of a stirrup (1000) according to an embodiment of the present invention.

FIG. 3 Illustrative representation of a stirrup (1000) according to an embodiment of the present invention.

FIG. 4 Illustrative representation of a stirrup (1000) according to an embodiment of the present invention; wherein **FIG. 4A** shows a frontal view and **FIG. 4B** a rear view.

FIG. 5A Illustrative representation of a stirrup (1000) according to an embodiment of the present invention, comprising a metal insert (400); wherein **FIG. 5B** shows a cross-sectional view of the stirrup (1000); **FIG**. **5C** and **FIG. 5D** depict embodiments of the metal insert (400).

FIG. 6 Example of a stirrup (1000) according to an embodiment of the present invention; wherein **FIG**. **6A** depicts a first stirrup-part (1000a) comprising a plurality of coupling element (450), and **FIG**. **6B** depicts a second stirrup-part (1000b) comprising a metal insert (400).

FIG. **7** Illustrative embodiment of stirrups (100) according to an embodiment of the present invention; wherein each stirrup further comprises a filler (250) according to various embodiments thereof.

FIG. **8** Example of a stirrup (1000) according to an embodiment of the present invention while in-use and mounted to a stirrup leather.

DETAILED DESCRIPTION OF THE INVENTION

[0031] Before the present unit and method of the invention is described, it is to be understood that this invention is not limited to particular units and methods or combinations described, since such units and methods and combinations may, of course, vary. It is also to be understood that the terminology used herein is not intended to be limiting, since the scope of the present invention will be limited only by the appended claims.

[0032] As used herein, the singular forms "a", "an", and "the" include both singular and plural referents unless the context clearly dictates otherwise.

[0033] The terms "comprising", "comprises" and "comprised of" as used herein are synonymous with "including", "includes" or "containing", "contains", and are inclusive or open-ended and do not exclude additional, non-recited members, elements or method steps. It will be appreciated that the terms "comprising", "comprises" and "comprised of" as used herein comprise the terms "consisting of", "consists" and "consists of".

[0034] The recitation of numerical ranges by endpoints includes all numbers and fractions subsumed within the respective ranges, as well as the recited endpoints.

[0035] Whereas the terms "one or more" or "at least one", such as one or more or at least one member(s) of a group of members, is clear per se, by means of further exemplification, the term encompasses inter alia a reference to any one of said members, or to any two or more of said members, such as, e.g., any ≥ 3, ≥ 4, ≥ 5, ≥ 6 or ≥ 7 etc. of said members, and up to all said members.

[0036] All references cited in the present specification are hereby incorporated by reference in their entirety. In particular, the teachings of all references herein specifically referred to are incorporated by reference.

[0037] Unless otherwise defined, all terms used in disclosing the invention, including technical and scientific terms, have the meaning as commonly understood by one of ordinary skill in the art to which this invention belongs. By means of further guidance, term definitions are included to better appreciate the teaching of the present invention.

[0038] In the following passages, different aspects of the invention are defined in more detail. Each aspect so defined may be combined with any other aspect or aspects unless clearly indicated to the contrary. In particular, any feature indicated as being preferred or advantageous may be combined with any other feature or features indicated as being preferred or advantageous.

[0039] Reference throughout this specification to "one embodiment" or "an embodiment" means that a particular feature, structure or characteristic described in connection with the embodiment is included in at least one embodiment of the present invention. Thus, appearances of the phrases "in one embodiment" or "in an embodiment" in various places throughout this specification are not necessarily all referring to the same embodiment, but may. Furthermore, the particular features, structures or characteristics may be combined in any suitable manner, as would be apparent to a person skilled in the art from this disclosure, in one or more embodiments. Furthermore, while some embodiments described herein include some but not other features included in other embodiments, combinations of features of different embodi-

ments are meant to be within the scope of the invention, and form different embodiments, as would be understood by those in the art. For example, in the appended claims, any of the claimed embodiments can be used in any combination.

[0040] In the present description of the invention, reference is made to the accompanying drawings that form a part hereof, and in which are shown by way of illustration only of specific embodiments in which the invention may be practiced. Parenthesized and/or emboldened reference numerals affixed to respective elements merely exemplify the elements by way of example, with which it is not intended to limit the respective elements. It is to be understood that other embodiments may be utilised and structural or logical changes may be made without departing from the scope of the present invention. The following detailed description, therefore, is not to be taken in a limiting sense, and the scope of the present invention is defined by the appended claims.

[0041] The present invention generally discloses a stirrup for horse riding. The stirrup as described herein provides advantages in durability, reliability, and/or safety.

[0042] While riding the static (e.g. the horse is resting) or the dynamic (e.g. the horse is moving) force are exerted on the foot platform and subsequently transferred through the stirrup to the saddle. However, due to the leverage configuration of traditional stirrups (e.g. triangular or arch-shaped frames) the corners of the stirrups become focal points for stress. In particular the inward corner (i.e. the corner adjacent to the barrel of the horse) tends to be the load bearing corner. These focal points over time will suffer from material deterioration (e.g. repetitive wear, micro-cracks, etc.), causing the frame to eventually crack and break. Furthermore, focal points are also present on the more novel stirrup design, which tend to be variations based of the traditional leverage configuration. In fact, certain designs are even more prone to breakage; such as the open design that consists of a single corner in the front, thereby forming a single focal point.

[0043] By comparison, with the stirrup of the present invention, the risk of breakage may be significantly minimized or even altogether prevented. Indeed, the present design and features can prevent the occurrence of stress-sensitive focal points by allowing the total force exerted on the foot platform to be spread out along the length of the stirrup. Moreover, even if an unlikely breakage was to occur, the present design prevents the stirrup from completely falling apart and allowing the rider to regain composure to come to a safe halt. As a result hereof, the stirrup is more reliable and safer than present stirrups, in particular for professional riders. Additionally, the lifetime of the stirrup may be greatly increased, requiring less to no replacements.

[0044] An aspect of the invention provides for a stirrup for horse riding, the stirrup comprising: a first arch, optionally provided with a means for mounting the stirrup; a foot platform, disposed along the span of the first arch; and a second, preferably inverted, arch that is arranged opposite of the first arch so that the foot platform is disposed in-between the first arch and the second arch. In some embodiments, the stirrup comprises a first full- or half-arch for placement of a foot and provided with a means for mounting the stirrup; a foot platform, disposed along the span of the first arch; and a second, inverted arch in a way that the foot platform is disposed in-between the first arch and the second arch.

[0045] An arch is curved structure that spans a space, such as the space above the foot platform thereby forming the frame of a stirrup. Each arch is characterised by at least one base (i.e. a partial arch, for example a half-arch) and typically two bases (i.e. a full-arch); a base is defined as the beginning and/or end-point from which the curved arch formed. In the present invention the base will be located near or adjacent to the foot platform. The virtual line connecting the first base with the second base is referred to as the span; in case of a half-arch, the span is the virtual line connecting the first base with a second, imaginary base corresponding with a reflection or mirroring the half-arch. Additionally, each arch can be further characterised by an apex, which is the highest point of the arch or in other words, the point most distant from the base. The distance between the apex and the span is referred to as the rise; the rise is measured by perpendicularly intersecting a virtual line running through the apex and a virtual line running along the span.

[0046] In some embodiments, the shape of the first and/or second arch is triangular, (semi-) circular, elliptical, parabolic, horseshoe, spiral and/or is a combination of shapes; for example a C, G, €, or 6-shape. Different arch shapes are possible as appreciated by those skilled in the art and the present stirrup design is not limited to a particular arch shape, but these merely present viable options that can be regarded as preferred embodiments. The first and second arches may have the same shape, buy may also have different shapes; for example the first arch may be circular while the second arch is triangular. Different designs allow a degree of customization to best support the rider's need and level; for example professional or novice.

The combinations of shapes, including the C, G, €, or 6-shape, are particularly preferred because they may allow for an improved support of the foot platform by allowing a degree of flexibility while also better resisting mechanical deformations.

[0047] In some embodiments, the second arch spans the entire span of the foot platform. This allows for a very rigid design that provides optimal support and durability; it is for example well suited for professional riding or sport events.

[0048] In some embodiments, the first arch spans less than the span of the foot platform; such as 90%; such as 80%; such as 70%; such as 60%; such as 50%. In some embodiments, the second arch spans less than the span of the foot platform; such as 90%; such as 80%; such as 70%; such as 60%; such as 50%. This allows for a more

flexible design that increases the degree of comfort for the rider; it is for example well suited for casual riding or novices.

[0049] In some embodiments, the first arch is a full-arch. This type of design provides improved durability and rigidity by removing the occurrence of stress-sensitive focal points. As a result, the stirrup also increases the safety of the rider; it is for example well suited for professional riding or sport events. Furthermore, the manufacturing costs of such a stirrup are lower.

[0050] In some embodiments, the first arch is a partial arch, for example a half-arch; in particular wherein the half arch is adjacent to the barrel of the horse. By having the outer side of the stirrup free from the supportive arch structure the chance of the rider's foot or leg getting caught in the stirrup after fall is minimised. This type of design may require a more rigid or sturdy second arch support to uphold the durability of the general design.

[0051] In some embodiments, at least one base of the first arch is connected to a corresponding base of the second, inverted arch. Preferably, both bases of the first arch are connected to both bases of the second arch; thereby forming a continuative frame. The stirrup frame may form a circular to elliptical shape, largely depending on the shape of the respective arch.

[0052] In some embodiments, the first arch comprises two partial arches, preferably two half-arches: namely, an inner section configured for stability and an outer section configured for ease-of-access. The terms "inner" and "outer" refer to the stirrup when in use. When not in use, these terms may be interchangeable. The term "inner section" refers to the section near the horse's flank when in use, adjacent to the barrel of the horse, while the term "outer section" refers to the section away from the horse when in use, distant from the barrel of the horse (and opposite of the inner section). In some embodiments, the second arch comprises two partial arches, preferably two half-arches: namely, an inner section configured for stability and an outer section. Preferably, the second arch is a full arch, with no intervals.

[0053] In some embodiments, the outer section of the first arch further comprises an interval and/or a hinging means.

[0054] In some embodiments, the first arch comprises two partial arches, preferably two half-arches, each section having a different rigidity. In some preferred embodiments, the inner section has a high rigidity, or a higher rigidity than the outer section. In some preferred embodiments, the outer section has a high flexibility, or a higher flexibility than the inner section. This type of designs provides for an optimal balance between durability, safety and comfort. The (highly) rigid inner section prevents any focal points to wear down the stirrup, while the (highly) flexible outer section allows for easier mounting of the rider.

[0055] In some embodiments, the outer section is configured for ease-of-access and/or easier leg release, which may allow for easier mounting and dismounting, but may also prevent rider's foot or leg to be caught during a fall. In some preferred embodiments the outer section comprises an interval; for example an opening near or adjacent to the foot platform, the means for mounting the stirrup, and/or in-between the former. Additionally or alternatively, the outer section comprises a hinging means, which allows the outer section to be opened during mounting and dismounting, yet during riding the outer section can be closed to prevent an early detachment of the rider's foot out of the stirrup.

[0056] In some embodiments, the stirrup is mounted via a flexible strap (i.e. the stirrup leather); accordingly, the means for mounting the stirrup may be any structure or opening that allows for attaching said strap. For example, a slot or slit that allows the strap to be inserted and pulled through.

[0057] In some embodiments, the second arch is further provided with a filler. The filler allows for the pressure to be transferred throughout the entire arch body, instead of only the curvature. Moreover, the filler can also serve as an information carrier. For example, the filler may comprise details about the owner of the horse (e.g. personal details) or competitive information (e.g. participation number). Alternatively, it may also serve an aesthetic purpose; for example by competitive details (e.g. country colours or flag), ornaments (e.g. stickers and drawings.), commercials (e.g. sponsors).

[0058] In some embodiments, the stirrup is comprised of a polymer. Preferably the polymer is selected from the following list: polypropylene, polyethylene, polyamide; most preferably is polyamide. The listed polymers provide for a good durability and are thus particularly well suited for the present stirrup. Moreover, the listed polymers can be used for injection moulding, which is the preferred manufactory method for the present stirrup.

[0059] The stirrup comprises at least one metal insert. As used herein, the term "insert" refers to a structural element within the stirrup. For example, the stirrup may comprise a first stirrup-part coupled to a second stirrup-part, preferably comprising at least one first or second coupling element for coupling the first stirrup-part to the a second stirrup-part, preferably wherein the coupled first stirrup-part and second stirrup-part encapsulate the metal insert. Preferably, the stirrup forms one solid piece, preferably wherein the stirrup was moulded around the metal insert.

[0060] The inclusion of one or more metal inserts provides for an even more improved durability and reliability. For instance a metal insert may be placed along the (first or second) arch, along the arch (first or second) curvature, in the foot platform, in the mounting means, and/or any combination thereof. Preferably, the metal insert is positioned at least partly within the first arch and at least partly within the second arch, preferably at least partly (preferably entirely) within the inner section of the first arch and at least partly (preferably entirely) within the inner section of the second arch.

[0061] In some embodiments, the metal insert is a

curved elongated insert spanning from the apex of the first arch to the apex of the second arch. This type of metal insert allows for supporting the stirrup by structurally connecting the first and second arch, thereby spreading out the exerted pressure along the full stirrup, in addition to absorbing any deformation. Preferably the metal insert is situated along the inner arches adjacent to the barrel of the hose, since that side is the most pressure sensitive.

[0062] In some embodiments, the metal insert extends to the foot platform spanning along the second arch. This type of metal insert allows for supporting the foot platform on both sides, thereby spreading out the exerted pressure along the full stirrup, in addition to absorbing any deformation.

[0063] In some preferred embodiments the metal insert is a curved elongated insert spanning (downwards) from the apex of the first arch to the apex of the second arch and continuing (upwards) along the second arch towards to the foot platform. This type of metal insert may allow the highest durability, reliability, and/or safety.

[0064] In some preferred embodiments the curved elongated insert has at least one curvature situated at an extremity, said curvature matching the shape of the adjacent arch. An additional curvature allows for better spreading out the pressure. Preferably the curvature is situated near or adjacent to the means for mounting because that is the point through which all the pressure is transmitted to the saddle, thereby allowing for a more durable and reliable design. Accordingly, the curvature will preferably match the shape of the means for mounting. Preferably the mounting occurs through an opening in the metal insert.

[0065] In some embodiments, the metal inserts a planar metal insert.

[0066] In some preferred embodiments, the metal insert is a twisted planar metal insert, for example twisted under an angle from at least 0.5° to at most 50°, for example from 2° to 40°, for example from 3° to 30°, for example from 4° to 20°, for example from 5° to 10°. By having the metal insert twisted the foot platform may be disposed at an angle, as described further below.

[0067] In some embodiments, the metal is selected from the following list: steel, aluminium, titanium, and/or an alloy thereof; preferably the metal is stainless steel. Metals that provide for a high durability yet maintain a low weight are preferred. Stainless steel in particular provides a good balance between weight, durability, resistance and rust resistive properties.

In some embodiments, the foot platform is provided with a slippage-prevention means; preferably, grooves, dots, stripes, and the like. These structures prevent the rider's foot from slipping out of the stirrup during riding.

[0068] In some embodiments, the foot platform is disposed at an angle with the longitudinal direction of a foot placed upon the foot platform, wherein the angle is at least 30° to at most 60°; preferably 35° to 55°; more preferably 40 to 50°; most preferably 42 to 47; for example 45°. In a traditional stirrup the rider's foot is placed perpendicularly (i.e. 90° ± 10°) on the foot platform. However, this causes excessive pressure to be exerted on the tendons, which pressure runs vertically from the bottom of the rider's foot through the ankle along the leg. Over long periods of extreme use, this can cause various medical conditions ranging from simple impaired walking to severe pronation or supination of the foot. Accordingly, by placing the foot at a different angle the positioning of the rider's foot and/or leg in the stirrup may be improved, and it may also reduce also the vertical transmission of the pressure from the stirrup along the rider's leg, thereby minimizing strain in the ankle. This may substantially decrease the risk of medical concerns, in particular after prolonged periods of riding. Additionally, the increased surface area and adjusted centre of gravity may allow for the rider to have an improved sense of balance. Moreover, when hanging along the barrel of the horse the foot platform will be positioned at an angle, making it easier for the rider to engage with the foot platform when mounting and/or after slipping out, which may improve the user-friendliness and safety.

In some embodiments, the foot platform comprises a shock absorber. The shock absorber means may be a (passive) shock absorbing material or an (active) device, or a combination of both. A suitable example of a shock absorbing material may be an elastic polymer that can be compressed. A suitable example of a shock absorbing device may be a set of springs or coils that are configured to compress as a result of the shock, thus partially absorbing the force exerted on the rider's foot, ankle and/or leg.

[0069] In some embodiments, the stirrup is produced through a process selected from the group comprising injection moulding, fibre extrusion, film extrusion, sheet extrusion, pipe extrusion, blow moulding, rotomoulding, slush moulding, injection-stretch blow moulding and extrusion-thermoforming. Preferably, the stirrup is produced through injection moulding. Injected moulding allows for selecting and combining polymers to provide for improved performance and mechanical properties. For example, the injection moulded stirrup may better withstand extreme weather conditions, preserving the mechanical resistance and durability expected of the stirrup. Moreover, it may also allow easier adaptation of aesthetic features, such as pigments, surface treatments and surface printing.

[0070] The injection moulded stirrups may be formed by any suitable injection moulding process known to one of skill in the art. Injection moulding processes generally comprise heating the polymeric composition to form a molten polymer and subsequently forcing (i.e., injecting) the molten polymer into a mould cavity where the molten polymer fills the mould cavity thereby taking the desired shape of the mould cavity. Thereafter, the molten polymer inside the mould cavity cools and hardens to form a moulded article which is subsequently ejected from the mould.

[0071] In some embodiments, the stirrup is at least partially coated with at least one coating. The presence of a coating can have various benefits, for example improved durability (e.g. scratch-resistance, dirt-resistance) or improved aesthetics.

[0072] In some embodiments, the stirrup may have a span from at least 100 mm to at most 170 mm; preferably from 110 mm to 150 mm; more preferably from 115 mm to 145 mm; most preferably from 120 mm to 140 mm; for example 127 mm; for example 132 mm; for example 137 mm.

[0073] A stirrup may be manufactured in different dimensions. The most important parameter when producing the stirrup is the size of the rider's foot, which varies with age and gender. Accordingly, the span of the first arch may be adapted to better accommodate the width and height of the rider's foot. By changing the span of the first arch, the size of the foot platform will changed too. The span may typically vary between 150 mm to 100 mm, to allow the foot sufficient room to move, for instance during mounting and dismounting, yet without overextending so that the stirrup becomes too cumbersome and large.

[0074] In another aspect the present provides for a use of a stirrup according to an embodiment as described herein. Preferably, the use of the stirrup is for riding a horse.

[0075] In some embodiments, the stirrup is used during professional riding events; preferably cross country, dressage, eventing, (free) jumping and/or related disciplines and combinations thereof.

[0076] In an aspect, the present invention relates to a method for producing a stirrup, preferably a stirrup as described above.

[0077] In some embodiments, the method comprises the steps of:

- placing a metal insert in a mould; and,
- injection moulding a polymer into the mould around the metal insert.

Such a method forms a first arch, optionally provided with a means for mounting the stirrup, a foot platform, disposed along the span of the first arch; and a second, preferably inverted, arch that is arranged opposite of the first arch so that the foot platform is disposed in-between the first arch and the second arch.

[0078] In some preferred embodiments, the method comprises the steps of:

- placing a metal insert (400) in a mould; and,
- injection moulding a polymer into the mould around the metal insert (400); preferably overmoulding; thereby forming a stirrup (100) in one piece.

[0079] In some embodiments, the method comprises the steps of:

- injection moulding a polymer into a first mould; thereby forming a first stirrup-part;
- injection moulding a polymer into a second mould; thereby forming a second stirrup-part;
- inserting at least one metal insert onto or into the first or second stirrup-part; and,
- connecting the first stirrup-part (to the second stirrup-part, preferably through the at least one first or second coupling element; thereby encapsulating metal insert within the stirrup.

[0080] The first stirrup-part may partially comprise a first arch, optionally provided with a means for mounting the stirrup, a foot platform, disposed along the span of the first arch; and a second, preferably inverted, arch that is arranged opposite of the first arch so that the foot platform is disposed in-between the first arch and the second arch; preferably wherein the first stirrup-part comprises at least one first coupling element;

[0081] The second stirrup-part may partially comprise a first arch, optionally provided with a means for mounting the stirrup, a foot platform, disposed along the span of the first arch; and a second, preferably inverted, arch that is arranged opposite of the first arch so that the foot platform is disposed in-between the first arch and the second arch; preferably wherein the second stirrup-part comprises at least one second coupling element.

[0082] In some embodiments, the method comprises the step of moulding a polymer or a polymer blend into a stirrup according to an embodiment as described herein. The moulding may be performed through a process selected from the group comprising injection moulding, fibre extrusion, film extrusion, sheet extrusion, pipe extrusion, blow moulding, rotomoulding, slush moulding, injection-stretch blow moulding and extrusion-thermoforming. Preferably, the method is performed through injection moulding. Accordingly, the method is preferably performed using a using a moulding apparatus; preferably an injection moulding apparatus.

[0083] In some embodiments, the method for production of a stirrup comprises the steps of: a. (injection) moulding of the stirrup in two or more stirrup-parts, wherein at least one part thereof comprises at least one coupling element; b. inserting at least one metal insert onto or into a stirrup-part; and, c. connecting the two or more stirrup-parts through the at least one coupling element; thereby obtaining a stirrup.

[0084] In some embodiments, the method comprises the step of at least partially coating the stirrup with at least one coating. The presence of a coating can have various benefits, for example improved durability (e.g. scratch-resistance dirt-resistance) or improved aesthetics.

EXAMPLES

[0085] To better illustrate the properties, advantages and features of the present invention some preferred em-

bodiments are disclosed as examples with reference to the enclosed figures.

[0086] Accordingly, the present invention discloses many embodiments and adjustments as appreciated by those skilled in the art and the scope of the present invention is by no means limited to one the illustrative examples presented below.

Example 1: The stirrup's (100) shapes and features

[0087] Reference is first made to **Fig. 1**, which illustrates an embodiment of the stirrup (1000) for horse riding. The stirrup (1000) comprising a first arch (100) (consisting of an inner section (120) provided with a means for mounting (150) the stirrup; a foot platform (300); and a second, inverted arch (200). The foot platform runs along the spans of the first arch (100), from the base of the inner section (120) until the base of the virtual outer section that mirrors the inner section; thus forming a virtual full-arch. The second, inverted arch (200) is arranged to run opposite of the first arch (100) and connects to the foot platform (300) on at least one base. This configuration allows the second, inverted arch (200) to fully support any force (e.g. pressure) exerted upon the foot platform (300). Moreover, the half-open design of the embodiment illustrated by **Fig. 1** allows for easier and faster mounting and dismounting.

[0088] Secondly, reference is made to **Fig. 2**, which illustrates another embodiment of the stirrup (1000) for horse riding. The stirrup (1000) comprising a first arch (100), almost full, provided with a means for mounting (150) the stirrup; a foot platform (300); and a second, inverted arch (200). The first arch (100) essentially comprises two halves: namely, an inner section (120) configured for stability and an outer section (130) configured for ease-of-access. The outer section (130) for instance has one interval (135) large enough for a foot to pass through. Preferably, the inner section (120) is very rigid, to ensure high stability and durability. Optionally, the outer section (130) may be flexible, to allow minor bending and/or increased comfort when inserting a foot.

[0089] Thirdly, reference is made to **Fig. 3**, which illustrates another embodiment of the stirrup (1000) for horse riding. The stirrup (1000) comprising a first full-arch (100) provided with a means for mounting (150) the stirrup; a foot platform (300); and a second, inverted arch (200). The first arch (100) and the second, inverted arch (200) comprise two bases each, and are arranged so that each of the corresponding bases is connected to each other; thereby forming a circular/elliptical shape (i.e. depending on the shape of the respective arch). Additionally, the first arch (100) comprises one interval (135) to allow for easier mounting and dismounting, preferably in the outer section (130).

[0090] Fourthly, reference is made to **Fig. 4,** which illustrates another embodiment of the stirrup (1000) for horse riding. In particular, **FIG**. **4A** shows a frontal view and **FIG**. **4B** a rear view. The stirrup (1000) comprising a first full-arch (100) provided with a means for mounting (150) the stirrup; a foot platform (300); and a second, inverted arch (200). Similarly to above, the bases of the first arch (100) and second arch (200) are connected to each other, thereby forming a circular/elliptical shape (i.e. depending on the shape of the respective arch). The stirrup is lacking any interval or hinging means allowing for a more sturdy and robust design. Accordingly, the stirrup is particularly well-suited for professional riding events, such as free jump, wherein greater forces (e.g. pressure) are typically exerted on the foot platform and/or the stirrup. An exemplary embodiment of the latter is depicted in **Fig. 8** while in-use by a rider on a horse by mounting the stirrup (1000) to a saddle through a stirrup leather.

[0091] The stirrups illustrated in Example 1 were prepared by first blending the polymeric components in an extruder and by injection moulding them into a stirrup, or alternatively stirrup components that could be assembled in a stirrup.

Example 2: The metal insert (400) and fillers (250)

[0092] Reference is made to **Fig. 5A**, which illustrates an embodiment of the stirrup (1000) for horse riding comprising a metal insert (400). The metal insert is illustrated more clearly on **FIG. 5C.** As is shown, the metal insert (400) preferably has a curved elongated shape, the length of the metal insert (400) spans from the apex of the first arch (100) to the apex of the second arch (200), preferably along the inner section of the first arch (120) and along the inner section of the second arch (220). This allows the first and second arch to be structurally connected, thereby spreading out the total force exerted on the foot platform (e.g. pressure) and/or on the stirrup along the length of the stirrup. As a result the occurrence of stress-sensitive focal points is prevented.

An alternative embodiment of the metal insert is illustrated in **FIG. 5D.** This insert (400) extends to the foot platform (300) spanning along the second arch (200). This allows both sides (or ends) of the foot platform to be structurally connected, in addition to the first and second arch, thereby spreading out the total force exerted on the foot platform (e.g. pressure) and/or on the stirrup along the length of the stirrup. As a result the occurrence of stress-sensitive focal points is prevented further.

[0093] The metal insert further comprises one curvature situated at an extremity, in particular at the apex of the first arch (100), said curvature matching the shape of the adjacent first arch (100). This curvature allows for providing additional support to the means for mounting (150) the stirrup. Additionally, the metal insert also comprises one coupling element means, in this case a circular hole. The hole is designed to have a diameter equivalent to the corresponding coupling element situated on the stirrup (1000), in this case a protruding circle. Additional or alternative coupling elements may include a notch, screw, holes, and the like.

[0094] The placement of the metal insert (400) is

shown on **FIG**. **5B,** which shows a cross-sectional view of the stirrup (1000). The metal insert (400) is seen to be arranged inside the arch at the inward corner (i.e. the corner adjacent to the barrel of the horse), which is the main load bearing corner. **FIG**. **5C** shows a detailed view of such a curved elongated insert metal insert (400) spanning from the apex of the first arch (100) to the apex of the second arch (200). Alternatively, the metal insert (400) may extend to the foot platform (300) spanning along the second arch (200); as is shown in **FIG. 5D.**

An alternative assembly is depicted on **Fig. 6A** and **Fig. 6B**, which depict the stirrup produced in 2 stirrup-parts (1000a and 1000b). The primary difference between both stirrup-parts (1000a and 1000b) is the presence of (corresponding) coupling elements (450); namely, the first stirrup-part (1000a) shown on **Fig. 6A** comprises three coupling elements (450a) that are protruding circles, whereas the second stirrup-part (1000b) shown on **Fig. 6B** comprises three coupling elements (450b) that are circular holes. The circular holes have a diameter that corresponds with the diameter of the protruding circles and allow a coupling or connection of the first (1000a) and the second (1000b) stirrup-parts through sliding engagement. Additionally or alternatively other connecting means may be applied, such as adhesives (e.g. glue) and the like. Preferably at least one coupling element is provided through an opening in the metal insert (400), preferably a circular hole.

[0095] Furthermore, the metal insert (400) is also provided with a circular hole that has a diameter that corresponds with the diameter of the protruding circle at the inward corner. This is shown on **Fig. 6B** while overlapping with the coupling element (450) of the second stirrup-part (1000b). The metal insert can thus be easily and securely coupled between the first (1000a) and the second (1000b) stirrup-parts during assembly of the stirrup (1000). Once assembled, the stirrup (1000) will resemble the stirrup depicted on **Fig. 8.**

[0096] Reference is also made to **Fig. 7**, which shows several stirrups (100) comprising a filler (250). The filler (250) is placed within the opening of the second arch (200) so that the filler (250) fills up the second arch (200). The presence of a filler can serve to transfer pressure throughout the stirrup (1000) towards the second arch (200). Additionally, the filler may also have informative or aesthetic purposes. For example, the embodiments presented on **Fig. 7** show competitive details about the rider, depicted using the flag of the rider's country. This is particularly useful during competitive riding event to better distinguish the riders without having to look for other information source (e.g. details on the rider's back), which are sometimes not clearly visible on certain camera angles (e.g. zoom-in during replays).

[0097] Additionally, the stirrups (100) may also comprise a slippage-prevention means provided on the foot platform. For example, the embodiments presented on **Fig. 7** are provided with a plurality of protruding dots. Additional or alternative slippage-prevention means may include stripes, notches, hooks, tapes, and the like.

Example 3: The stirrup's (100) dimensions

[0098] A stirrup as described in the present invention may be manufactured in different dimensions. By varying the span the stirrup may be adapted to better accommodate the width and height of the rider's foot (e.g. age, sex, body and shoe type).

[0099] In an example, a stirrup intended for use by a child may have a span of 120 mm. In another example, a stirrup intended for use by a female rider may have a span of 127 mm. In another example, a stirrup intended for use by a male rider may have a span of 132 mm. In another example, a stirrup intended for use by a large male rider (e.g. heavy boots) may have a span of 137 mm. These span sizes are exemplary and may be customized or adapted to better suit the rider's needs (e.g. casual or professional), body and shoe type.

Claims

1. Stirrup (1000) for horse riding, comprising:

- a first arch (100), optionally provided with a means for mounting (150) the stirrup;
- a foot platform (300), disposed along the span of the first arch (100) and optionally comprising a shock absorber;
- a second, preferably inverted, arch (200) that is arranged opposite of the first arch (100) so that the foot platform (300) is disposed in-between the first arch (100) and the second arch (200); and,

wherein the stirrup comprises at least one metal insert (400).

2. The stirrup (1000) according to claim 1, wherein the metal insert (400) is positioned at least partly within the first arch (100) and at least partly within the second arch (200), preferably at least partly within the inner section of the first arch (120) and at least partly within the inner section of the second arch (220).

3. The stirrup (1000) according to any one of claims 1 or 2, wherein the metal insert (400) is a curved elongated insert spanning from the apex of the first arch (100) to the apex of the second arch (200); preferably wherein the metal insert extends to the foot platform (300) spanning along the second arch (200).

4. The stirrup (1000) according to any one of claims 1 to 3, wherein the metal insert (400) has at least one curvature situated at an extremity of the first and/or second arch (100, 200), wherein said curvature is adapted for supporting the adjacent arch (100, 200)

and/or foot platform (300); preferably wherein said curvature matches the shape of the adjacent arch (100, 200).

5. The stirrup (1000) according to any one of claims 1 to 4, wherein the metal is selected from the group comprising: steel, aluminium, titanium and/or an alloy thereof; preferably the metal is stainless steel.

6. The stirrup (1000) according to any one of claims 1 to 5, wherein the metal insert (400) is a twisted planar metal insert, for example twisted under an angle from at least 0.5° to at most 50°, for example from 2° to 40°, for example from 3° to 30°, for example from 4° to 20°, for example from 5° to 10°.

7. The stirrup (1000) according to any one of claims 1 to 6, wherein the shape of the first and/or second arch (100, 200) is triangular, semi-circular, circular, elliptical, parabolic, horseshoe, spiral, and/or is a combination of such shapes; for example a C, G, €, or 6-shape.

8. The stirrup (1000) according to any one of claims 1 to 7, wherein the stirrup (100) forms one solid piece, preferably wherein the stirrup (100) was injection-moulded around the metal insert.

9. The stirrup (1000) according to any one of claims 1 to 8, wherein the second arch (200) comprises a filler element (250) in the free space within the second arch (200); preferably wherein the filler element (250) fills up the free space within the second arch (200) partially or entirely.

10. The stirrup (1000) according to any one of claims 1 to 9, wherein the stirrup (1000) is a polymeric stirrup comprising a hardened polymer; preferably wherein the polymer is selected from the group comprising: polypropylene, polyethylene, polyamide; most preferably is polyamide.

11. The stirrup (1000) according to any of claims 1 to 10, wherein the stirrup (1000) is an injection-moulded stirrup.

12. The stirrup (1000) according to any one of claims 1 to 11, wherein the first arch (100) comprises an interval (135) and/or a hinging means, preferably adjacent to the means for mounting (150).

13. The stirrup (1000) according to any one of claims 1 to 12, wherein the foot platform is disposed at an angle with the longitudinal direction of a foot placed upon the foot platform, wherein the angle is from at least 30° to at most 60°; preferably from 35° to 55°; more preferably from 40° to 50°; most preferably 42° to 47°; for example 45°.

14. Method for producing a stirrup (1000), preferably a stirrup (1000) according to any of claims 1 to 13, wherein the method comprises the steps of:

- placing a metal insert (400) in a mould; and,
- injection moulding a polymer into the mould around the metal insert;

thereby forming a first arch (100), optionally provided with a means for mounting (150) the stirrup, a foot platform (300), disposed along the span of the first arch (100); and a second, inverted, arch (200) that is arranged opposite of the first arch (100) so that the foot platform (300) is disposed in-between the first arch (100) and the second arch (200).

15. Method for producing a stirrup (1000), preferably a stirrup (1000) according to any of claims 1 to 13, wherein the method comprises the steps of:

- injection moulding a polymer into a first mould; thereby forming a first stirrup-part (1000a), the first stirrup-part (1000a) partially comprising a first arch (100), optionally provided with a means for mounting (150) the stirrup, a foot platform (300), disposed along the span of the first arch (100); and a second, inverted, arch (200) that is arranged opposite of the first arch (100) so that the foot platform (300) is disposed in-between the first arch (100) and the second arch (200); preferably wherein the first stirrup-part (1000a) comprises at least one first coupling element (450a);
- injection moulding a polymer into a second mould; thereby forming a second stirrup-part (1000b), the second stirrup-part (1000b) partially comprising a first arch (100), optionally provided with a means for mounting (150) the stirrup, a foot platform (300), disposed along the span of the first arch (100); and a second, inverted, arch (200) that is arranged opposite of the first arch (100) so that the foot platform (300) is disposed in-between the first arch (100) and the second arch (200); preferably wherein the second stirrup-part (1000b) comprises at least one second coupling element (450b);
- inserting at least one metal insert (400) onto or into the first or second stirrup-part (1000a, 1000b); and,
- connecting the first stirrup-part (1000a) to the second stirrup-part (1000b), preferably through the at least one first or second coupling element (450a,450b); thereby encapsulating metal insert (400) within the stirrup (1000).

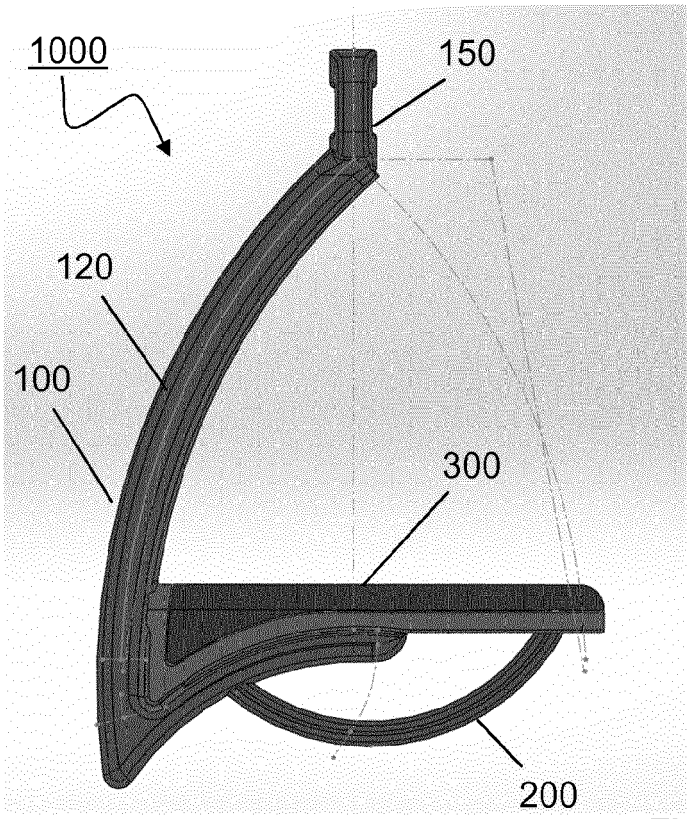

FIG. 1

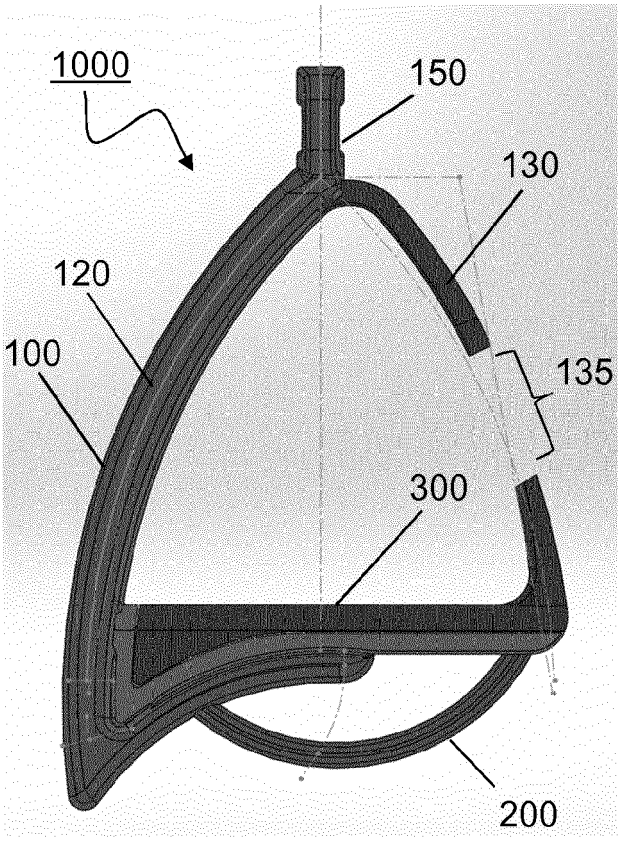

FIG. 2

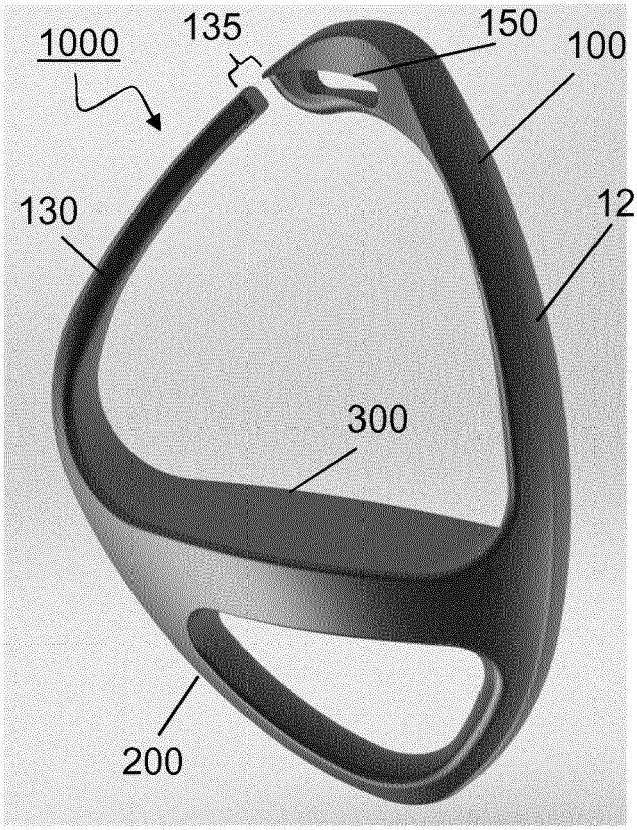

FIG. 3

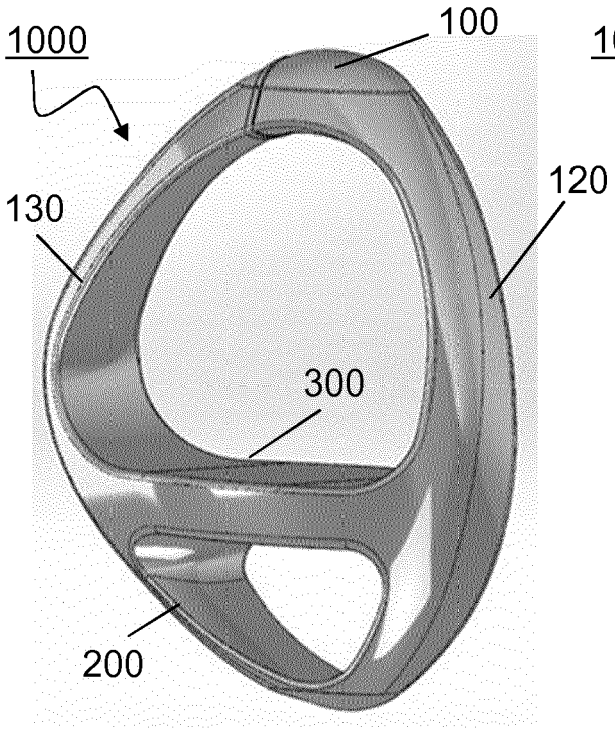

FIG. 4A

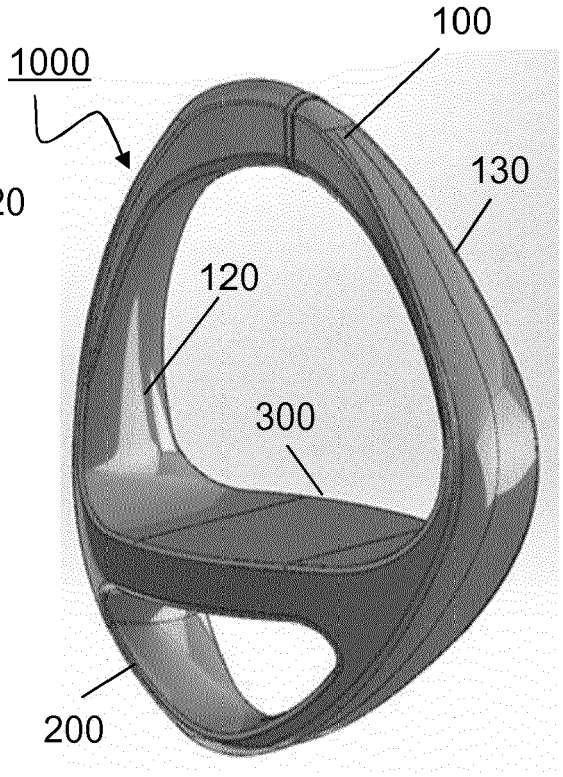

FIG. 4B

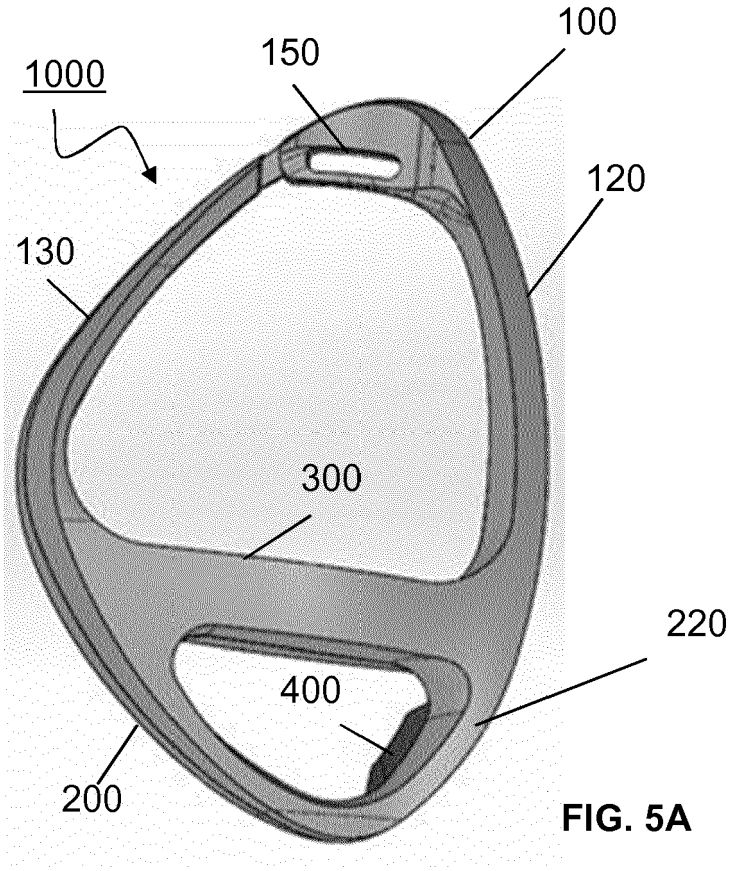
1000
150
100
120
130
300
220
400
200

FIG. 5A

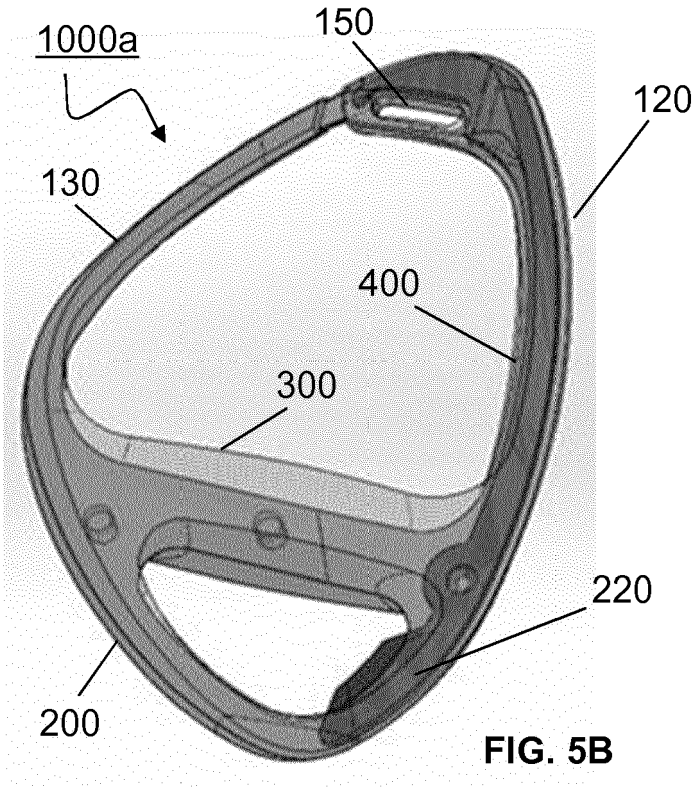
1000a
150
120
130
400
300
220
200

FIG. 5B

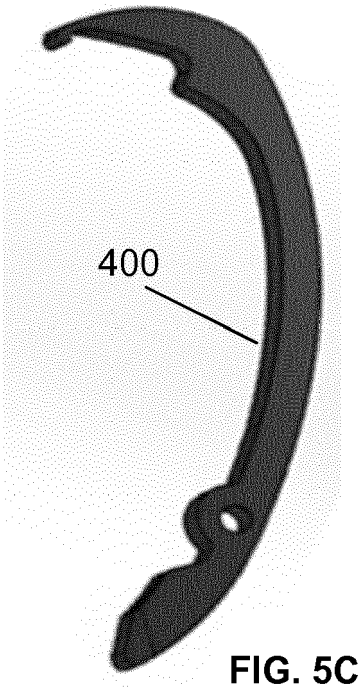

FIG. 5C

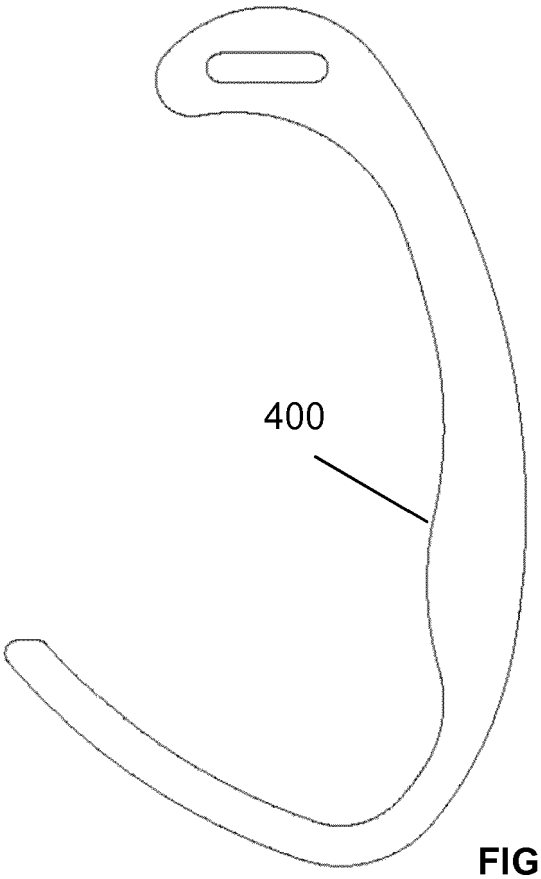

FIG. 5D

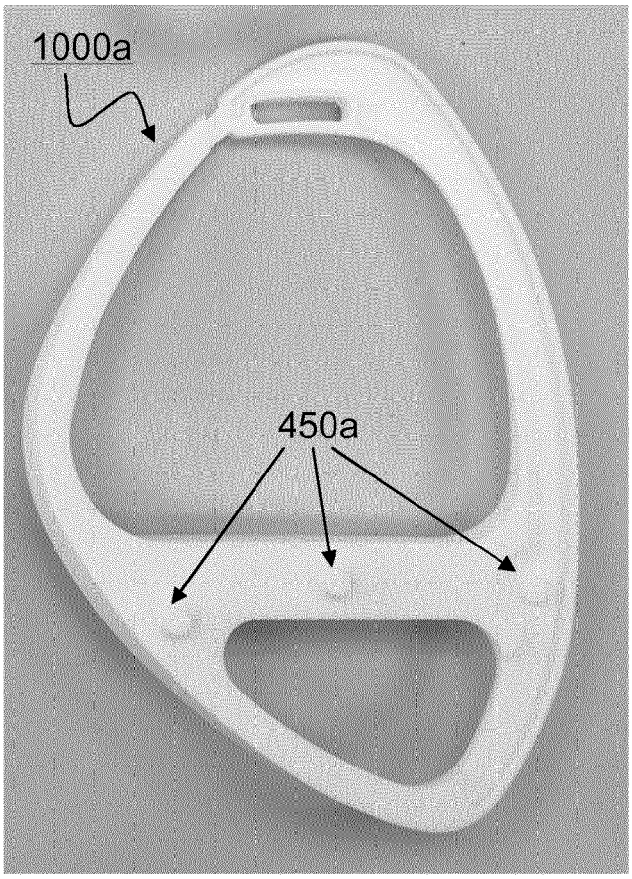

FIG. 6A

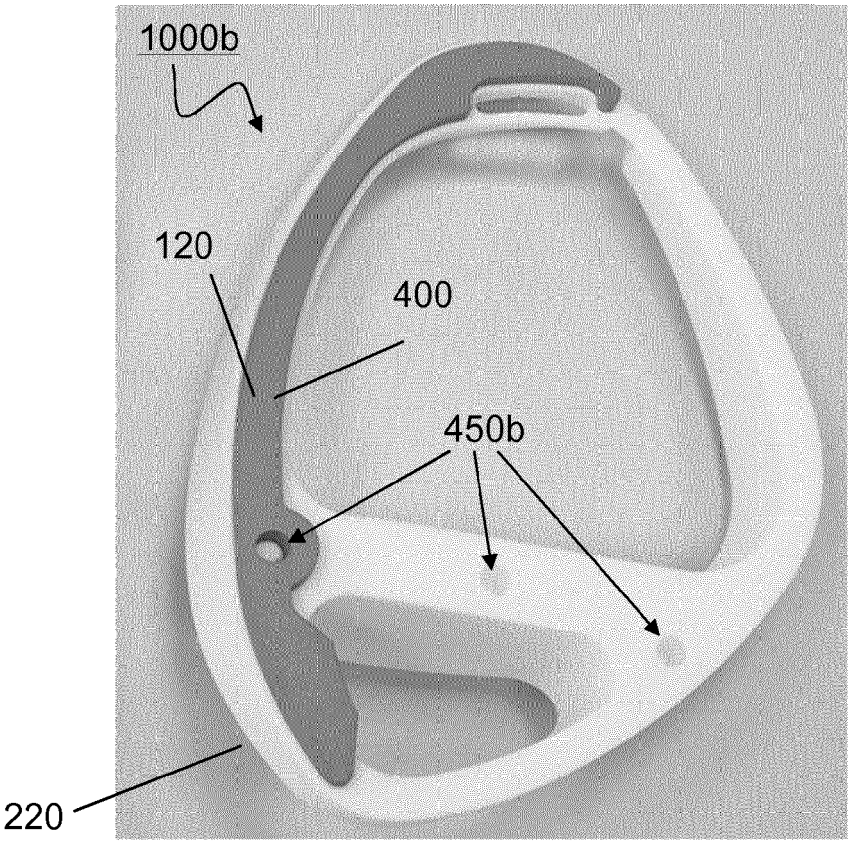

FIG. 6B

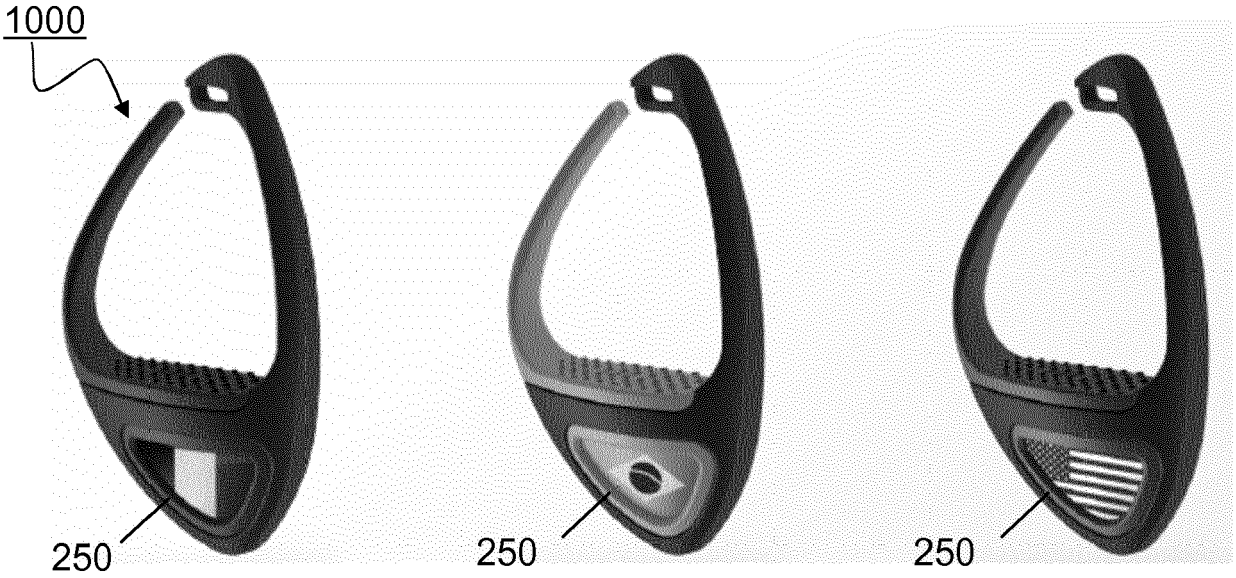

FIG. 7

FIG. 8

Europäisches Patentamt
European Patent Office
Office européen des brevets

EUROPEAN SEARCH REPORT

Application Number
EP 17 20 6389

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
Y A	FR 2 880 340 A1 (PERROT MICHEL CLAUDE [FR]) 7 July 2006 (2006-07-07) * abstract * * page 4, line 13 - page 11, line 27 * * figures 1-5 * -----	1,2,4-7, 10-13 3,8,9, 14,15	INV. B68C3/00 B68C3/02
Y A	WO 2017/182941 A2 (ACAVALLO S R L [IT]) 26 October 2017 (2017-10-26) * abstract * * paragraphs [0013] - [0026] * * figures 1-4,8 * -----	1,2,4-7, 10-13 3,8,9, 14,15	

TECHNICAL FIELDS SEARCHED (IPC)

B68C

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	15 May 2018	Espeel, Els

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)

ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 17 20 6389

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
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

15-05-2018

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
FR 2880340 A1	07-07-2006	NONE	
WO 2017182941 A2	26-10-2017	NONE	

EPO FORM P0459

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