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(54) BLADE HOLDER DEVICE, BLADE HOLDER ASSEMBLY, ICE SKATE BLADE AND ICE SKATE

(57) Blade holder device (20) which extends along a longitudinal axis (L12) and which comprises a blade holder (20) and a locking device (40) which is mounted within said blade holder (20) in a manner that the locking device (40) is rotatable about a locking device axis (B), wherein the rotatable locking device (40) is configured to mount a hook (36) of an ice skate blade (30) to the blade holder (20) and comprises at least one radial irregularity with respect to the device axis (B) for interaction between the radial irregularity and a hook of an ice skate blade (30).

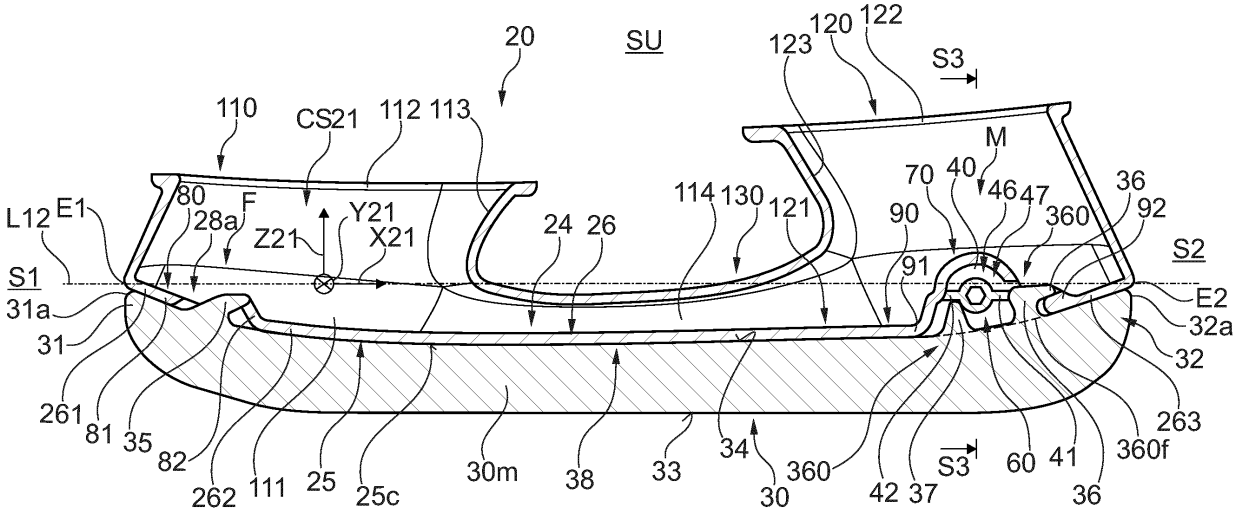


Fig. 2

EP 4 566 686 A1

Description

[0001] The present invention relates to a blade holder device, a blade holder assembly with a blade holder device, an ice skate blade and an ice skate. The blade holder device allows the mounting of an ice skate blade and the replacement of the by another ice skate blade.

[0002] Ice skate assemblies comprising an ice skate blade replacement mechanism are well known in the art.

[0003] EP2478937A1 shows an ice skate blade assembly comprising an ice skate blade, a blade holder having a longitudinal groove to receive the ice skate blade and a finger accessible single actuator to release the ice skate blade from the blade holder. By applying pressure by one or two fingers to said single actuator, the releasing process is initiated in which in a first step, the wedging of the ice skate blade within the blade holder is released and in a second step, thanks to an integrated ejection mechanism, the ice skate blade is pushed out of the blade holder automatically.

[0004] CA3065238A1 shows an embodiment of a blade holder assembly, with a blade having front and rear projections as well as an intermediate projection in a curved hook shape extending upwardly and forwardly above the elongated top edge of the blade. The projections are removably engageable in their respective holder-recesses and moveable together within their respective holder-recesses to allow relative movement between the blade and holder between the engagement position where the projections are prevented from disengagement from the holder-recesses and the disengagement position where the projections are removed from their respective holder-recesses. Supplementary, a locking arm is movable between a locked position maintaining the blade in the engagement position, and an unlocked position allowing the blade to move to the disengagement position.

[0005] WO2019218070A1 shows a skate blade holder with a blade attachment mechanism comprising a boot and a blade assembly; the blade assembly including: a blade holder attached beneath a sole of the boot, the blade holder having a bottom surface defining a groove and recesses extending upwardly from the groove; a blade including a body defining an ice-engaging edge and a top edge opposite the ice-engaging edge, projections extending from the top edge and away from the ice-engaging edge, a slot defined in one of the projections, the blade moveable with respect to the blade holder between an engagement position in which the top edge is received in the groove and a disengagement position in which the blade is disengaged from the recesses and the groove; a locking pin displaceable within the blade holder along a longitudinal axis between a locked position in which the locking pin is in engagement with the slot and an unlocked position in which the locking pin is disengaged from the slot; and a pin actuator received within a socket of the blade holder, the socket having at least one socket opening located on one of opposed lateral sides of the blade holder, the pin actuator engageable by a user for rotating the pin actuator about the longitudinal axis, the pin actuator in driving engagement with the locking pin such that rotation of the pin actuator induces translation of the locking pin along the longitudinal axis from the locked position to the unlocked position.

[0006] US10894200B2 shows an ice skate blade assembly with releasable blade, including a blade holder that releasably receives an ice skate blade therein. The blade has first and edge portion receiving hooks projecting upwardly from respective first and second ends of the blade. The holder has a bridge portion with a groove to receive the main portion of the blade therein and first and second pedestals at either end of the bridge portion with cavities to receive the first and edge portion receiving hooks therein. An actuator mounted within the second pedestal includes a hook-receiving portion slidably movable along a curved sliding path between one end portion parallel to the longitudinal axis of the assembly in a locked position retaining the edge portion receiving hook thereon and an opposing released position. The actuator is recessed into the pedestal and includes a tool receiving aperture so that a tool is used to displace the actuator.

[0007] It is an object of the present invention to provide a blade holder device that allows the user to mount an ice skate blade on the blade holder device and to replace the same by another ice skate blade and which is an alternative solution to known solutions of this kind. In particular, an object of the present invention is to provide a blade holder device that allows the exchange of an ice skate blade which is mounted on the blade holder device by another ice skate blade in an easy, fast and safe way, wherein the respective ice skate blade can be mounted on the blade holder device such that the ice skate blade is safely mounted on the blade holder device.

[0008] A further object of the invention is to provide an ice skate blade assembly with a blade holder device according to the invention an ice skate blade in the mounting condition.

[0009] A further object of the invention is to provide an ice skate blade which is an alternative for exchangeable ice skate blades known from the state of the art. Particularly, a further object of the invention is to provide an ice skate blade for being used in an ice skate blade assembly with a blade holder device according to the invention.These objects are achieved by the combination of features of the independent claims. Further embodiments of the invention are described in the subclaims which are referred to respective independent claims.

[0010] According to the invention, a blade holder device is provided, the blade holder device is provided comprising a blade holder body and a locking device, wherein the blade holder body comprises:

a base portion comprising a blade receiving section and a pivot bearing device with a pivot bearing surface, wherein the blade receiving section comprises a bearing groove which extends in a longitudinal axis between a first end and a

second end, in a width direction and in a height direction, wherein the bearing groove opens from a groove bottom surface to a lower side and is configured to accommodate a blade engaging portion of an ice skate blade for being mounted on the blade holder body in a mounting condition, wherein blade receiving section comprises edge portions forming an opening in the groove bottom surface between edge portions,

a fastening device which extends from the base portion in the height direction and which is configured to fasten the blade holder device to a sole of a boot on an upper side of the blade holder device, wherein the pivot bearing device is located in a bearing section recess of the blade holder body which extends from the opening in the groove bottom surface in the height direction to a through-hole in the fastening device, which extends transversely the longitudinal axis, wherein the bearing section recess is configured to receive an interacting hook device of an ice skate blade and to allow an end sectio of the interacting hook device to be moved into the engagement space until the end section rests against an edge portion of the base portion in a mounting condition,

wherein the blade holder device comprises a fixation device which, in the mounting condition, connects a first end section of the ice skate blade to a first end section of the base portion,

wherein the locking device comprises a locking device main body with an outer circumferential surface, which comprises a locking device bearing surface and at least one surface irregularity which radially extends from the outer circumferential surface, wherein the pivot bearing surface and the locking device bearing surface are configured to allow a rotational movement of the locking device around the central axis of the through-hole by providing an effective rotation surface,

wherein the locking device is configured such that, in the mounting condition, in a first rotational position, the at least one surface irregularity contacts the end section of the interacting hook device extending into the recess such that the end section is held in a locking state in which the same rests against an abutment portion of the blade holder body, and, in a second rotational position, the at least one surface irregularity is displaced from the end section of the interacting hook device and provides a release state of the end section of the ice skate blade, in which the interacting hook device has a freedom of movement between the edge portion and the at least one surface irregularity allowing the interacting hook device to be moved along the longitudinal axis and further out of the bearing section recess.

[0011] In each of the embodiments of the blade holder device according to the invention with otherwise each combination of features of the holding device described herein, the blade holder device can be realized in such a way that the pivot bearing device comprises a guide device which partly surrounds the central axis in the circumferential direction and which comprises a guide slot which opens in the pivot bearing surface and which extends in the radial direction from the pivot bearing surface, wherein the at least one surface irregularity of the outer circumferential surface in a rotational area of the locking device protrudes in the radial direction from the effective rotation surface into the guide slot, thereby providing a guiding of the locking device against movements in the axial directions. In this case, 50% to 100% of the circumferential extension of the guide device may be located above the through-hole.

[0012] In each of the embodiments of the blade holder device according to the invention with otherwise each combination of features of the holding device described herein, the blade holder device can be realized in such a way that the bearing section recess which extends from the bearing groove in the height direction to the through-hole, comprises a main recess portion with the opening and an engagement space, which extends from the main recess portion along the longitudinal axis which is partly delimited by the abutment portion of the blade holder body.

[0013] In each of the embodiments of the blade holder device according to the invention with otherwise each combination of features of the holding device described herein, the blade holder device can be realized in such a way that the abutment portion of the blade holder body is an edge portion of the base portion.

[0014] In each of the embodiments of the blade holder device according to the invention with otherwise each combination of features of the holding device described herein, the blade holder device can be realized in such a way that the fixation device comprises first recess with an opening in the groove bottom surface of the bearing groove for receiving the first hook of the ice skate blade.

[0015] In each of the embodiments of the blade holder device according to the invention with otherwise each combination of features of the holding device described herein, the blade holder device can be realized in such a way that the fastening device at least one fastening support comprises a first fastening support and a second fastening support, each of which extend from the base portion in the height direction.

[0016] In each of the embodiments of the blade holder device according to the invention with otherwise each combination of features of the holding device described herein, the blade holder device can be realized in such a way that the fastening device comprises a first fastening support and a second fastening support, each of which extend from the base portion in the height direction.

[0017] In each of the embodiments of the blade holder device according to the invention with otherwise each combination of features of the holding device described herein, the blade holder device can be realized in such a way that the the locking device comprises a main body with the locking device bearing surface and a locking pin,

wherein the main body comprises a through-hole having a middle axis which intersects the locking device axis,

wherein the locking pin comprises a first end section and a second end section lying opposed to the first end section and is arranged in the through-hole, wherein at least one of the end sections protrude from the through-hole forming a respective surface irregularity which radially extends from the outer circumferential surface.

[0018] In each of the embodiments of the blade holder device according to the invention with otherwise each combination of features of the holding device described herein, the blade holder device can be realized in such a way that the at least one surface irregularity comprises an excentric surface irregularity of the locking device which is realized by an excentric portion which protrudes from the main body in the radial direction.

[0019] In each of the embodiments of the blade holder device according to the invention with otherwise each combination of features of the holding device described herein, the blade holder device can be realized in such a way that the outer pivot bearing surface is formed at least partially as a cylindrical outer surface.

[0020] In each of the embodiments of the blade holder device according to the invention with otherwise each combination of features of the holding device described herein, the blade holder device can be realized in such a way that the inner pivot bearing surface is formed at least partially as a cylindrical inner surface. In this case, the inner pivot bearing surface is formed from a component the cross-section of which has at least partly the form of a polygon.

[0021] In each of the embodiments of the blade holder device according to the invention with otherwise each combination of features of the holding device described herein, the blade holder device can be realized in such a way that the first end section is a front end section of the blade holder device and the second end section is a rear end section of the blade holder device, or alternatively that the first end section is a rear end section of the blade holder device and the second end section is a front end section of the blade holder device.

[0022] According to a further aspect of the invention, a blade holder assembly is provided, the blade holder assembly comprising a blade holder device according to the invention and an ice skate blade, mounted on the blade holder device in the mounting condition.

[0023] According to a further aspect of the invention, an ice skate is provided, the ice skate comprising:

a blade holder assembly which comprises a blade holder device according to one of the preceding claims and an ice skate blade, mounted on the blade holder device in the mounting condition and

a skate boot which is fastened to a boot connecting section of the fastening device at the upper side thereof.

[0024] According to a further aspect of the invention, a blade holder assembly is provided, the blade holder assembly comprising:

According to a further aspect of the invention, an ice skate blade for mounting on a blade holder device in a mounting condition is provided, the ice skate blade extending in a blade longitudinal axis (A) between a first end and a second end and comprising a main skate body and an interacting hook device which extends from the main skate body transversely to the blade longitudinal axis for providing the mounting condition,

wherein the interacting hook device comprises at least one extension for locking the ice skate blade to the blade holder device which comprises an undercut surface, which faces the second end and is configured to receive an edge portion of the blade holder device, the edge portion delimiting a recess for receiving the interacting hook device and which comprises a surface which faces the first end, and an entrainment extension which lies between the first end and the at least one extension for locking the ice skate blade to the blade holder device,

wherein the shortest distance in the blade longitudinal axis (A) between a point on at least a portion of a surface which faces the first end and a point on at least a portion of the back surface which faces the second end amounts between 5 mm and 50 mm.

[0025] In particular, an ice skate blade and an ice skate blade assembly extending along a longitudinal axis, comprising a blade holder, an ice skate blade and a rotatable locking device which is mounted in said blade holder and rotatable about a device axis. Said rotatable locking device has at least partially some radial irregularities with respect to said device axis. Said ice skate blade has a first end and a second end, an ice contacting surface and an upper surface opposite said ice

contacting surface. Said upper surface comprises a first hook proximate to said first end of said ice skate blade and a edge portion receiving hook proximate to said second end of said ice skate blade. Said first and edge portion receiving hooks both extend upwardly from said upper surface and towards the same direction with respect to said longitudinal axis. Said ice skate blade assembly is further characterized in that said ice skate blade can be moved at least partially along said longitudinal axis by rotating said rotatable locking device about said device axis, whereby said radial irregularities of said rotatable locking device interact with said ice skate blade. Preferably, the unlocking process is executed by rotating said rotatable locking device about said device axis, whereby said radial irregularities of said rotatable locking device interact with and move said ice skate blade at least partially along said longitudinal axis to unhook said first and edge portion receiving hooks of said ice skate blade from said blade holder. Preferably, the locking process is executed by rotating said rotatable locking device about said device axis in the opposite direction with respect to said unlocking process, whereby said radial irregularities of said rotatable locking device interact with and move said ice skate blade at least partially along said longitudinal axis to hook said first and edge portion receiving hooks of said ice skate blade with said blade holder. With such a solution, the ice skate blade can be hooked with and/or unhooked from the blade holder just by rotating the rotatable locking device and therefore without touching the ice skate blade by hand which will eliminate the risk of cutting injuries due to the sharp edges on the ice skate blade. Thanks to the high torque that can be applied with such a rotatable locking device and potentially a corresponding tool, this process is functional even when the ice skate blade sits tight or is even stuck in the respective recess of the blade holder. Due to the simplicity of such a solution, even inexperienced or youth people can execute the process easily.

[0026] Preferably, said upper surface further comprises at least one additional projection extending upwardly from said upper surface, having a side surface to interact with said radial irregularities of said rotatable locking device. Having such additional projections can be a convenient way to provide interaction surfaces which can be configured such to ensure optimal power transmission.

[0027] Preferably, said unlocking process is extended by a subsequent movement, whereby said radial irregularities of said rotatable locking device interact with and move said ice skate blade downwards in the area of said rotatable locking device. With such a subsequent movement, the ice skate blade can be further separated from, or even completely moved out of the blade holder in the area of the rotatable locking device. In other words, the contact surface between the ice skate blade and the blade holder can be further minimized and therefore the removal of the ice skate blade from the blade holder by hand can be even more simplified, especially when the ice skate blade sits tight or is even stuck in the respective recess of the blade holder.

[0028] Preferably, said edge portion receiving hook has a back surface to interact with said radial irregularities of said rotatable locking device during said locking process. With such a solution, the edge portion receiving hook can have an additional function, which would otherwise require an additional projection and therefore complicate the shape of the ice skate blade and increase its weight.

[0029] Preferably, said edge portion receiving hook further has a top surface to interact with said radial irregularities of said rotatable locking device during said subsequent movement of said extended unlocking process. With such a solution, the edge portion receiving hook can have an additional function, which would otherwise require an additional projection and therefore complicate the shape of the ice skate blade and increase its weight.

[0030] Preferably, said ice skate blade further has an end stop surface to serve as an end stop for said rotatable locking device, characterized in that said radial irregularities of said rotatable locking device abut said end stop surface when said ice skate blade is in the locked position. With such a solution, the rotatable locking device cannot be further rotated about the device axis in the locking direction once the ice skate blade is in the locked position and hence, the user has an unambiguous feedback that the locking process is completed.

[0031] Preferably, said additional projection is providing said end stop surface. With such a solution, the additional projection can have an additional function, which would otherwise require another additional projection and therefore complicate the shape of the ice skate blade and increase its weight.

[0032] Preferably, said first end is the front end and said second end is the rear end of the ice skate blade, or alternatively, said first end is the rear end and said second end is the front end of the ice skate blade, to ensure flexibility regarding any potential design preferences.

[0033] Preferably, said first and edge portion receiving hooks both extend upwardly from said upper surface and towards the second end of the ice skate blade, or alternatively, said first and edge portion receiving hooks both extend upwardly from said upper surface and towards the first end of the ice skate blade, to ensure flexibility regarding any potential design preferences.

[0034] Preferably, said rotatable locking device consists of individual parts, namely at least one main body, and at least one elongated locking pin which is mounted in a respective mounting hole in said at least one main body and provides said radial irregularities with respect to said device axis by sticking out of said at least one main body. With such a solution, the assembly process can be solved by pushing the at least one main body along the device axis into the respective mounting hole in the blade holder in a first step, and in a second step, the at least one elongated locking pin can be pushed from the longitudinal groove into the respective mounting hole in the at least one main body. To disassemble the device, the at least

one elongated locking pin can be pulled out of the at least one main body through the longitudinal groove by using a standard needle nose pliers in a first step, and in a second step, the at least one main body can be pushed along the device axis, out of the blade holder. Consequently, such an embodiment allows an easy and quick replacement of any component of the rotatable locking device.

[0035] Preferably, said rotatable locking device comprises at least one damping element creating a friction between said rotatable locking device and the respective mounting hole in said blade holder. With such a solution, the rotatable locking device can be prevented from rotating accidentally about the device axis. In other words, due to the at least one damping element, a substantial torque will be needed to initiate a rotation of the rotatable locking device about the device axis.

[0036] Preferably, said rotatable locking device comprises at least one damping element creating a friction between said at least one main body and said at least one elongated locking pin. With such a solution, the at least one elongated locking pin can be prevented from falling out of the assembly when the ice skate blade is not in the locked position. In other words, due to the at least one damping element, a substantial force will be needed to move the at least one elongated locking pin out of the respective mounting hole in the at least one main body.

[0037] Preferably, said rotatable locking device comprises at least one damping element creating a friction between said rotatable locking device and said respective mounting hole in said blade holder, and between said at least one main body and said at least one elongated locking pin at 6 the same time. With such a solution, the rotatable locking device can be prevented from rotating accidentally about the device axis, and at the same time, the at least one elongated locking pin can be prevented from falling out of the assembly when the ice skate blade is not in the locked position.

[0038] The term "along" herein means, in the context of a directional indication mentioned herein, which may in particular also relate to the course of a contour line or a surface or a direction of a component or a structural component such as an axis or a shaft or a center axis thereof, with respect to a reference direction or a reference axis, that a section of the course or the tangent to a respective contour line or respective surface or the direction in an explicitly or implicitly predetermined viewing direction deviates locally or in sections at an angle of at most 45 degrees and in particular of at most 30 degrees from the respective reference direction or reference axis, respectively, to which the respective contour line or respective surface or the direction is related.

[0039] The term "transverse" herein means in the context of a directional indication mentioned herein, which may in particular also concern the course of a contour line or a surface or a direction of a component or a structural component such as an axis or a shaft or a central axis thereof, with respect to a reference direction or a reference axis, that a section of the course or the tangent to a respective contour line or respective surface or the direction in an explicitly or implicitly predetermined viewing direction deviates locally or in sections with an angle which is between 45 degrees and 135 degrees, and preferably with an angle which is between 67 degrees and 113 degrees, from the respective reference direction or reference axis to which the respective directional information is related.

[0040] The term "distance", in particular between two surfaces, is understood herein to mean in particular the shortest distance.

[0041] A "longitudinal direction" or another reference direction of a reference line, such as in particular a central axis or a centrally extending line or a center line of at least one structural component or of a part and in particular of a guideway, results herein in particular as a connecting line of the centers of gravity of the respective smallest cross-sectional areas of the respective structural component along a determined or predetermined direction or between two determined or predetermined ends. In the case that the reference line can be curved or at least partially curved, the reference direction may generally be understood as a local longitudinal direction. However, the reference direction herein may also be understood as the direction of a rectilinearly defined reference line, wherein a line whose attitude relative to the curved line results in the smallest deviation between these lines or the smallest deviation area is used to determine the rectilinear reference line. The same applies in case that a straight reference line is to be derived from a curved line.

[0042] The term "elongate" in relation to a component and in particular in relation to a leaf spring or leaf spring arrangement is understood herein to mean that a first length of the component, which is obtained in a first longitudinal direction, is at least 1.2 times greater than a second length of the component, which is obtained in a second longitudinal direction which is perpendicular to the first longitudinal direction and the thickness direction. In particular, the first length can be the longest length in terms of amount. The aforementioned lengths may also result in a reference plane, which may in particular be a center plane.

[0043] A longitudinal direction of a component can be understood herein in particular as the aforementioned first longitudinal direction and a width direction can be understood herein in particular as the aforementioned second longitudinal direction.

[0044] The term "substantially" in relation to a feature or value is understood herein in particular to mean that the feature contains a deviation of 20% and especially of 10% from the feature or its geometric property or value.

[0045] A "curved course" of a line or edge or surface means that the surface, viewed along a reference direction, comprises no corner over the entire width running transverse to the reference direction, i.e. comprises a differentiable course.

[0046] In this context, "curvature" of a component or a surface of a component along a direction, e.g. along a longitudinal

direction, means that the component curves along this direction. The curvature is visible in its course in a viewing direction transverse to this direction and can be visible, for example, along a width direction of the component.

[0047] In this context, "orientation" in relation to a surface and in particular a surface is understood to mean the normal to the respective surface. In the case that the surface in question is not a straight surface but, for example, a curved surface, the normal to a straight surface of the same size can be used to determine the surface normal, the attitude of which relative to the curved surface results in the smallest total deviation.

[0048] An "extension" of a surface section is understood to be a direction of a planar surface section which runs along the referenced surface section and, in relation to the latter, if the latter comprises curved sections or sections of different orientation, has an attitude such that the sum of the deviation amounts between the two surface sections is minimal. With reference to a length amount of the extension of a surface section, a length of a fictitious surface section of the same size in a direction to be defined is understood herein, which has an attitude relative to the referenced surface section at which the sum of the deviation amounts between the two surface sections is minimal.

[0049] The term "one-piece" in relation to a part or component is understood herein to mean that the part or component is manufactured as a single piece. In this regard, the part or component may be formed from several parts or parts that are connected or coupled or joined together. In this respect, the term "manufactured from one piece" is understood to mean that the part or component is manufactured from a single-piece starting workpiece.

[0050] In this context, the logical link "or" in relation to two alternatives is understood to mean only one or the other of the alternatives, unless otherwise specified.

BRIEF DESCRIPTION OF THE DRAWINGS

[0051] Preferred embodiments of the invention are described in the following with reference to the drawings, which are for the purpose of illustrating the present preferred embodiments of the invention and not for the purpose of limiting the same. Herein, the description of features or components of embodiments according to the invention is to be understood as meaning that a respective embodiment according to the invention, unless this is explicitly excluded, may also comprise at least one feature of another embodiment, in each case as an additional feature of this respective embodiment or as an alternative feature replacing another feature of this respective embodiment. In the drawings,

figure 1 shows a side view of an ice skate blade assembly comprising an embodiment of the blade holder according to the invention, an ice skate blade according to the invention and a rotatable locking device according to the invention;

figure 2 shows a section view of the ice skate blade assembly according to figure 1, in which the ice skate blade is in the locked position;

figure 3 shows a section view of the ice skate blade assembly according to section line S3-S3 in figure 2;

figure 4 shows a section view of the ice skate blade assembly according to figure 1, in which the ice skate blade is removed from the blade holder;

figure 5 shows a section view of the ice skate blade assembly according to figure 4;

figure 6 shows a section view of the ice skate blade assembly according to figure 1, in which the unlocking process gets initiated;

figure 7 shows a section view of the ice skate blade assembly according to figure 1, in which the subsequent movement of the unlocking process gets initiated;

figure 8 shows a section view of the ice skate blade assembly according to figure 1, in which the unlocking process is completed;

figure 9 shows a section view of the ice skate blade assembly according to figure 1, in which the locking process gets initiated;

figure 10 shows a side view of the rotatable locking device of the ice skate blade assembly according to figure 1;

figure 11 shows a front view of the rotatable locking device of the ice skate blade assembly according to figure 1;

figure 12 shows a top view of the rotatable locking device of the ice skate blade assembly according to figure 1;

figure 13 shows a perspective view of the rotatable locking device of the ice skate blade assembly according to figure 1;

figure 14 shows an exploded perspective view of the ice skate blade assembly according to figure 1 in which the ice skate blade is not shown and the rotatable locking device is shown in a preferred embodiment;

figure 15 shows a section view of the ice skate blade assembly according to figure 1, in which the ice skate blade is in the locked position and the rotatable locking device is shown in a preferred embodiment;

figure 16 shows the ice skate blade assembly according to figure 1, in which the rotatable locking device is shown in a particularly preferred embodiment;

figure 17 shows a section view of the ice skate blade assembly according to figure 16;

figure 18 shows a detail view of the ice skate blade assembly according to figure 17;

figure 19 shows the particularly preferred embodiment of the rotatable locking device of the ice skate blade assembly according to figures 16 to 18 in perspective view;

figure 20 shows a rear section of the ice skate blade assembly with a further embodiment of the blade holder device according to the invention;

figure 21 shows a rear section of the ice skate blade assembly with a further embodiment of the blade holder device according to the invention;

figure 22 shows a rear section of the ice skate blade assembly with a further embodiment of the blade holder device according to the invention.

[0052] Figures 1 and 2 show an ice skate blade assembly 10 extending along a blade longitudinal axis A. The ice skate blade assembly 10 is herein also referred to as blade holder assembly 10. The blade holder assembly 10 comprises a blade holder device 20 and an ice skate blade 30.

[0053] The blade holder device 20 extends along a longitudinal axis L12 of the same between a first end E1 of the blade holder device 2, which lies at a first side S1 thereof, and a second end E2 of the blade holder device 2, which lies at a second side S2 thereof, and is configured for being fastened to the sole of a skate boot. For this, the blade holder device 20 generally comprises a fastening device G extending, transversely to the longitudinal axis L12, between a lower side SL to an upper side SU of the blade holder body 21 and comprising a boot connecting device H which is configured to be connected or fastened to the sole of a skate boot. Herein, the direction which runs transversely to the longitudinal axis L12 from the lower side SL to an upper side SU of the blade holder device 20 is defined as height direction,

[0054] The combination of the blade holder assembly 10 and the skate blade 30 is herein defined as ice skate.

[0055] The blade holder device 20 comprises a blade holder body 21 and a locking device 40. The blade holder body 21 is preferably made as one piece, preferably by a casting method. In particular, the blade holder body 21 may be made of plastic.

[0056] The blade holder body 21 particularly comprises a base portion 24 which extends along the longitudinal axis L12, particularly between the first end E1 and the second first end E2, and which lies at the from the lower side SL to an upper side SU of the blade holder device 20. The base portion 24 comprises a bearing groove 25 which is open to the lower side SL and which opens in a direction opposite to the height direction. The bearing groove 25 has a width w, which defines a width direction of the blade holder body 21 or the blade holder device 20. The width direction runs transversely both to the longitudinal axis L12 and to the height direction.

[0057] Herein, a blade holder body coordinate system CS21 for the blade holder body 21 is defined which is defined as a Cartesian coordinate system and which is stationary assigned to the blade holder body 21 and which comprises an X21-axis, an Y21-axis and a Z21-axis. The blade holder coordinate system CS21 may be defined such that the X21-axis is defined as connecting the ends E1, E2, the Y21-axis is directed in the direction of the shortest distance between the side surfaces 25a, 25b of the groove 25. This results in a Z21-axis which is directed from the lower side SL to the upper side SU of the blade holder body 21. Based on this definition of the coordinate system CS21 a direction in the positive Y21-axis is referred to as "up", a direction in the negative Y21-axis as "down", a direction in the positive X21-axis as "forward" and a direction in the negative Y21-axis as "backward".

[0058] Alternatively, the X21-axis may be defined as being the central axis or a centrally extending line or a center line of the blade holder body 21, wherein the Y21-axis and the Z-axis are defined as respectively stated before-mentioned

definition.

[0059] The longitudinal axis L12 is preferably defined as being identical with the X21-axis of the blade holder coordinate system CS21 or as running along the X21-axis.

[0060] The Z21-axis may be herein defined as running in or along the height direction. The width direction of the blade holder body 21 or the blade holder device 20 may be herein defined as running in or along the Z21-axis.

[0061] As stated above, the blade holder body 21 generally comprises a fastening device G extending between the lower side SL to an upper side SU of the blade holder body 21 and comprising a boot connecting device H which is configured to be connected or fastened to the sole of a skate boot. The fastening device G may be herein defined to extend from the base portion 24 in the height direction to the upper side SU.

[0062] The fastening device G comprises at least one fastening support each of which is configured for fastening the blade holder device 20 to a sole of a boot. The boot connecting device H comprises at least one boot connecting section each of which is part of each fastening support at the upper side SU.

[0063] According to an embodiment of the blade holder device 20 according to the invention which is shown in figures 1 to 7, the fastening device G of the blade holder body 21 comprises: a first fastening support 110 in the form of a first or front pedestal which is located at the first side S1, a second fastening support 120 in the form of a second or rear pedestal which is located at the second side S2 and a bridge section 130 which connects the first fastening support 110 and the second fastening support 120 and supports them against one another. The first fastening support 110 is configured for being fastened to a toe portion of the sole of the skate boot. The second fastening support 120 is configured for being fastened to a heel portion of the sole of the skate boot. The longitudinal axis L12 of the blade holder device 20 or of the blade holder body 21 is running between the first side S1 and the second side S2 and therefore also between the first fastening support 110 and the second fastening support 120.

[0064] The first fastening support 110 of the blade holder body 21 comprises a first bottom wall 111, a first boot connecting section 112 and a first distance section 113 which extends transversely to the longitudinal axis L12 from the first bottom wall 111 to the first boot connecting section 112. The first boot connecting section 112 preferably comprises an inner opening and is preferably shaped as a connection flange for being fastened face-to-face to the toe section of the boot. Preferably, the first fastening support 110 is at least partially shaped as a hollow body which at least partially surrounds a first inner cavity 114.

[0065] Similarly, the second fastening support 120 of the blade holder body 21 comprises a second bottom wall 121, a second boot connecting section 122 and a second distance section 123 which extends transversely to the longitudinal axis L12 from the second bottom wall 121 to the second boot connecting section 122. The second boot connecting section 122 preferably comprises an inner opening and is preferably shaped as a connection flange for being fastened face-to-face to the heel section of the boot. Preferably, the second fastening support 120 is at least partially shaped as a hollow body which at least partially surrounds a second inner cavity 124.

[0066] According to an embodiment of the blade holder device 20 according to the invention which is shown in figures 1 to 7, the blade holder body 21 is formed such that the first inner cavity 114, the second inner cavity 124 and a third inner cavity of the bridge section 130 together form a continuous inner cavity 27.

[0067] Alternatively, the blade holder body 21 comprises one main fastening support which essentially is formed as one of the fastening supports 110, 120, which may at least partially surround only one continuous cavity or several cavities. The embodiments of the blade holder device 20 according to the invention also may comprise at least one fastening device which does not surround any cavity.

[0068] The first bottom wall 111, the second bottom wall 121 and the bridge section 130 together form a base portion 24 of the blade holder body 21 which extends along the longitudinal axis L12 essentially over the entire length of the blade holder body 21 along the longitudinal axis L12 and is preferably shaped as a continuously extending wall, even though at least two recesses are formed in the base portion 24. On the side of the blade holder body 21, the orientation of which is directed opposite the orientation of the outer surface of the first distance section 113 and second distance section 123, respectively, the base portion 24 forms a bearing groove 25 for receiving and accommodating a blade engaging portion 38 of the blade 30, when the blade holder device 20 and the ice skate blade 30 are in a mounting condition or mounting state. In the mounting condition of the blade holder assembly 10, as shown in figures 1 and 2, the ice skate blade 30 is accommodated in the bearing groove 25 of the blade holder body 21 and the locking device 40 is in its locking state in which the blade engaging portion 38 is accommodated in the bearing groove 25 and the ice skate blade 30 is mounted and fixed on the blade holder body 21.

[0069] The base portion 24 comprises a blade receiving section 26 with the bearing groove 25 which extends in the longitudinal axis L12 between the first end E1 and the second end E2, in a width direction and in a height direction. The bearing groove 25 is open to a lower side SL, comprises a groove bottom surface 25c located opposite the open side and is configured to accommodate a blade engaging portion 38 of an ice skate blade 30 for being mounted on the blade holder body 21 in a mounting condition. The blade receiving section 26 or at least main parts or force-transmitting parts thereof may be formed, in the width direction, as an end-to-end material section.

[0070] The bearing groove 25 comprises the groove bottom surface 25c or an inner groove bearing surface, which is

configured to abut against a contact surface of the ice skate blade 30. The inner contact surface 25a is defined to be the surface section of the groove 25 which connects two side walls 25a, 25b of the groove 25 which face each other, wherein the orientation of inner groove bearing surface 25c is directed opposite the orientation of the outer surface of the first boot connecting section 113 and second boot connecting section 123, respectively. In the mounting condition of the blade holder assembly 10, the blade bearing surface 34 at least partially abuts on the inner groove bearing surface 25c.

[0071] The bearing groove 25 comprises a first end E1 and a second end E2, wherein the ends E1, E2 are the ends of the bearing groove 25 in the longitudinal axis L12 or are the ends of the bearing groove 25 which result when viewed in a direction transversely to the longitudinal axis L12. At least one of the ends E1 or E2 can be shaped as open end of the groove or as closed ends of the groove 25. The latter means that the bearing groove 25 comprises a respective end surface which extends vertically to the groove bearing surface 25c and also vertically to the side surfaces. The first end E1 is herein defined as front end of the blade holder device 20 or of the blade holder body 21 and the second end E2 is herein defined as rear end of the blade holder device 20 or of the blade holder body 21.

[0072] Herein, the base portion 24 may be defined such that the same does not extend from the blade receiving section 26 in the height direction to the upper side SU.

[0073] The blade holder body 21 and particularly the base portion 24 comprises a pivot bearing device 70. The pivot bearing device 70 may connect two sub-sections 262, 263 of the blade receiving section 26 with the bearing groove 25 in the longitudinal axis L12. Preferably, the pivot bearing device 70, viewed transversely to the longitudinal axis L12, may at least partly be formed in the base portion 24 in a half or outer third thereof which includes the second end E2.

[0074] The pivot bearing device 70 extends from the lower side SL to the upper side SU. The pivot bearing device 70 may formed of two lower wall-sections 70a, 70b of the fastening device G and optionally of side walls 123a, 123b of the second distance section 123 of the blade holder body 21 which partly also form the fastening device G and particularly the second fastening support 120. The wall-sections 70a, 70b of the pivot bearing device 70 extend in the height direction along each other and in a distance to each other in the width direction, whereby the wall-sections 70a, 70b delimit an inner bearing device space, in the following referred to as bearing section recess 60. The bearing section recess 60 opens towards the lower side SL by an opening or a through-passage 70c.

[0075] The pivot bearing device 70 comprises a through-hole 7 with a central axis which defines a radial direction. The through-hole 7 or its central axis extends along or in the width direction. The through-hole 7 is configured to rotatably mount the locking device 40 on the blade holder body 21. The through-hole 7 is formed by a circumferential base portion bearing surface or an inner pivot bearing surface 74. The through-hole 7 may be formed of holes, one of which is formed in each of the wall-sections 70a, 70b, wherein the holes lie concentric to each other with regard to the width direction.

[0076] The bearing section recess 60 comprises a main recess portion 61 which opens by an opening 60a in the groove bottom surface 25c of the bearing groove 25 at the lower edge of the pivot bearing device 70 to the lower side SL and which extends in the height direction from the opening 60a or the lower side SL to the through-hole 7, wherein the main recess portion 61 and the through-holes 7 are spaces connecting each other. When viewed transversely to the longitudinal axis L12, the main recess portion 61 extends from the opening 60a between two sub-sections 262, 263, wherein the opening 60a extends in the longitudinal axis L12 between two edge portions 91, 92 of the blade receiving section 26 which lie opposite to each other and face each other.

[0077] The main recess portion 61 extends between the wall-sections 70a, 70b in the area of the opening 60a, when viewed transversely to the longitudinal axis L12. The bearing section recess 60 further comprises an engagement space 62, which extends from the main recess portion 61 along the longitudinal axis L12, particularly in the direction to the second end E2. The bearing section recess 60 is configured to receive an interacting hook device 360 of the ice skate blade 30 and, in order to realize a locking state of the blade holder device 20, to allow an end section 362 of the interacting hook device 360 to be moved into the engagement space 62 until the end section 362 rests against an abutment portion of the blade holder body 21. The abutment portion of the blade holder body 21 may be the second edge portion 92 of the blade receiving section 26.

[0078] The pivot bearing device 70 or the blade holder body 21 may comprise an abutment section 72.

[0079] The pivot bearing device 70 may comprise a guide device 71 which may be formed as a bridge-shaped connecting section which extends in the width direction and connects the wall-sections 70a, 70b. The guide device 71 is located at least partially above the through-hole 7 or which lies on the side of the upper side SU with regard to the through-hole 7. Preferably 50% to 100% of the guide device 71 is located above the through-hole 7. The guide device 71 may partially surround the central axis in the circumferential direction. The guide device 71 may be formed of a connecting bridge which connects the two lower wall-sections 70a, 70b in the Y21-direction. Particularly, the angle with regard to the central axis over which the guide device 71 extends, amounts between 90 degrees and 270 degrees. In case that the pivot bearing device 70 comprises the guide device 71, the same preferably comprises a guide slot 75, wherein the longitudinal direction of which extends in the circumferential direction. The guide slot 75 opens towards the pivot bearing surface 74. The slot depth of the guide slot 75 extends in the radial direction, which is defined by the central axis. The guide slot 75 is configured to receive the at least one surface irregularity 41 of the outer circumferential surface 46 which, in an engagement rotating angle range of the locking device 40, protrudes in the radial direction from the effective rotation

surface into the guide slot 75, thereby allowing surface irregularity 41 to be moved in the circumferential direction around the central axis while providing a lateral guiding of the locking device 40 against movements in the axial directions. The lateral guidance is provided by side surfaces 75a, 75b of the guide slot 75 which lie opposed to each other and which extend from the groove bottom surface along the radial direction.

[0080] In case that the pivot bearing device 70 does not comprise a guide slot 75, the guiding of the locking device 40 against movements in the axial directions may be realized in another manner, for example by a corresponding form-fitting interacting of a locking device bearing surface 47 and the inner pivot bearing surface 74, wherein one of the surfaces 47, 74 may comprise a circumferential groove and the other of these surfaces 47, 74 may comprise a circumferential ridge which protrudes into the groove.

[0081] The guide device 71 and the locking device 40, the base portion bearing surface 74 of which abuts the inner surface 73 of the guide device 71, together define a rotation device M.

[0082] The through-hole 7 is configured to rotatably mount the locking device 40 on the blade holder body 21. The through-hole 7 is formed by a circumferential base portion bearing surface or an inner pivot bearing surface 74.

[0083] The locking device 40 comprises an outer circumferential surface 46 which comprises a locking device bearing surface 47 or an outer pivot bearing surface and a protruding surface 48 which forms at least one surface irregularity 41. The inner pivot bearing surface 74 and the outer pivot bearing surface 47 are configured to allow a rotational movement of the locking device 40 around a rotational axis B. Preferably, the rotational axis B is identical with the central axis of the through-hole 7. The at least one surface irregularity 41 or the protruding surface 48 may particularly protrude in a radial direction from the locking device bearing surface 47 or particularly may protrude from an effective circumferential rotation surface which is defined by one or both of the of the locking device bearing surface 47 and the bearing surface 74 of the base portion 24 for providing a rotational movement of the locking device 40 in the through-hole 7. The effective circumferential rotation surface is an effective rotation enabling surface which may comprise, in the circumferential direction at least partially, a cylindrical surface portion of one of the locking device bearing surface 47 and the inner pivot bearing surface 74. Consequently, only one of the surfaces 47, 74 may comprise a at least partly cylindrical surface while the respective other surface 47, 74 may be the outside of the polygon component.

[0084] For the description of the ice skate blade 30 a skate blade coordinate system CS30 which is defined as a Cartesian coordinate system and which is stationary assigned to the ice skate blade 30 and which comprises an X30-axis, an Y30-axis and a Z30-axis. The skate blade coordinate system CS30 may defined such that the X30-axis is defined as connecting a first end 31a of a first end section 31 and a second end 32 of a second end section 32 and is running in the direction form the first end 31a to the second end 32a, wherein the ends 31a, 32a are the outmost ends of the blade 30 which lie opposite to each other and are the positions on the blade 30 which have the largest longitudinal distance from each other, when viewed transversely to the direction of the width w. The ice skate blade 30 has a thickness t and further comprises two side surfaces 30a, 30b which, in a distance of the blade thickness t, are oriented opposed to each other. Between the first end section 31, which is defined as a front end of the ice skate blade 30, and the second end section 32, which is defined as a rear end of the ice skate blade 30, an ice contacting surface 33 and a blade engagement surface or upper surface 34 opposite the ice contacting surface 33 are extending. The direction of the blade thickness t defines a blade thickness direction. The side surfaces 30a, 30b are lying opposite to each other such that the same are oriented in directions which oppose each other and which run in or along the thickness direction or in or along the positive or negative Y30-direction. The side surfaces 30a, 30b are each connecting the ice contacting surface 33 and an upper surface 34. The Y30-axis is directed in the direction of the shortest distance between the side surfaces 30a, 30b of the ice skate blade 30. Thus, the Z30-axis is directed in a direction which runs from the ice contacting surface 33 to the blade bearing surface 34 of the ice skate blade 30. The blade bearing surface 34 may therefore be defined as an upper surface 34 of the ice skate blade 30.

[0085] The blade longitudinal axis A is preferably defined as being identical with the X-axis of the skate blade coordinate system CS30.

[0086] The ice contacting surface 33 extends over an area which is intended to be used as contacting an ice surface when the ice skate is practically used for predetermined main purpose in a usual manner. The engagement portion 38 extends over an area in which an upper surface thereof, which is directed along the Z30-direction, is intended to contact the groove bottom surface of the bearing groove 25 in the mounting condition of the blade holder assembly 10. When viewed transversely to the longitudinal axis A, the outer surfaces first end section 31 and the second end section 32 adjoin the ice contacting surface 33 on opposing sides thereof. Further, when viewed transversely to the longitudinal axis A, the outer surfaces first end section 31 and the second end section 32 adjoin the engagement portion 38 on opposing sides thereof. The transitions of the engagement portion 38 to the first end section 31 and the second end section 32 may be defined as being a respective transition point in which the engagement portion 38 begins to have no contact with the groove bottom surface of the bearing groove 25 in the mounting condition according to the respective embodiment of the blade holder assembly 10, when viewed form a middle section of the ice skate blade 30 with regard to the blade longitudinal axis A. Also, the respective transition points may be defined by respective turning points of the contour line of the ice skate blade 30 when viewed transversely to the longitudinal axis A at the first end 31 and the second end 32a, respectively. The transitions

of the ice contacting surface 33 to the first end section 31 and the second end section 32 may be defined by the intercepts of vertical lines through the before-mentioned transition points between 38 and the end sections 31, 32a, the vertical lines running vertically to the blade longitudinal axis A.

[0087] The engagement portion 38 of the embodiment of the ice skate blade 30, which is shown in particular in figure 4, comprises an engagement portion 38 which comprises two interruptions of the engagement portion 38 which in each case are extensions of the ice skate blade 30 which in each case extend from the upper surface of the ice skate blade 30 transversely to the blade longitudinal axis A in the Z30-direction. These extensions of the ice skate blade 30 are provided to enable a locked state between the blade holder body 21 and the respective blade section in which the respective estension is located with regard to the blade longitudinal axis A.

[0088] According to the embodiment of the ice skate blade 30 shown in figure 4, a first of such interruptions of the engagement portion 38 results from an optional first end section fixing hook or a first hook 35 proximate to the first end section 31 of the ice skate blade 30 and a second of such interruptions of the engagement portion 38 results from an interacting hook device 360 edge portion receiving hookproximate to the second end section 32 of the ice skate blade 30. For the further description of the ice skate blade 30, a fictitious continuous engagement portion line is defined which runs continuously between the first end section 31 and the second end section 32 and which is identical with the middle line of the different sections of the engagement portion 38 along the blade longitudinal axis A. In the areas of the extensions the fictitious continuous engagement portion line is supplemented by fictitious line sections each of which are bridging the sections of the 38 which are neighboring the respective extension. Each of the fictitious bridging line sections is formed by a uniform curvature without a turning point, whereby the uniform curvature is designed in such a way that the two sections of the engagement portion 38 adjacent to the interruption merge into it without a step and without a bend. Accordingly, the ice skate blade 30 according to the invention may be considered to be composed of a main skate body 30m and in addition the first hook 35 and the interacting hook device 360, wherein the main skate body 30m is, when viewed in the Y30-direction, essentially limited by the ice contacting surface 33, the outer surface of the first end section 31, the outer surface of the second end section 32 and the fictitious continuous engagement portion line. For presentation of the fictitious line section in the area of the first hook 35 and the fictitious line section in the interacting hook device 360 are shown in figure 4 by dotted lines 35f and 360f, respectively.

[0089] The first end section fixing hook 35 comprises a hook connecting section 351, which adjoins the main skate body 30m at line 35f, and an outer end section 352, which lies opposite the hook connecting section 351. Preferably, the outer end section 352 extends from the hook connecting section 351 essentially towards the second end 32a, thereby forming a undercut area 350K which opens towards the second end 32a. The first end section fixing hook 35 may be located in an outer section of the engagement portion 38 or of the blade which adjoins the first end section 31 and which has a length of a third or particularly a quarter of the total length of the ice skate blade 30 in the X30-direction.

[0090] The interacting hook device 360 comprises an edge portion receiving hook 36 which comprises a connecting section 361, which adjoins the main skate body 30m, and an outer end section 362, which lies opposite the hook connecting section 361. The interacting hook device 360 may adjoin an outer section of the engagement portion 38 or of the blade in the X30-direction which outer section adjoins the first end section 31 and which has a length of a third or particularly a quarter of the total length of the ice skate blade 30 in the X30-direction. The interacting hook device 360 comprises at least the edge portion receiving hook 36.

[0091] By the first end section fixing hook 35 and the interacting hook device 360 being formed, the blade engaging portion 38 comprises a first engaging sub-section 381 for engaging with the first groove segment 251 of the groove 25, a second partial engaging sub-section 382 for engaging with the second groove segment 252 of the groove 25 and a third partial engaging sub-section 383 for engaging with the third groove segment 253 of the groove 25. Accordingly, the blade receiving section 26 comprises a first blade receiving sub-section 261, in which the first groove segment 251 is formed, a first blade receiving sub-section 262, in which the first groove segment 251 is formed, a third blade receiving sub-section 263, in which the first groove segment 251 is formed.

[0092] The first end section fixing hook 35 the edge portion receiving hook 36 and optionally provided further extensions, as an extension 39 for providing the mounting condition and a release function according to the invention, which extend upwardly from the upper surface 34 or along the Z30-axis and extend from the main skate body 30m towards the same direction transversely to the blade longitudinal axis A or the X30-axis.

[0093] The edge portion receiving hook 36 of the embodiment of the blade 30 shown in figure 4 comprises a connecting section 361, which adjoins the main skate body 30m, essentially extends in a direction transversely to the blade longitudinal axis A or in the Z30-direction from the main skate body 30m (line 36f of line 360f), while the receiving hook end section 362 extends from the receiving hook connecting section 361 essentially along the blade longitudinal axis A. When longitudinally moving on the generally upper surface of the ice skate blade 30 and coming from the first end 31a, the edge portion receiving hook 36 comprises a first surface or an outer surface 363 which faces a first side of the edge portion receiving hook 36 or the first end 31a and a second surface or an undercut surface 364 which faces a second side of the edge portion receiving hook 36 or the second end 32a lying opposed to the first side thereof. The first surface or an outer surface 363 comprises a portion which is essentially oriented in the negative X30-direction, while the second surface 364

comprises a portion which is essentially oriented in the positive X30-direction.

[0094] The second surface 364 connects the first surface 363 with the blade bearing surface 34 towards the second end 32a. At least a section of the outer surface 363 extends along the Z30-direction or the height direction. In detail, particularly in case the 363 has to fulfill a retraction function, the first surface 363 comprises a retraction surface portion or back surface portion 365, at least a section of which extends along the Z30-direction, a top surface portion 366, at least a section of which extends along the blade longitudinal axis A, and optionally a curved portion 367 connecting the surface portions 365 and 366. The curved portion 367 may have, along its longitudinal extension, orientations which include angles with regard to the positive X30-axis which lie within an angle range between 150° and 15° or between 150° and 30° or between 90° and 30°.

[0095] In the mounting condition of the blade holder assembly 10, the first surface or the outer surface 363 and particularly the curved portion 367 fulfills or fulfill a locking function with regard to a locking rotational position of the locking device 40 in a locking state of the blade holder device 20. In order to realize a locking state of the blade holder device 20, the retraction extension 39 has the function that, by correspondingly rotating the locking device 40 in the counter-clockwise direction view in the Y21-direction, the surface irregularity 41 comes into contact with the outer surface 363 and particularly the curved portion 367 and, by further rotation of the locking device 40 in the same direction, moves the ice skate blade 30 towards the second end 32a until at least a portion of the undercut surface 364 rests against the edge portion 92.

[0096] The undercut surface 364 forms or delimits an undercut area 360K which is open towards the second end 32a. The undercut surface 364 comprises an engagement portion 368 the orientation of which is directed transversely to the X30-axis. Especially, the engagement portion 368 may extend along a direction with an angle relative to the positive X30-direction which amounts between 0 degree to 80 degrees and preferably between 0 degree to 60 degrees. In order to realize the locking state of the blade holder device 20 in the mounting condition, the undercut surface 364 is moved by rotation of the locking device 40 in a direction towards the second end E2 until at least a portion of the undercut surface 364 rests against the edge portion 92. edge portion receiving hook As an option, the ice skate blade 30, which is shown in particular in figure 4, or the interacting hook device 360 may comprise a further extension extending from the main skate body 30m and which is herein referred to as entrainment extension 37. The entrainment extension 37 is positioned such that the entrainment extension 37 is located from the position of the edge portion receiving hook 36 in a distance towards the first end 31a. In case, that the 10 comprises the retraction extension 39 in addition to the edge portion receiving hook 36 and entrainment extension 37, the retraction extension 39 is located between the edge portion receiving hook 36 and entrainment extension 37, when viewed transversely to the blade longitudinal axis A.

[0097] For presentation of the imaginary line in the area of the third hook 37, in figure 4, the dotted line 37f as part of dotted line 360f is inserted in order to mark the fictitious line section between the main skate body 30m and the abutment extension 37. The entrainment extension 37 extends upwardly from main skate body 30m or along the Y30-axis. The entrainment extension 37 is located between the first end section fixing hook 35 and the edge portion receiving hook 36. The optionally provided entrainment extension 37 may be located proximate to the edge portion receiving hook 36 and comprises a first abutment surface 371 and a second abutment surface 372 and an outer connecting surface 373 which connects the first abutment surface 371 and a second abutment surface 372. Preferably, the first abutment surface 371 comprises a surface portion which is oriented in a direction along the negative X30-axis. The first abutment surface 371 may be formed as a straight surface or convex surface when viewed from the first end 31y. Preferably the second abutment surface 372 comprises a surface portion which is oriented in a direction along the positive X30-axis and which may extend in a direction which, in relation to the Z30-direction, in an angle range between 0° and 45°, especially between 0° and 30°. The outer connecting surface 373 may be oriented in a direction along the positive Z30-axis and may be formed as a curved surface. The first abutment surface 371 may be provided to abut against an abutment portion 95 which lies, with regard to the bearing section recess 60 on the side of the first end 31a. The abutment portion 95 may have different forms which are suitable to fulfil this function. As shown in figures 2 to 4, the abutment portion 95 may be formed as connecting portion which connects the edge portion 91 and the guide device 71, particularly along the Z21-direction.

[0098] The first surface 363 or retraction surface portion 364 of the edge portion receiving hook 36 may be spaced apart from the second abutment surface 372 of the entrainment extension 37 in case that the same is provided, wherein the retraction surface portion 364 and the second abutment surface 372 delimit an intermediate space 360s which is open in the Z30-direction. With regard to the embodiments described with reference to figures 2 to 4, the shortest distance in the blade longitudinal axis A between a point on at least a portion of the first surface or an outer surface 363 or of the retraction surface portion or back surface portion 365 of the edge portion receiving hook 36 and a point on at least a portion of the second abutment surface 372 amounts between 5 mm and 50 mm and especially amounts between 10 mm and 30 mm. Generally, the back surface or undercut surface 364 is, at least in a section, oriented in the direction of the X30-axis. With regard to the embodiments described with reference to figure 20, the shortest distance in the blade longitudinal axis A between a point on at least a portion of the first surface 393 of the retraction extension 39 and a point on at least a portion of the second abutment surface 372 amounts between 5 mm and 50 mm and especially amounts between 10 mm and 30 mm

[0099] Especially, the back surface or undercut surface 364 or particularly an engagement surface portion 368 thereof may be arranged such that the same extends in a direction which runs approximately parallel to the extension direction of at

least the engagement surface portion 368 of the second abutment surface 372 or which runs along each other with an angle difference the absolute amount of which lies between 0° and 15°.

[0100] Especially, at least a portion of the engagement portion 368 of the edge portion receiving hook 36 and at least a portion of the second abutment surface 372 of the entrainment extension 37 may extend relative to each other with an angle difference the absolute amount of which lies between 30° and 60°. edge portion receiving hookedge portion receiving hookAlternatively, the retraction surface portion 365 or said top surface portion 366 may be replaced by a retraction surface or a top surface of any further additional extension or projection next to the edge portion receiving hook 36 or an additional projection or extension.

[0101] A further embodiment of the blade holder device 20, which is shown in figure 20, comprises, in addition to the edge portion receiving hook 36, a retraction extension 39 extending from the main skate body 30m. In this embodiment the edge portion receiving function in the locking state is, as in the embodiment of the blade holder device 20 shown in figures 2 to 4, fulfilled by a form of the edge portion receiving hook 36, which at least comprises the undercut surface 364 with any further options of the realization of the edge portion receiving hook 36 which are described herein. In embodiments comprising the edge portion receiving hook 36, a retraction extension 39, the edge portion receiving hook 36 may comprise any other features described herein.

[0102] The retraction extension 39 comprises a connecting section 391, which adjoins the main skate body 30m, and essentially extends in a direction transversely to the blade longitudinal axis A or in the Z30-direction from the main skate body 30m, and a receiving hook end section 392 which adjoins the connecting section 391. Further, the retraction extension 39 comprises a first surface 393, at least a portion of which faces the first end 31a and which is oriented in the negative X30-direction, and a second surface 394, at least a portion of which faces the second end 32a and which is oriented in the negative X30-direction, wherein the first surface 393 and the second surface 394 are oriented opposed to each other. The receiving hook end section 392 of the retraction extension 39 may comprise a curved portion 397 which connects outer ends of the first surface 393 and of the second surface 394. The curved portion 397 may have, along its longitudinal extension, orientations which include angles with regard to the positive X30-axis which lie within an angle range between 150° and 15° or between 90° and 30°.

[0103] In the embodiment of the blade holder assembly 10 or the blade holder device 20 shown in figure 20, in case the same is in the mounting condition, the first surface or the outer surface 393 and particularly the curved portion 397 fulfills or fulfill a locking function with regard to a locking rotational position of the locking device 40 in a locking state of the blade holder device 20. In order to realize the locking state of the blade holder device 20, the retraction extension 39 has the function that, by correspondingly rotating the locking device 40, the surface irregularity 41 comes into contact with the outer surface 393 and particularly the curved portion 367 and, by further rotation of the locking device 40 in the same direction, moves the ice skate blade 30 towards the second end E2 until at least a portion of the undercut surface 364 of the edge portion receiving hook 36 rests against the edge portion 92.

[0104] The embodiment of the skate blade 30 shown in figure 20 comprises an interacting hook device 360 with an edge portion receiving hook 36 with the engagement surface 367, with a retraction extension 39 and with an entrainment extension 37, wherein locking projection 39 lies, in the longitudinal axis L12, between the edge portion receiving hook 36 and the entrainment projection 37. However, as shown in figure 2 to 4, the skate blade 30 may comprise the edge portion receiving hook 36 with the engagement surface 368, and the entrainment extension 37, but not a retraction extension 39, particularly if the edge portion receiving hook 36 comprises a retraction surface portion 365 according to any of its embodiments described above.

[0105] The entrainment extension 37 comprises an entrainment extension connecting section 371, which adjoins the main skate body 30m, and essentially extends in a direction transversely to the blade longitudinal axis A or in the Z30-direction from the main skate body 30m, and an entrainment extension end section 372 which adjoins the entrainment extension connecting section 371. Further, the entrainment extension 37 comprises a first surface 373, at least a portion of which faces the first end 31a and which is oriented in the negative X30-direction, and a second surface 374, at least a portion of which faces the second end 32a and which is oriented in the negative X30-direction, wherein the first surface 373 and the second surface 374 are oriented opposed to each other. The entrainment extension end section 392 of the entrainment extension 39 may comprise a curved portion 397 which connects outer ends of the first surface 393 and of the second surface 394. The curved portion 397 may have, along its longitudinal extension, orientations which include angles with regard to the positive X30-axis which lie within an angle range between 150° and 15° or between 90° and 30°. The first surface 373 may extend, along its longitudinal extension, in directions which include angles with regard to the positive X30-axis which lie within an angle range between 80° and 15° or between 75° and 45°. The second surface 374 may extend, along its longitudinal extension, in directions which include angles with regard to the positive X30-axis which lie within an angle range between 90° and 135° or between 95° and 120°.

[0106] The entrainment extension 37 comes into play when, from the locking state of the blade holder assembly 10, the blade holder device 20 shall be brought into the release state in order to move the blade out of the recess 60, wherein the ice skate blade 30 may comprise an entrainment extension 39 or not. In the locking state, the undercut surface 364 or the engagement surface 367 of the edge portion receiving hook 36 rests against the edge portion 92, when the locking device

40 is in a locking rotational position. By rotation the locking device 40 about 90 degrees or more in the clockwise direction, the first protrusion 41 gets out of contact with the first surface 363 of the edge portion receiving hook 36 or out of contact with the first surface 393 of the retraction extension 39. By further rotating the locking device 40 in the same direction, the first protrusion 41 contacts the second surface 374 of the entrainment extension 37 and moves the entrainment projection 37 opposite the X30-direction into a position in which the interacting hook device 360 can be displaced from the bearing section recess 60.

[0107] The blade holder body 21 may comprise an abutment section 72 with an abutment surface 72a at least a portion of which is oriented in the X30-Direction. The abutment section 72 or the abutment surface 72a is located, viewed transversely to the longitudinal axis L12, between the neighboring portion of the bearing section 26 and the main body 45 of the locking device 40 in the height direction and between the edge portion 91 and the main body 45 of the locking device 40 in the longitudinal axis L12. By further rotating the locking device 40 in the same rotational direction, the second protrusion, which lies opposite the first protrusion 41, can be moved out of the bearing section recess 60 opposite the Z21-direction. When the first protrusion 41 moves the entrainment extension 37 towards the abutment section 72, the first surface 373 comes in contact with the abutment surface 72a. If the locking device 40 is rotate further in same direction, the orientation of the first surface 373 supports that the interacting hook device 360 is moved out of the recess 60 and the blade 30 is removed from the blade holder body 21.In case the locking device 40 comprises a second protrusion 42 as described herein, by a further rotation of the locking device 40 in the clockwise direction, the second protrusion 42 presses the edge portion receiving hook 36 (embodiment of the blade holder body 21 according to figures 2 to 4) or the retraction extension 39 (embodiment of the blade holder body 21 according to figure 20) in the negative Z21-direction and moves the same in the negative Z21-direction in order to move the interacting hook device 360 out of the recess 60 and to remove the blade 30 from the blade holder body 21 (push-out movement).

[0108] As shown in the present application, the extension 35 is the front hook and the extension 36 is the rear hook of the ice skate blade 30. However, it will be understood that said extension 35 may otherwise be the rear hook and the extension 36 may be the front hook of the ice skate blade 30 in such an embodiment.

[0109] In the following the locking device 40 is described in detail:

The locking device 40 comprises a locking device main body 45 and at least partially at least one radial irregularity and particularly some radial irregularities with respect to the locking device rotational axis B. The locking device rotational axis B defines a radial direction running from the locking device rotational axis B and a circumferential direction which is oriented transversely or vertically to the locking device rotational axis B and vertically to the radial direction. An outer circumferential surface 46 of the locking device main body 45 extends at least partly in the circumferential direction around the locking device rotational axis B. The outer circumferential surface 46 comprises the locking device bearing surface 47, which preferably is an outer surface and has, in the embodiment shown in figures 2 and 3, a cylindrical shape for rotatably mounting the locking device main body 45 on the pivot bearing device 70 of the base portion 24 of the blade holder body 21.

[0110] In this case, the surface irregularity may be understood as an irregularity of the cylindrical shape of the locking device bearing surface 47. The at least one surface irregularity or protrusion is particularly defined to be in each case a protrusion which extends radially beyond the surface surroundings which lies in the circumferential direction next to the respective protrusion. The locking device 40 of the embodiment of the blade holder device 20 according to figures 2 to 7 comprises a first protrusion 31 and a second protrusion 42. In case that the locking device 40 comprises two protrusions, the protrusions extend in a direction from the locking device bearing surface 47 such that between the extension directions lies a smallest angle which amounts to between 45 degrees and 180 degrees. The embodiment of the blade holder device 20 according to figures 2 to 7 comprises two protrusions 41, 42 which extend diametrically opposite to each other with an angle of 180 degrees between them.

[0111] The at least one radial irregularity or a first radial irregularity is configured in a manner that,

(R1) in a locking rotational position of the locking device main body 45, the at least one radial irregularity or a first radial irregularity (irregularity or protrusion 41), with a surface of the same which is oriented in the radial direction, presses against the back surface 364 of the edge portion receiving hook 36 (figure 2), whereby an outer section of the edge portion receiving hook 36 or the engagement surface 367 thereof is pressed against a rear edge portion 92 of a base section 24 of the blade holder body 21,

(R2) in a releasing rotational position of the locking device main body 45, which is achieved by performing a releasing movement of the locking device main body 45 and by rotating the blade holder body 21 around the locking device rotational axis B in a first direction such that the at least one radial irregularity or the first radial irregularity (irregularity or protrusion 41) is moved in the direction to the first end 31 or the first hook 35 as far that the blade 30 has enough freedom of movement that the edge portion receiving hook 36 and particularly the engagement surface 367 can be moved completely out of contact of the same with the rear edge portion 92 of a base section 24 of the blade holder body 21 (figure 6),

(continued)

(R3) in a push-out movement of the locking device main body 45, a second irregularity (irregularity or protrusion 42) - by further rotation in the first direction - initially contacts the top surface 365 of the edge portion receiving hook 36 and then presses downwardly or against the direction of the X30-axis such that the edge portion receiving hook 36 is moved, at least partially, out of the body 21 (figure 7 shows the starting moment of step (R3)).

[0112] Step (R2) may include a further rotational movement of the blade holder body 21 in the case that the blade 30 comprises the additional protrusion 37. As figure 7 shows, this further rotational movement of the blade holder body 21 causes the blade 30 to be moved against the X21-direction and the first hook 35 of the blade 30 towards a front section 81 of the recess 50. Figure 7 shows the position of the blade 30 after this further rotational movement of the blade holder body 21.

[0113] Step (R3) with the push-out movement is a mere optional step in the case that the blade 30 comprises the extension 37.

[0114] In the locking rotational position of the locking device main body 45 a locking state is defined when at the same time the blade engaging portion 38 of an ice skate blade 30 is at least partially accommodated in the bearing groove 25 in a predetermined manner, as defined by the mounting condition.

[0115] The first and second surface irregularity may be shaped such that the same are located opposite to each other and also and extend opposite to each other and from their respective surrounding surface.

[0116] The pivot bearing device 70 of the blade holder body 21 may comprise a guide slot 75 which is formed in the inner surface 73 and which extends from the base portion bearing surface 74 in the radial direction with regard to the locking device rotational axis B. The guide groove 75 extends in the circumferential direction with regard to the locking device rotational axis B. The guide groove 75 is formed to receive and guide the at least one surface irregularity at least in a respective section of their movement for locking and unlocking the blade 30.

[0117] The pivot bearing device 70 may be configured such that the same connects two sections of the blade receiving section 26.

[0118] Particularly, the ice skate blade 30 can be moved at least partially along the direction of the longitudinal axis A or a longitudinal axis L12 of the blade holder body 21 by rotating the locking device 40 about the device axis B, whereby the at least one irregularity or a first radial surface irregularity of the locking device 40 is interacting with the ice skate blade 30 and particularly with the top surface 366 of the edge portion receiving hook 36. In a further step, due to said radial irregularities, the rotational movement of the rotatable locking device 40 can be transformed into a linear movement of the ice skate blade. Said radial irregularities can be provided by at least one protrusion 41, 42 on the rotatable locking device 40. Alternatively, said radial irregularities can be provided by an eccentric or polygonal shape of the rotatable locking device 40 in the respective area. However, any other shape or mechanism providing at least partially some radial irregularities on the rotatable locking device 40 with respect to the device axis B might be also conceivable. As shown in the present application, the rotatable locking device 40 can have a hexagonal center hole to apply a torque by using an appropriate Allen key. However, it is understood that any other drive shape might be also conceivable. Furthermore, it is also conceivable that the rotatable locking device 40 can be operated by a user's hand directly without requiring the use of a tool. In such an embodiment, an appropriate shape or mechanism will be provided on the rotatable locking device 40, allowing the user to apply an appropriate torque to operate the system.

[0119] In summary, the general shape of the blade holder 20 is defined by first and second pedestals or fastening supports 110, 120 to fix the blade holder to a skate boot and a bridge portion 130 connecting the fastening supports 110, 120 at the base portion 24 of the blade holder 20. The base portion 24 is provided with the longitudinal groove 25 extending along the longitudinal axis A with the purpose to receive the upper portion or blade engaging portion 38 of the ice skate blade 30. Said longitudinal bearing groove 25 is formed by side walls defining a groove width w. The bearing groove 25 is formed in a base wall or a blade receiving section 26 of the base portion 24. The blade receiving section 26 is a section of the base portion 24 which lies at the lower side SU of the base portion 24 and forms a bottom section thereof. The groove depth d of the bearing groove 25 is provided such that the bearing groove 25 is separated from the at least one inner cavity of the at least one fastening support. The blade receiving section 26 of the bearing groove 25 generally matches the profile of the upper surface or bearing surface 34 of the blade engaging portion 38 of the ice skate blade 30 along the longitudinal axis A. In this regard, the groove width w may be almost identical with the thickness t of the ice skate blade 30. Thereby, as shown in figures 2 and 3, when the mounting condition of the blade holder assembly 10 is realized, the ice skate blade 30 can be tightly mounted within the blade holder 20 with the locking rotational position of the locking device main body 45.

[0120] The blade receiving section 26 of the embodiment of the blade holder body 21 which is shown in the figures 1 to 7 comprises a first recess 50 with an opening in the groove bottom surface 25c of the bearing groove 25 in the form of a for receiving the first hook 35 of the ice skate blade 30 and a second opening 60a of the groove bottom surface 25c of the bearing groove 25 in the form of a I for receiving the edge portion receiving hook 36 of the ice skate blade 30. The blade receiving section 26 with the bearing groove 25 is formed with the side surfaces 25a, 25b in order to generally match the

respective engagement surfaces 35b, 367 of the first end section fixing hook 35 and edge portion receiving hook 36 when the ice skate blade 30 is in the locked position as shown in figure 2.

[0121] The blade holder body 21 particularly comprises a base portion 24 which extends along the longitudinal axis L12 and forms the first recess 50 and the second recess 60. In the area of the recesses 50, 60 the blade receiving section 26 do not form a bearing groove 25 according to its main function.

[0122] The first recess 50 is located closer to the first end E1 than the second recess 60 and is therefore herein also referred to a front recess and, vice versa, the second recess 60 is located closer to the second end E2 and is therefore herein also referred to a rear recess.

[0123] The first recess 50 may be formed as a depression or a recess or opening in the bearing section and in the groove bearing surface 25c of the bearing groove 25. In this case, the bearing groove 25 with the groove bearing surface 25c extends of over the first recess 50 in form of a depression. Alternatively, as shown for example in figure 2, the first recess 50 may be formed as a passage opening. In both cases the blade receiving section 26 is a section of the base portion 24 and comprises a front circumferential edge portion 80 within which the recess is formed. The circumferential edge portion 80 comprises a front edge portion 81 and a rear edge portion 82 which lie opposed to each other with regard to the first recess 50 and which are located at positions according to a continuous course of the blade receiving section 26 having essentially the same curvature and no turning point in the area of the first recess 50. According to the embodiment of the blade holder assembly 10 shown in figures 1 to 7, the first hook 35 is formed such that, in the mounting condition of the blade holder assembly 10, an outer end portion 35e of the same extends over the rear edge portion 82, whereby the rear edge portion 82 serves as an abutment against the movement of the first hook 35 in the direction against the Z21-direction and as an abutment against the movement of the first hook 35 in the direction in the X21-direction. In the mounting condition, the distance between front edge portion 81 and a rear edge portion 82 is, when viewed in the Y21-direction, greater than the width of the first hook 35 between the edge portions 81, 82, whereby leaving a movement space 85 between a surface section of the front edge portion 81 and a surface section of the first hook 35, the surface sections facing each other. This movement space 85 allows the movement of the blade 30 as described above with regard to step (R2) and the further rotational movement of the blade holder body 21 in the case that the blade 30 comprises the additional protrusion 37.

[0124] The second recess or bearing section recess 60 may be formed as a depression or a recess or opening in the bearing section and in the groove bearing surface 25c of the bearing groove 25. For forming the bearing section recess 60, the blade receiving section 26 comprises a second circumferential edge device 90 of the blade receiving section 26 within which the recess is formed. The second circumferential edge section 90 comprises the first edge portion 91 or front edge portion and the second edge portion 92 or rear edge portion which lie opposed to each other with regard to the second recess 60 and which are located at positions according to a continuous course of the blade receiving section 26 having essentially the same curvature and no turning point in the area of the second recess 60. The pivot bearing device 70 with a first end section adjoins the first edge portion 91 with the first edge portion 91 merging into the pivot bearing device 70. From this position, a first section of the pivot bearing device 70 extends in direction to the upper side SU into an inner cavity which is formed within the at least one fastening support or the second fastening support 120, respectively. A a second end section of the pivot bearing device 70, lying opposite to the first end section thereof, may extend in direction to the lower side SL and to the rear edge portion 91 and may adjoin the front edge portion 91 and merge into it. Alternatively, as shown in figure 7, the second end section may not adjoin the rear edge portion 92, but is located at a distance from the rear edge portion 92, wherein the distance is great enough in order to leave a space between them, which is sufficient that the edge portion receiving hook 36 can be moved at least partially through the space in order to achieve the mounting condition in which the engagement surface 367 abuts against an inner surface of the rear edge portion 92, the orientation of the inner surface is opposite to the orientation of the groove bearing surface 25c.

[0125] The recesses 50, 60 divide the bearing groove 25 with the groove bearing surface 25c and the side walls 25a, 25b in three segments: a first groove segment 251 which extends between the first end E1 and the first edge portion 81 or front edge portion, a second or intermediate groove segment 252 which extends between the second edge portion 82 or rear edge portion, a third groove segment 253 which extends between the second edge portion 92 and the second end E2.

[0126] The interacting of the first recess 50 with the first hook 35 may be defined as a fixation device F which, in the mounting condition, fixes a front section of the blade 30 against a movement in the X21-direction or towards the second end E2, and allows movement distance from the before-mentions position against the X21-direction or towards the first end E1 which is sufficient to withdraw the blade 30, preferably in an easy manner, from engagement with the bearing groove 25 and the mounting condition.

[0127] Alternatively, the fixation device may be realized differently, for example without the provision of a recess 50 and a first hook 35, but instead by a bracket, which connects a front portion of the blade 30 to a front portion of the body 21 with providing the functionality of a restriction against a movement in the X21-direction and of allowing a sufficient movement against the X21-direction.

[0128] In a preferred embodiment, and as also shown in figure 2, when the ice skate blade 30 is in the mounting condition or in a mounted or locked position with regard to the blade holder body 21, the locking device 40 is rotated into an end position in which a second protrusion 42 abuts the end stop surface or outer connecting surface 373 of the additional

projection 37, and the first protrusion 41 approximately abuts preferably the edge portion receiving hook 36. Due to the fact that in the end position, the longitudinal axis of the first protrusion 41 is approximately parallel to the blade longitudinal axis A, the ice skate blade 30 will be unable to initiate a rotation of the rotatable locking device 40 and is therefore prevented from sliding out of the locked position along the longitudinal axis A. Alternatively, the first protrusion 41 approximately abuts any further additional projection next to the extension 37, instead of the edge portion receiving hook 36. When moving the second protrusion 42 away from the end stop surface 377 by rotating the rotatable locking device 40 about the device axis B continuously, the unlocking process gets initiated, whereby the first protrusion 41 will touch the side surface 374 of the entrainment extension 37 as shown in figure 6, and start to move the ice skate blade 30 along the longitudinal axis A to unhook the first and extensions 35, 36 of the ice skate blade 30 from the blade holder 20, until the second protrusion 42 naturally moves beyond the side surface 374 due to its rotational movement as shown in figure 7. It is particularly preferred that the unlocking process is extended by a subsequent movement, whereby, and as also shown in figure 7, the second protrusion 42 will preferably touch the top surface 365 of the edge portion receiving hook 36 and start to move the ice skate blade 30 downwards in the area of the rotatable locking device until the second protrusion 42 naturally moves beyond the top surface 365 due to its rotational movement, as shown in figure 8. The ice skate blade 30 can now easily be removed by hand and the rotatable locking device 40 is free to rotate in any direction about the device axis B. Alternatively, the second protrusion 42 will touch a top surface of any further additional projection next to the additional projection 37, instead of the top surface 366 of the edge portion receiving hook 36. For reinstallation, the ice skate blade 30 is put in place by hand, as shown in figure 9. By rotating the rotatable locking device about the device axis B in the opposite direction with respect to the unlocking process, the locking process gets initiated, in which the first protrusion 41 will preferably touch the back surface 364 of the edge portion receiving hook 36 and start to push the ice skate blade 30 along the longitudinal axis A to hook the first and edge portion receiving hooks 35, 36 of the ice skate blade 30 with the blade holder 20, until the first protrusion 41 abuts the end stop surface 377 of the additional projection 37, and thus, the ice skate blade 30 is in the locked position again as shown in figures 2 and 3. Alternatively, the second protrusion 42 will touch a side surface of any further additional projection next to the additional projection 37, instead of the back surface 364 of the edge portion receiving hook 36. As best seen in figures 4 and 5, in the area of the first and second recess 50, 60 of the blade receiving section or the base wall 26 of the blade holder 20, the side walls of the longitudinal groove 25 extend 10 upwardly to provide lateral support to the first end section fixing hook 35 and edge portion receiving hook 36 of the ice skate blade 30 when the ice skate blade 30 is in the locked position. Furthermore, in the area of the second recess 60, the extended side walls of the longitudinal groove 25 prevent the rotatable locking device 40 from moving along the device axis B, because in such an embodiment, the dimension x of the protrusions 41, 42 of the rotatable locking device 40, as shown in figure 12, is approximately identical to the thickness t of the ice skate blade 30. It will be understood that the first protrusion 41 may otherwise be the second protrusion and the second protrusion 42 may be the first protrusion, or any additional protrusions can be provided on the rotatable locking device 40.

[0129] In a preferred embodiment, the rotatable locking device 40 comprises individual parts, namely, at least, preferably a main body 45, and at least one elongated locking pin 150 which is mounted in a respective mounting through-hole 45a of the main body 45, wherein the middle axis of the through-hole 45a intersects the locking device axis B. The main body 45 comprises an outer pivot bearing surface 47 which has the function of the effective circumferential rotation surface. The main body 45 and the pin 150 may be configured to provide a frictional or load-carrying connection between them when the pin 150 is mounted in the main body 45.

[0130] The locking pin 150 comprises two end sections 151, 152, which lie opposed to each other. The locking pin 150 may be positioned in the through-hole 45a such that only one of the end sections 151, 152 protrude from the outer pivot bearing surface 47 of the main body 45. As shown in figure 18, the locking pin 150 may also be positioned in the through-hole 45a such that both of the end sections 151, 152 protrude or stick out on opposite sides from the outer pivot bearing surface 47 of the main body 45. In this case, the locking device 40 comprises two radial surface irregularities 41, 42 each of which protrude from the effective circumferential rotation surface with respect to the device axis B by protruding from or sticking out of the main body 45. With such a solution, the assembly process can be solved by pushing the main body 45 along the locking device axis B into the respective mounting hole in the blade holder device 20 in a first step, and in a second step, the at least one elongated locking pin 150 can be pushed through the opening 60a or the longitudinal groove 25 into the respective mounting hole or through-hole 45a in the main body 45 as shown in figure 14.

[0131] In order to disassemble the device, the at least one elongated locking pin 150 can be pulled out of the main body 45 through the opening 60a or the longitudinal groove 25, for example, by using a standard needle, nose pliers in a first step, and in a second step, the main body 45 can be pushed along the device axis B, out of the blade holder 20. In a particularly preferred embodiment, only one elongated locking pin 150 is provided which protrudes through the main body 45. With such an embodiment, the blade holder 20 may comprise the bearing section 70in order to limit the axial movement of the respective surface protrusion or one of the elongated locking pin 52 within the respective mounting hole in the main body 45 when the ice skate blade 30 is in the locked position, as shown in figure 15, as well as during the unlocking and locking process.

[0132] Alternatively, the main body 51 consists of individual parts, for instance, a cylindrical main body can be divided

into cylinder segments, however, any other shape and subdivision might be also conceivable.

[0133] As shown in figures 21 and 22, a surface irregularity may be realized by an excentric portion 161 which protrudes from the main body 45 in the radial direction and which forms one excentric surface irregularity 41 or several surface irregularities 41, 42. The excentric surface irregularity 161 may be realized having different shapes depending on the respective application. Figure 21 shows a first form of the excentric portion 161 and figure 22 shows a second form of the excentric portion 261. The excentric portion 161 may be part of an excentre device 250 which additionally comprises a mounting portion configured such that the same can be positioned on the main body 45 such that the mounting portion fits in the through-hole 7 and the excentric portion 161 protrudes from the main body 45 and forms a surface irregularity 161.

[0134] In a particularly preferred embodiment, the assembly is further equipped with at least one damping element 157, 158 creating a friction between the rotatable locking device 40 and the respective mounting hole in the blade holder 20, to prevent the rotatable locking device 40 from rotating accidentally about the device axis B. In other words, due to the at least one damping element 157, 158, a substantial torque will be needed to initiate a rotation of the rotatable locking device 40 about the device axis B. Accordingly, the assembly can be further equipped with at least one damping element 157, 158 creating a friction between the main body 45 and the at least one elongated locking pin 150, to prevent the at least one elongated locking pin 150 from falling out of the assembly when the ice skate blade 30 is not in the locked position. In other words, due to the at least one damping element 157, 158, a substantial force will be needed to move 11 the at least one elongated locking pin 150 out of the respective mounting hole in the main body 45. The at least one damping element 53 can be a sealing ring made of any rubber or elastomeric material. It is particularly preferred that the damping element 53 is positioned such, to create a friction between the rotatable locking device 40 and the respective mounting hole in the blade holder 20, and between the main body 45 and the at least one elongated locking pin 150 at the same time, as shown in figures 17 to 19. However, any other solution to prevent the rotatable locking device 40 from rotating accidentally about the device axis B and to prevent the at least one elongated locking pin 150 from falling out of the assembly might be also conceivable.

Claims

1. Blade holder device (20), comprising a blade holder body (21) and a locking device (40), wherein the blade holder body (21) comprises:

   a base portion (24) comprising a blade receiving section (26) and a pivot bearing device (70) with a pivot bearing surface (74), wherein the blade receiving section (26) comprises a bearing groove (25) which extends in a longitudinal axis (L12) between a first end (E1) and a second end (E2), in a width direction and in a height direction, wherein the bearing groove (25) opens from a groove bottom surface (25c) to a lower side (SL) and is configured to accommodate a blade engaging portion (38) of an ice skate blade (30) for being mounted on the blade holder body (21) in a mounting condition, wherein blade receiving section (26) comprises edge portions (91, 92) forming an opening (60a) in the groove bottom surface (25c) between edge portions (91, 92),
   a fastening device (G) which extends from the base portion (24) in the height direction and which is configured to fasten the blade holder device (20) to a sole of a boot on an upper side (SU) of the blade holder device (20), wherein the pivot bearing device (70) is located in a bearing section recess (60) of the blade holder body (21) which extends from the opening (60a) in the groove bottom surface (25c) in the height direction to a through-hole (7) in the fastening device (G), which extends transversely the longitudinal axis (L12), wherein the bearing section recess (60) is configured to receive an interacting hook device (360) of an ice skate blade (30) and to allow an end section (362) of the interacting hook device (360) to be moved into the engagement space (62) until the end section (362) rests against an edge portion (92) of the base portion (24) in a mounting condition,
   wherein the blade holder device (20) comprises a fixation device (F) which, in the mounting condition, connects a first end section of the ice skate blade (30) to a first end section of the base portion (24),
   wherein the locking device (40) comprises a locking device main body (45) with an outer circumferential surface (46), which comprises a locking device bearing surface (47) and at least one surface irregularity (41) which radially extends from the outer circumferential surface (46), wherein the pivot bearing surface (74) and the locking device bearing surface (47) are configured to allow a rotational movement of the locking device (40) around the central axis of the through-hole (7) by providing an effective rotation surface,
   wherein the locking device (40) is configured such that, in the mounting condition, in a first rotational position, the at least one surface irregularity (41) contacts the end section (362, 392) of the interacting hook device (360) extending into the recess (60) such that the end section (362, 392) is held in a locking state in which the same rests against an abutment portion of the blade holder body (21), and, in a second rotational position, the at least one surface irregularity (41) is displaced from the end section (362, 392) of the interacting hook device (360a) and provides a release state of the end section (362, 392) of the ice skate blade (30), in which the interacting hook

device (360) has a freedom of movement between the edge portion (92) and the at least one surface irregularity (41) allowing the interacting hook device (360) to be moved along the longitudinal axis (L12) and further out of the bearing section recess (60).

2. Blade holder device (20) according to claim 1, wherein the pivot bearing device (70) comprises a guide device (71) which partly surrounds the central axis in the circumferential direction and which comprises a guide slot (75) which opens in the pivot bearing surface (74) and which extends in the radial direction from the pivot bearing surface (74), wherein the at least one surface irregularity (41) of the outer circumferential surface (46) in a rotational area of the locking device (40) protrudes in the radial direction from the effective rotation surface into the guide slot (75), thereby providing a guiding of the locking device (40) against movements in the axial directions.

3. Blade holder device (20) according to claim 2, wherein 50% to 100% of the circumferential extension of the guide device (71) is located above the through-hole (7).

4. Blade holder device (20) according to one of the preceding claims, wherein the bearing section recess (60) which extends from the bearing groove (25) in the height direction to the through-hole (7), comprises a main recess portion (61) with the opening (60a) and an engagement space (62), which extends from the main recess portion (61) along the longitudinal axis (L12) which is partly delimited by the abutment portion of the blade holder body (21).

5. Blade holder device (20) according to one of the preceding claims, wherein the abutment portion of the blade holder body (21) is an edge portion (92) of the base portion (24).

6. Blade holder device (20) according to one of the preceding claims, wherein the fixation device (F) comprises first recess (50) with an opening in the groove bottom surface (25c) of the bearing groove (25) for receiving the first hook (35) of the ice skate blade (30).

7. Blade holder device (20) according to one of the preceding claims, wherein the fastening device (G) at least one fastening support (110, 120) comprises a first fastening support (110) and a second fastening support (120), each of which extends from the base portion (24) in the height direction.

8. Blade holder device (20) according to one of the preceding claims, wherein the fastening device (G) comprises a first fastening support (110) and a second fastening support (120), each of which extend from the base portion (24) in the height direction.

9. Blade holder device (20) according to one of the preceding claims, wherein the the locking device (40) comprises a main body (45) with the locking device bearing surface (47) and a locking pin (150),

wherein the main body (45) comprises a through-hole (45a) having a middle axis which intersects the locking device axis (B),
wherein the locking pin (150) comprises a first end section and a second end section lying opposed to the first end section and is arranged in the through-hole (45a), wherein at least one of the end sections protrude from the through-hole (45a) forming a respective surface irregularity (41) which radially extends from the outer circumferential surface (46).

10. Blade holder device (20) according to one of the claims 1 to 8, wherein the at least one surface irregularity (41) comprises an excentric surface irregularity (41) of the locking device (40) which is realized by an excentric portion (161) which protrudes from the main body (45) in the radial direction.

11. Blade holder device (20) according to one of the preceding claims, wherein the outer pivot bearing surface (47) is formed at least partially as a cylindrical outer surface.

12. Blade holder device (20) according to one of the preceding claims, wherein the inner pivot bearing surface (74) is formed at least partially as a cylindrical inner surface.

13. Blade holder assembly (10), comprising a blade holder device (20) according to one of the preceding claims and an ice skate blade (30), mounted on the blade holder device (20) in the mounting condition.

14. Ice skate, comprising:

a blade holder assembly (10) which comprises a blade holder device (20) according to one of the preceding claims and an ice skate blade (30), mounted on the blade holder device (20) in the mounting condition and
a skate boot which is fastened to a boot connecting section (122) of the fastening device (G) at the upper side (SU) thereof.

15. Ice skate blade (30) for mounting on a blade holder device (20) in a mounting condition, the Ice skate blade (30) extending in a blade longitudinal axis (A) between a first end (31a) and a second end (31b) and comprising a main skate body (30m) and an interacting hook device (360) which extends from the main skate body (30m) transversely to the blade longitudinal axis (A) for providing the mounting condition,

wherein the interacting hook device (360) comprises at least one extension for locking the ice skate blade (30) to the blade holder device (20) which comprises an undercut surface (364), which faces the second end (32a) and is configured to receive an edge portion (92) of the blade holder device (20), the edge portion (92) delimiting a recess (60) for receiving the interacting hook device (360) and which comprises a surface (363, 393) which faces the first end (31a), and an entrainment extension (37) which lies between the first end (31a) and the at least one extension for locking the ice skate blade (30) to the blade holder device (20),
wherein the shortest distance in the blade longitudinal axis (A) between a point on at least a portion of a surface (363, 393) which faces the first end (31a) and a point on at least a portion of the back surface (373) which faces the second end (32a) amounts between 5 mm and 50 mm.

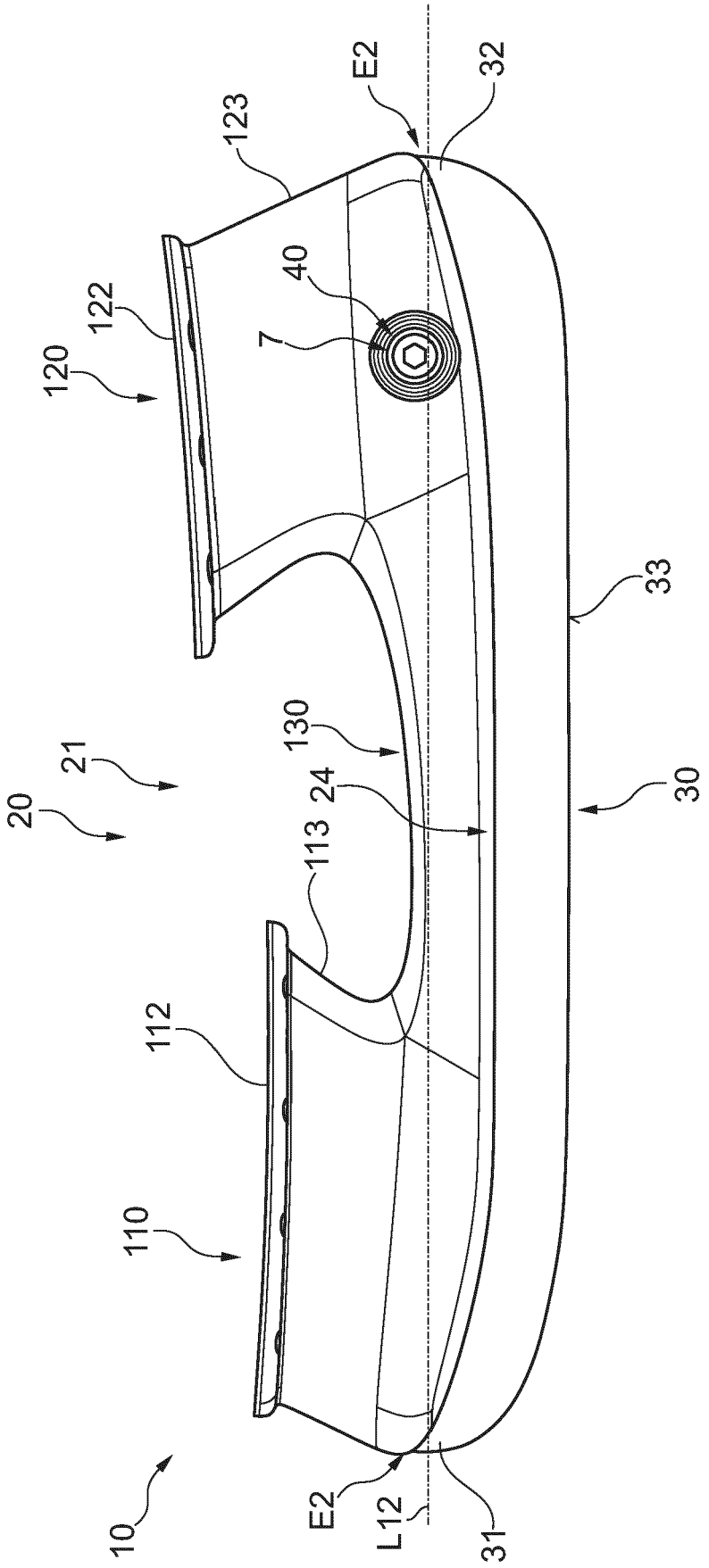
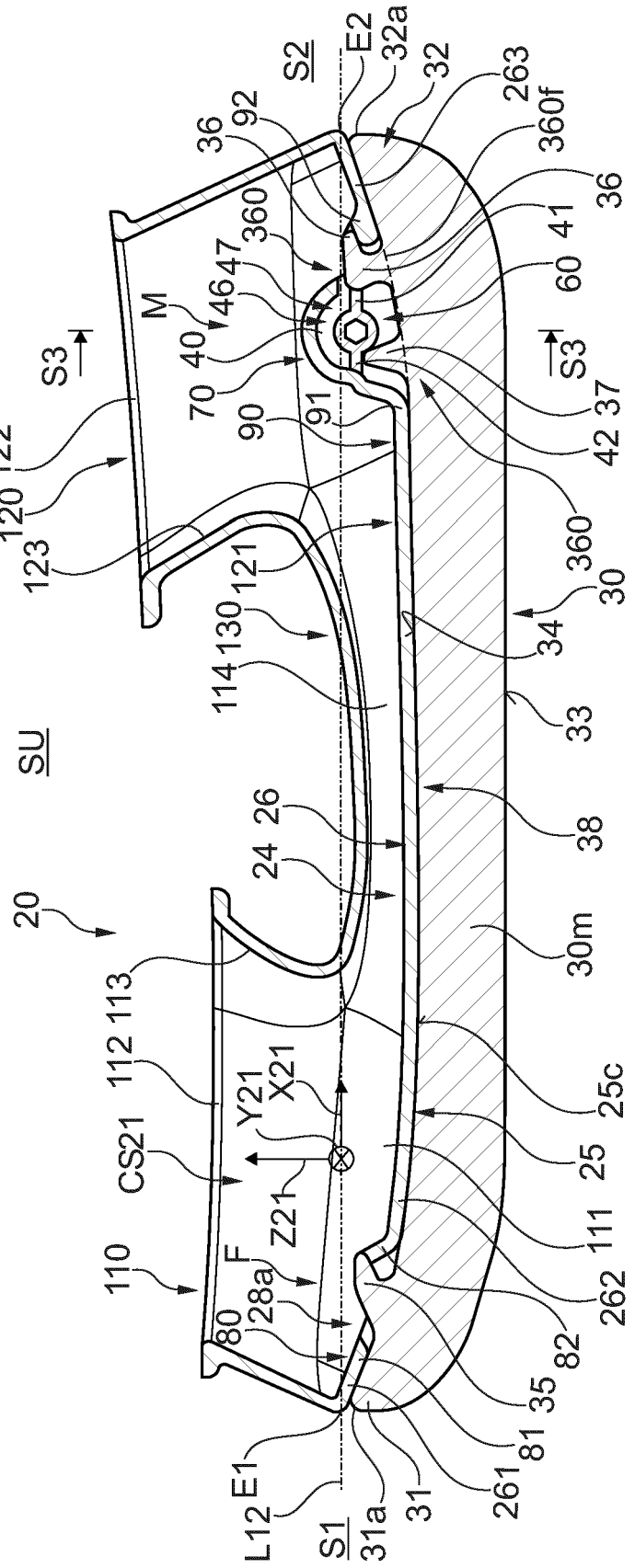


Fig. 1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121
360
30
34
130
114
33
SU
26
38
24
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30m
113
112
25c
Y21
X21
CS21
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E1
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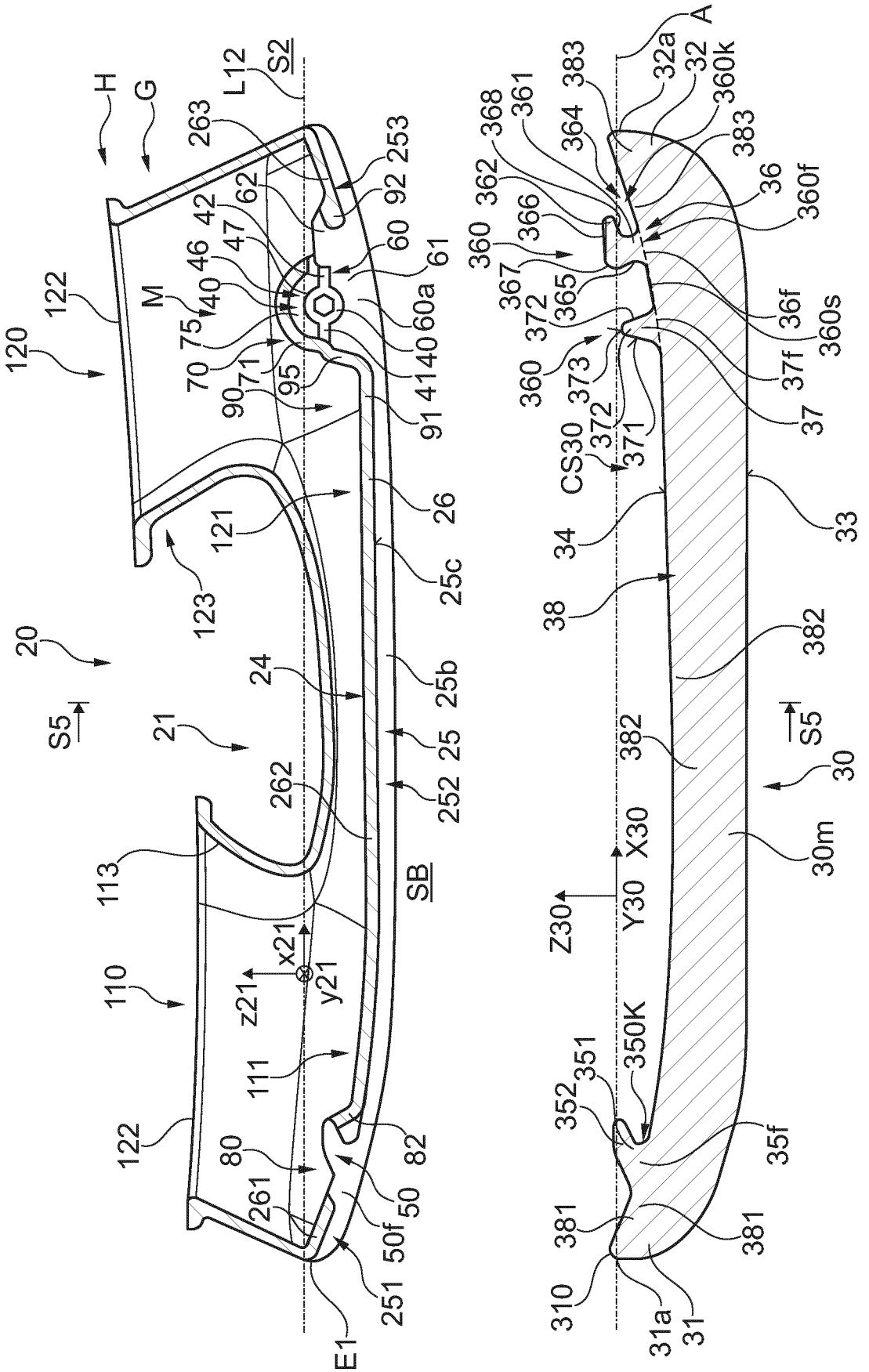
L12
S1
31a
31

Fig. 2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S5
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25b
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252
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z21
x21
y21
SB
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261
50
50f
82
251
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366
360
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CS30
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38
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360f
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360s
37f
37
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35f
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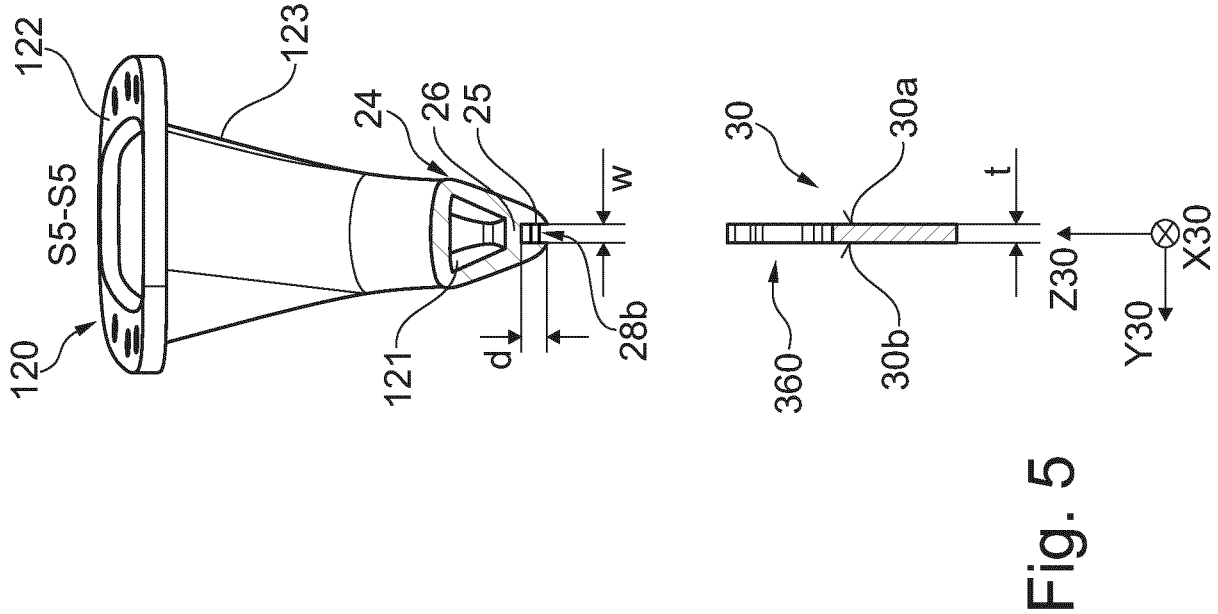
Fig. 4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t
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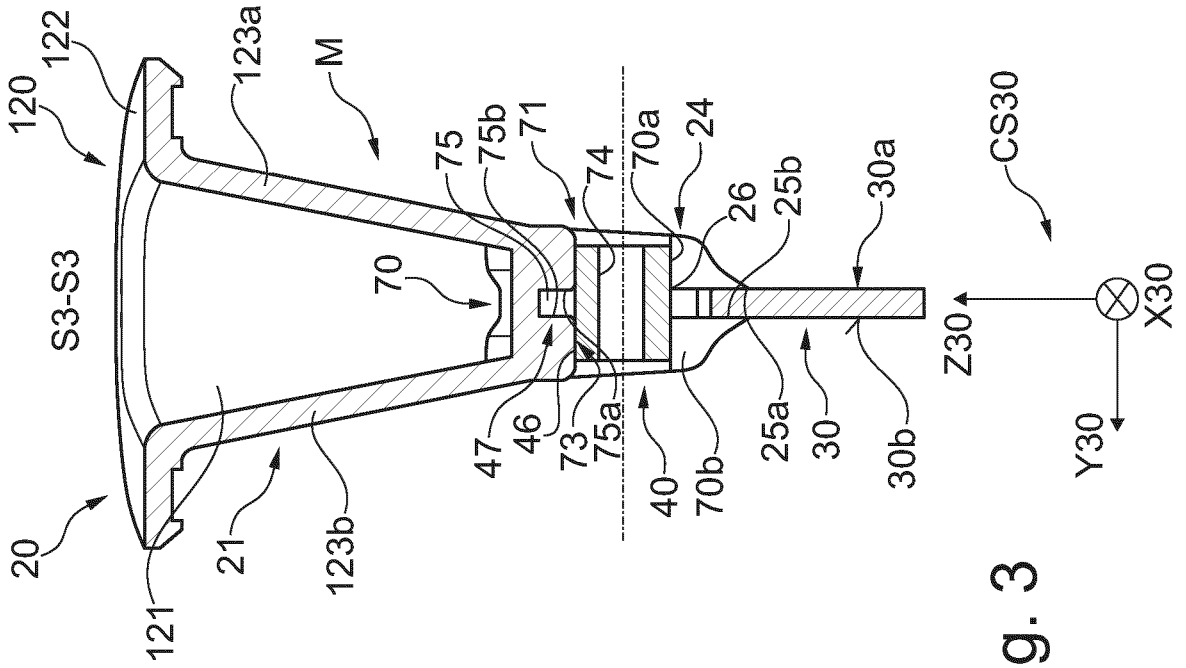
X30
Y30

Fig. 5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Y30
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25a
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30b

Fig. 3

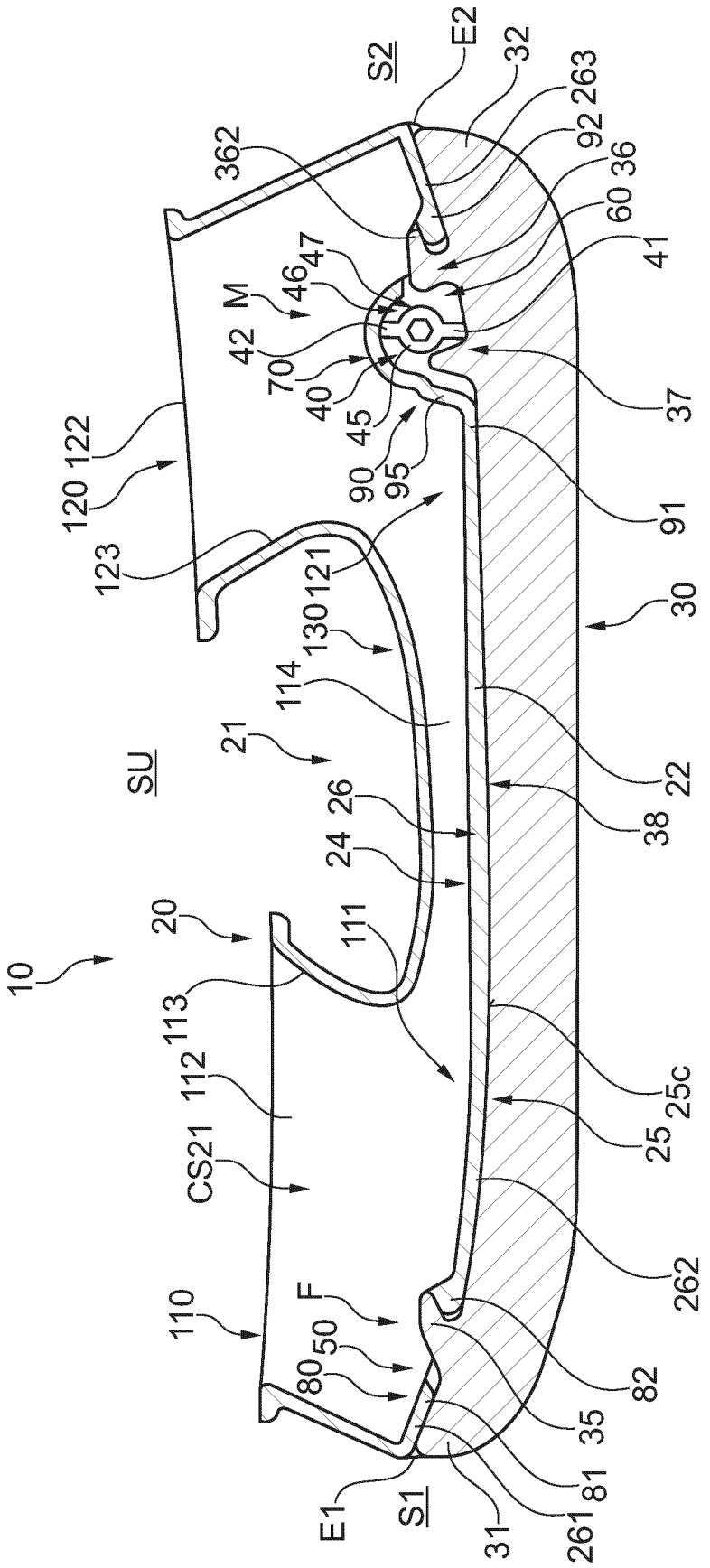
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Fig. 6

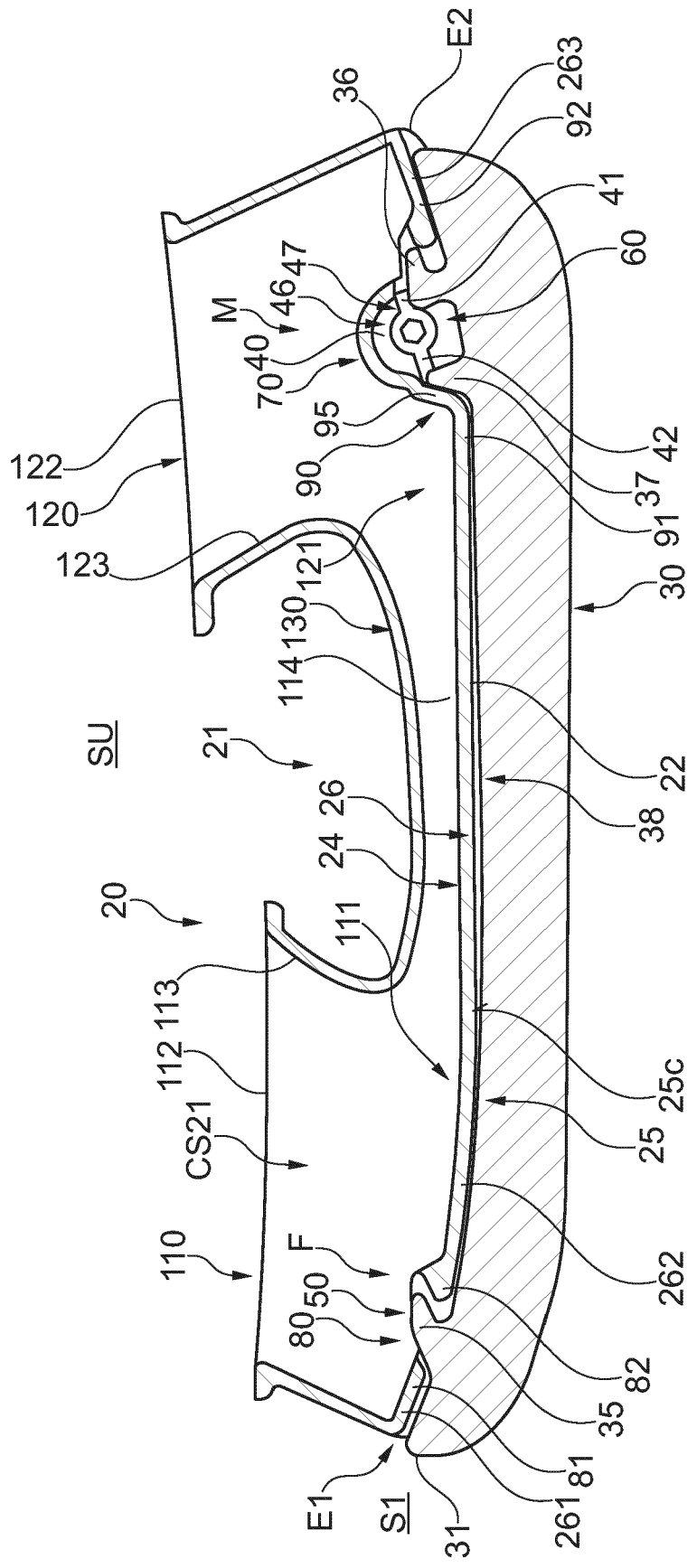
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Fig. 7

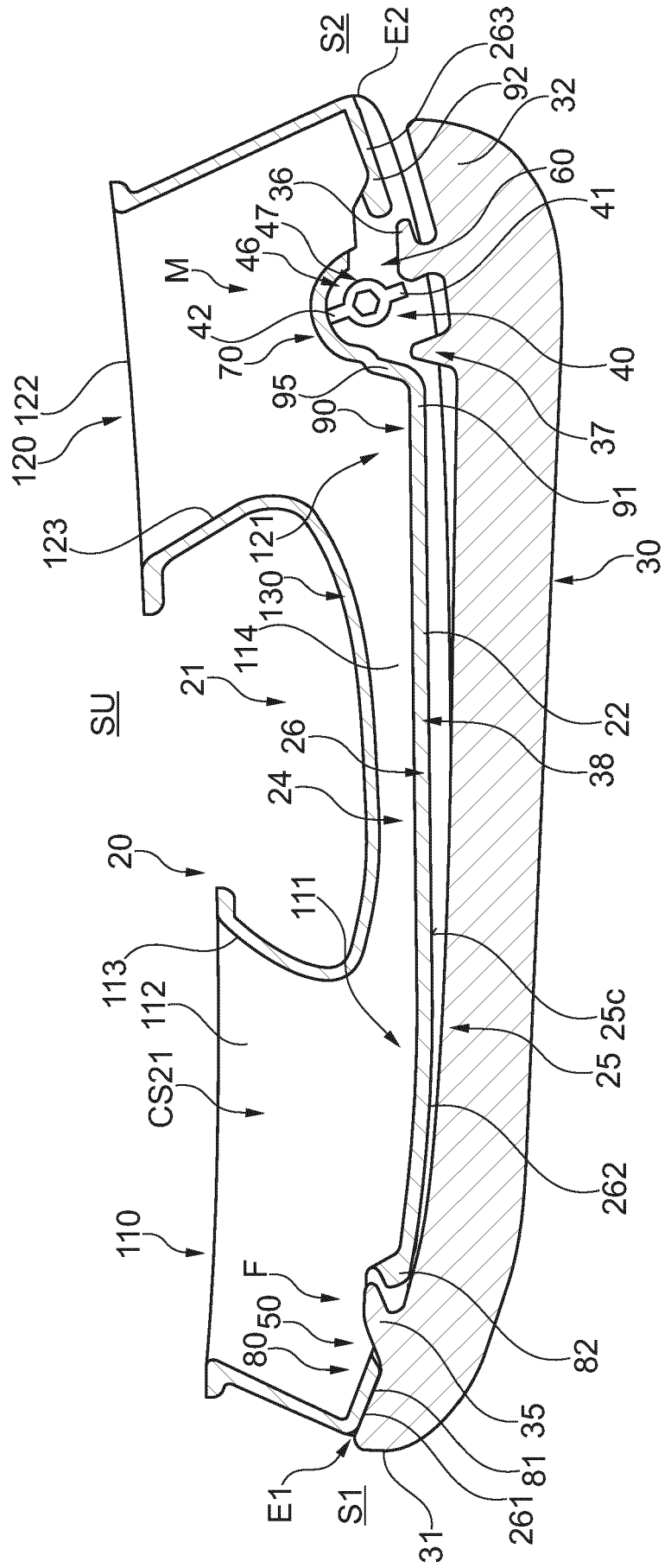
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Fig. 8

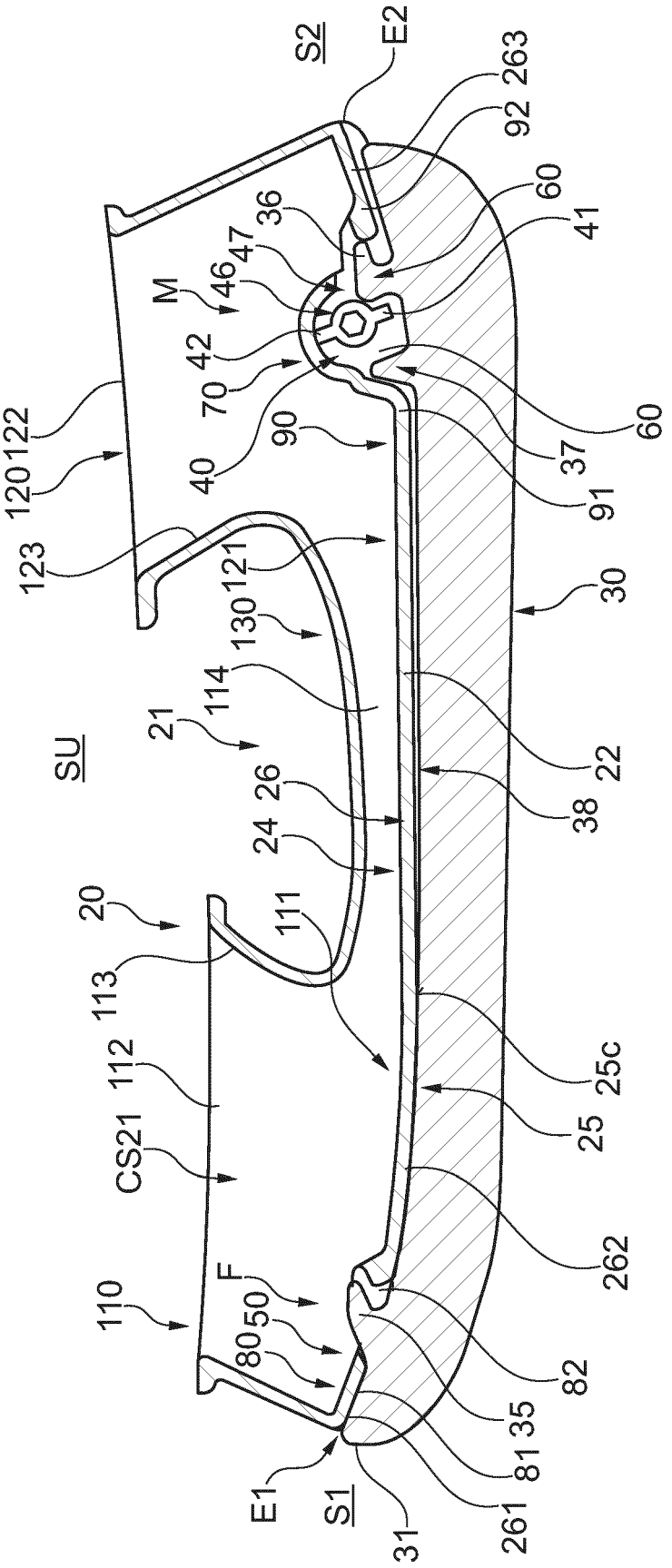
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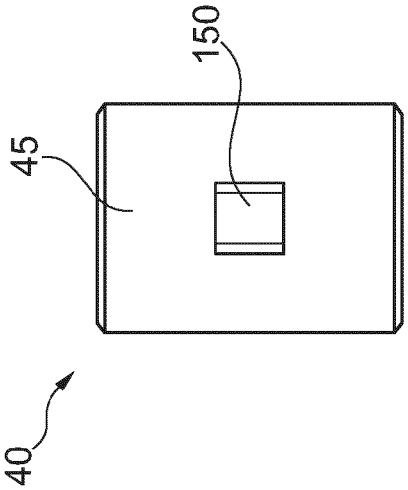
Fig. 9



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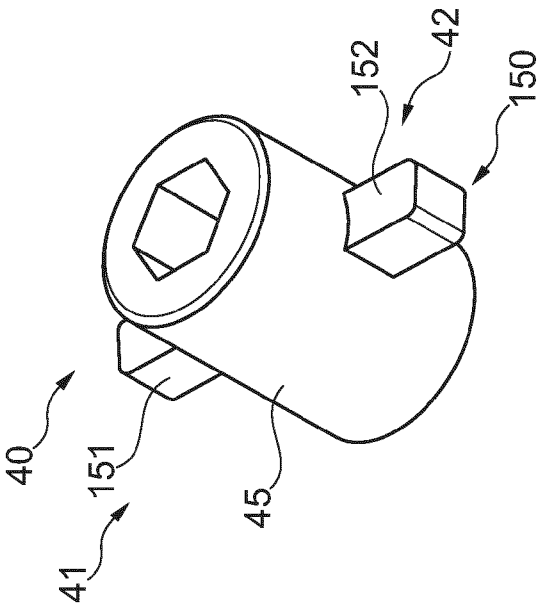
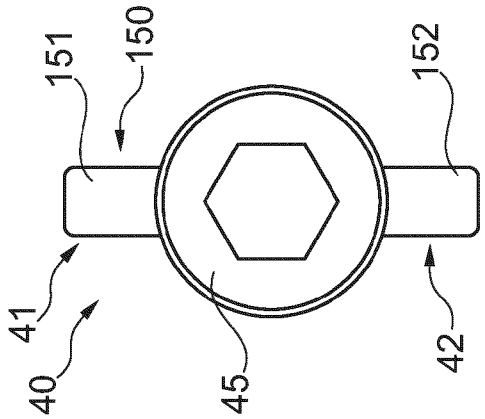


Fig. 13



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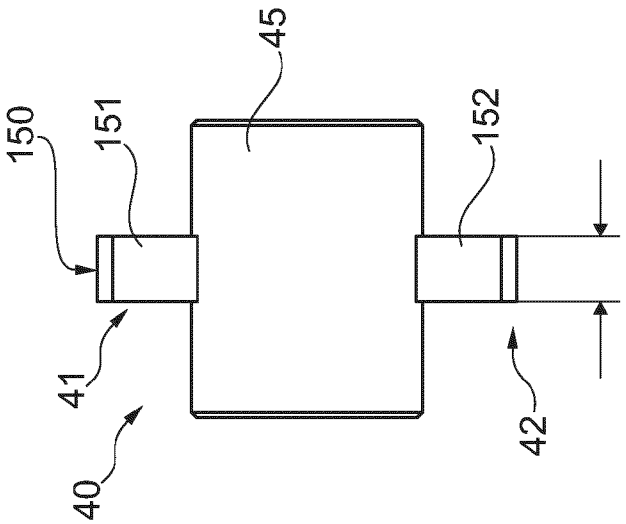

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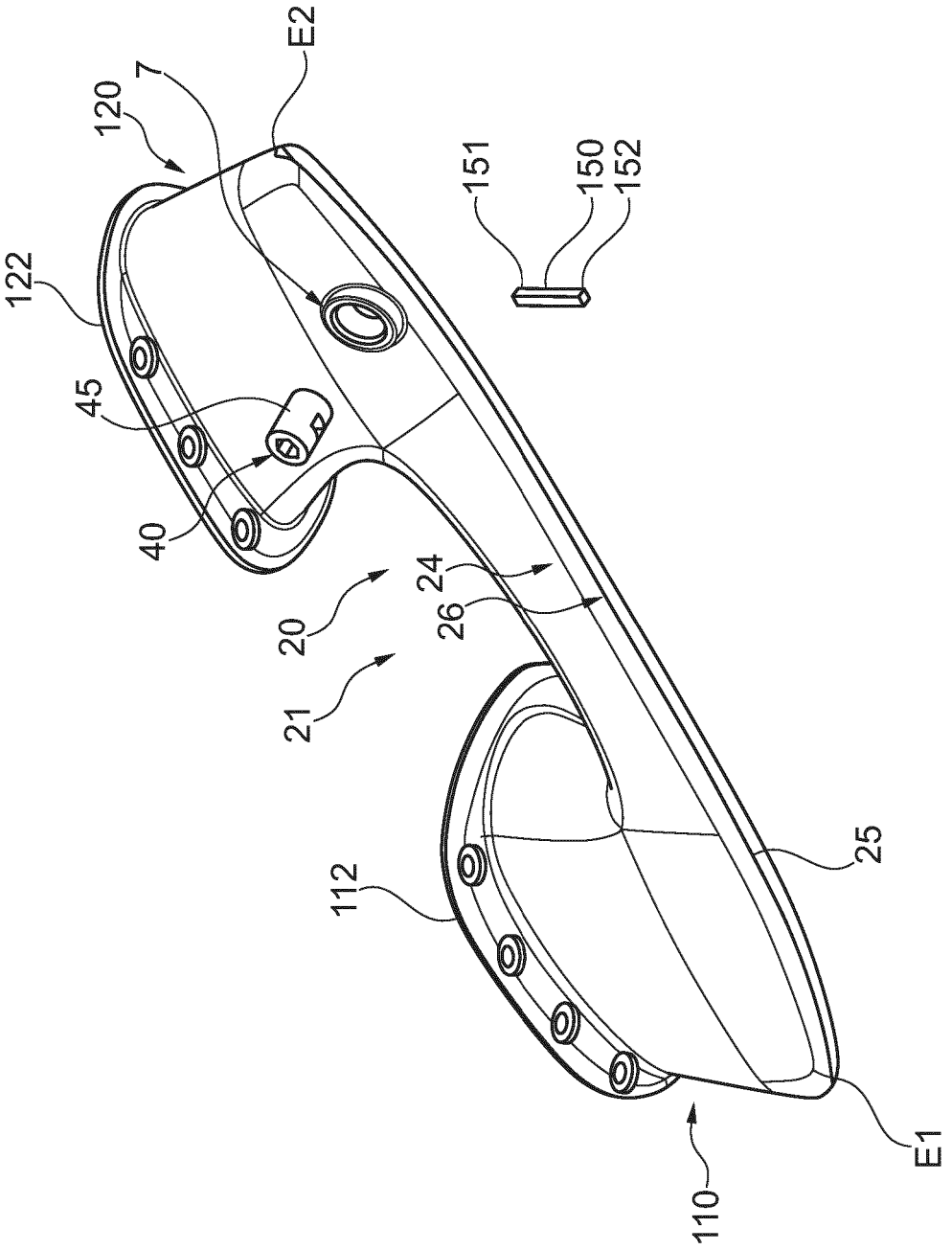

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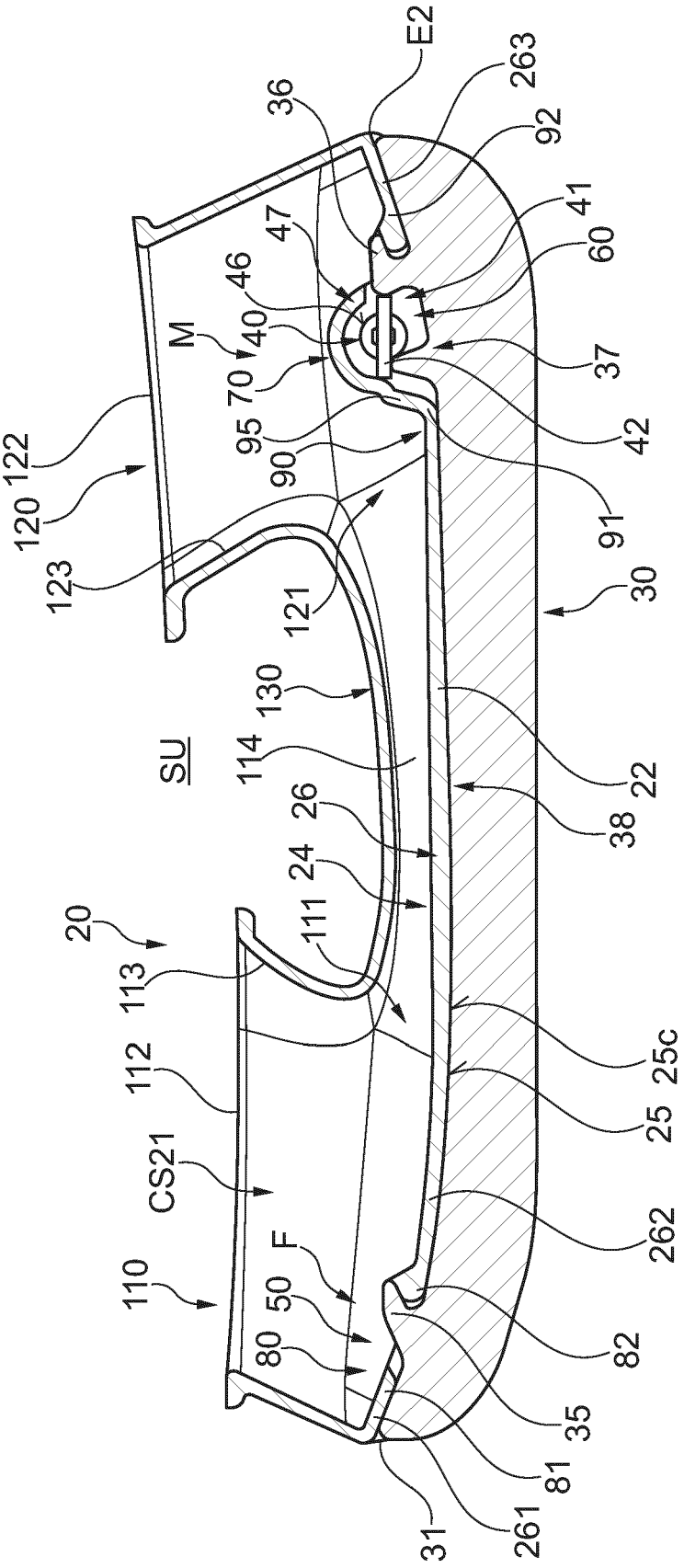
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Fig. 15

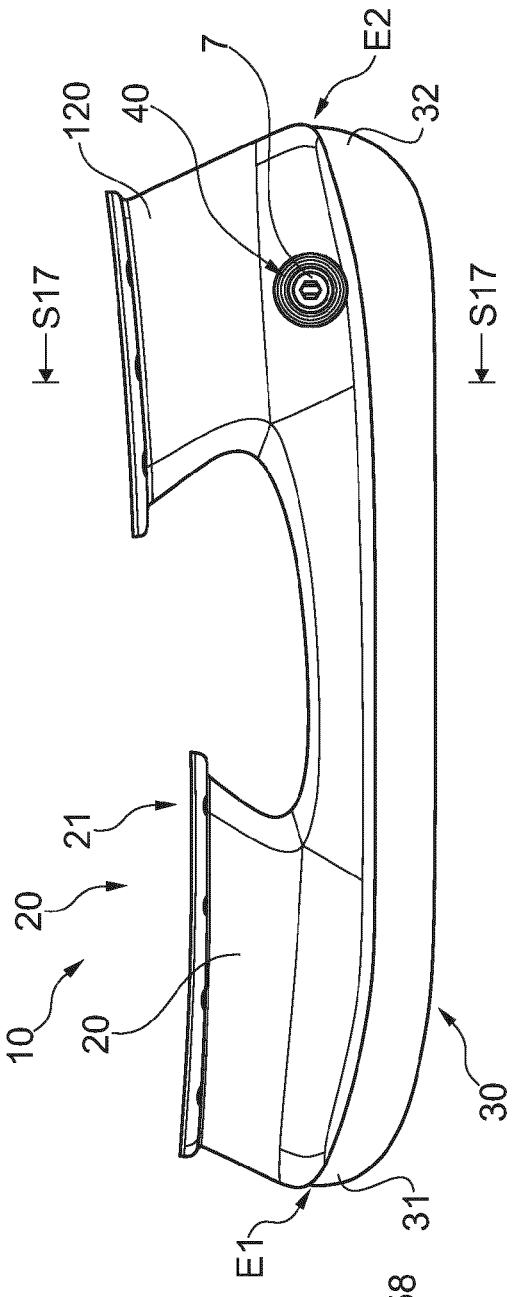


Fig. 16

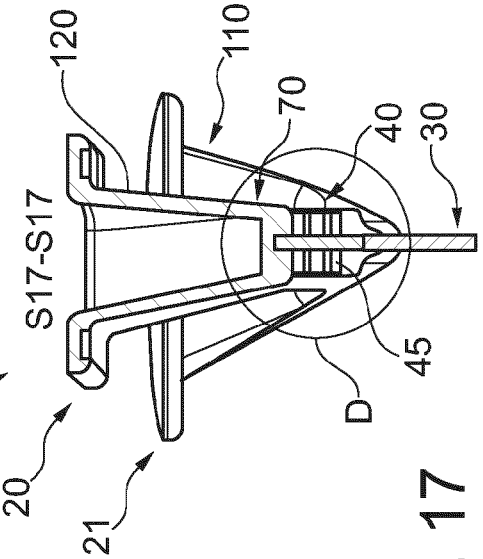
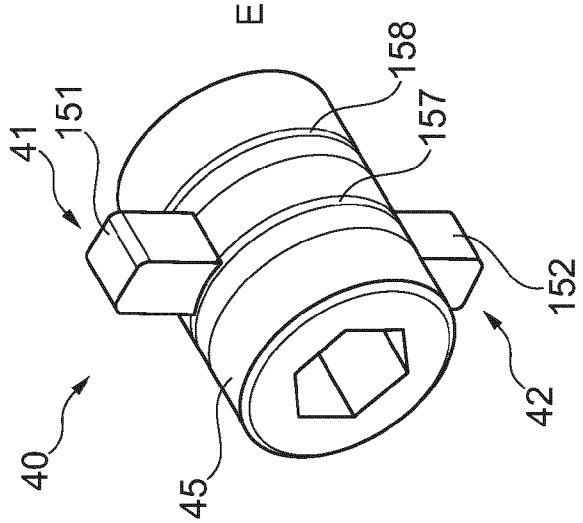


Fig. 17



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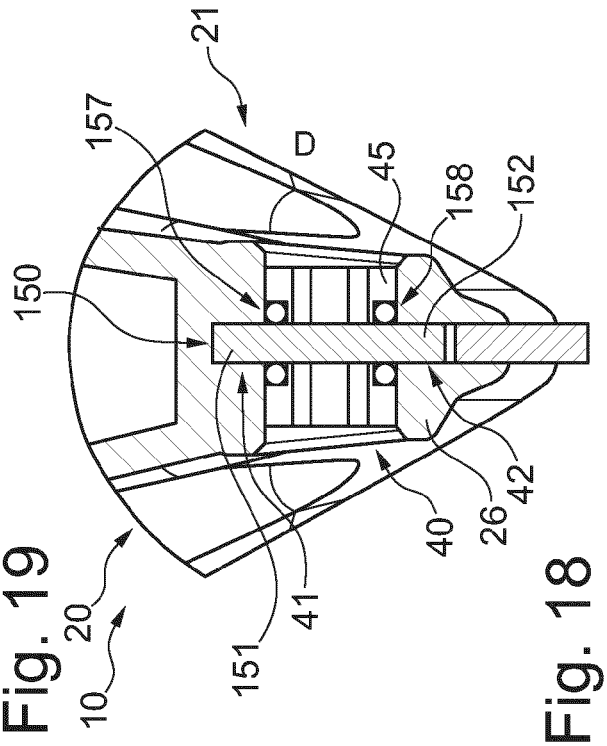

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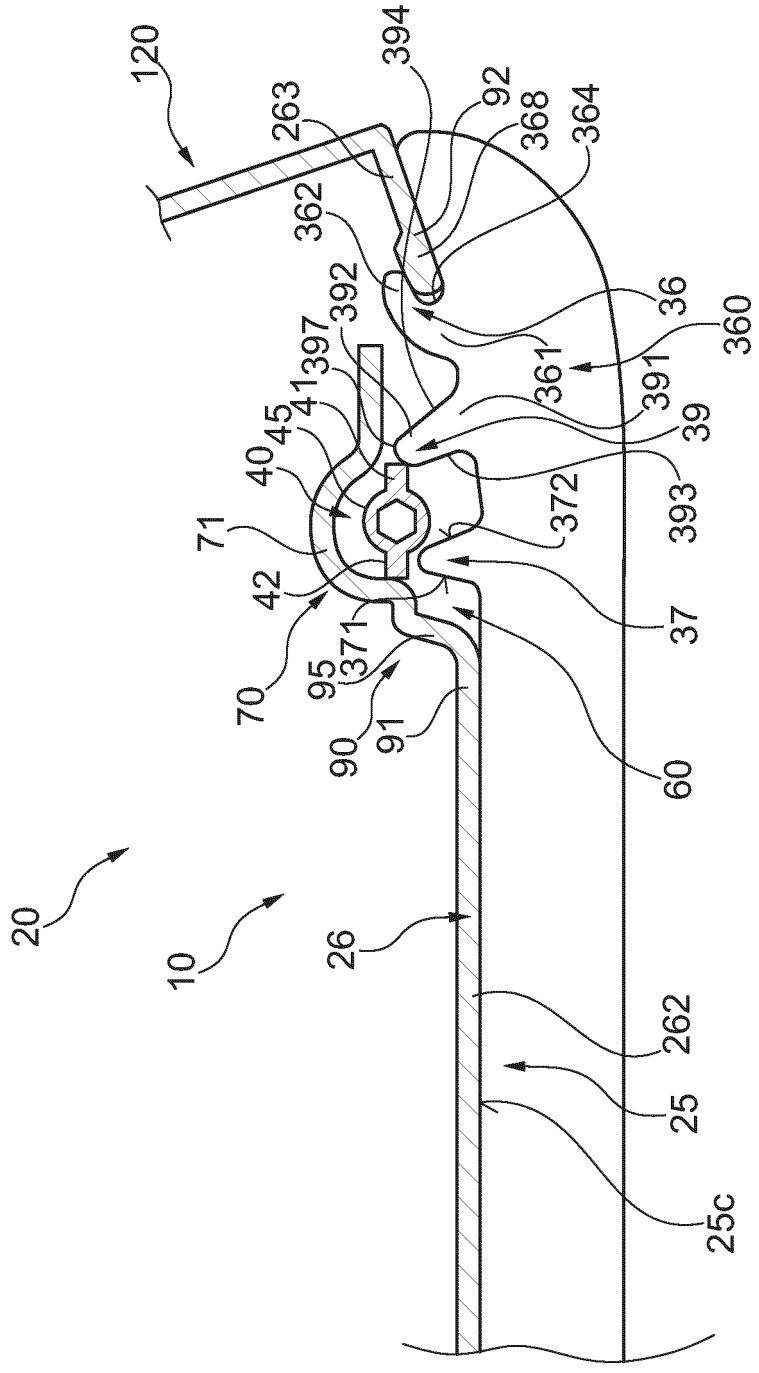
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Fig. 20

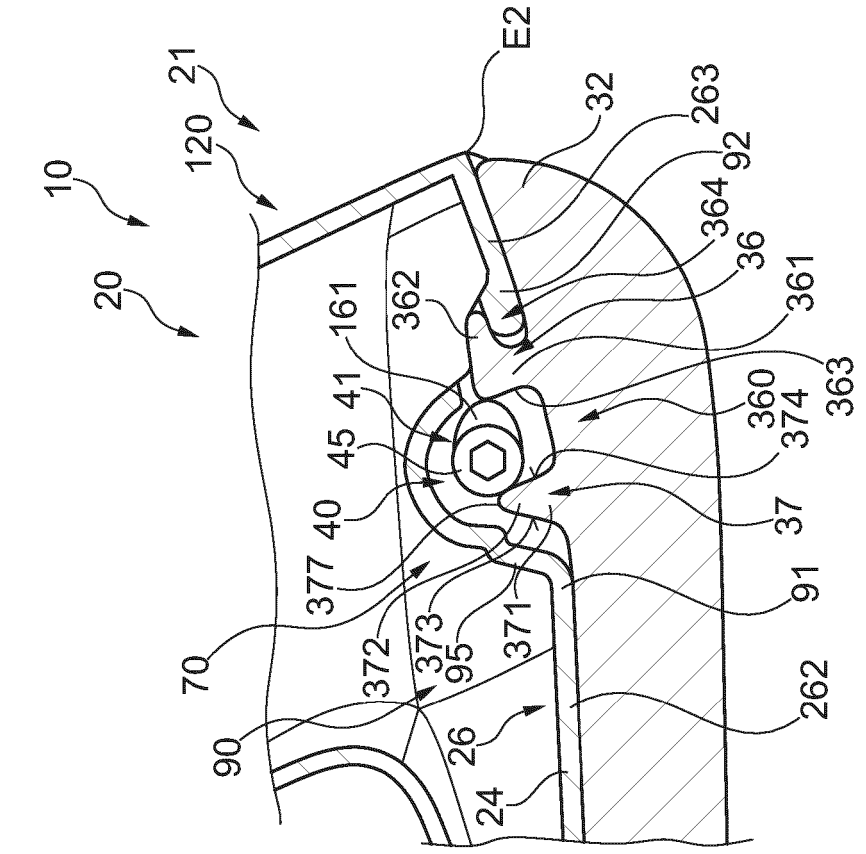
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Fig. 22

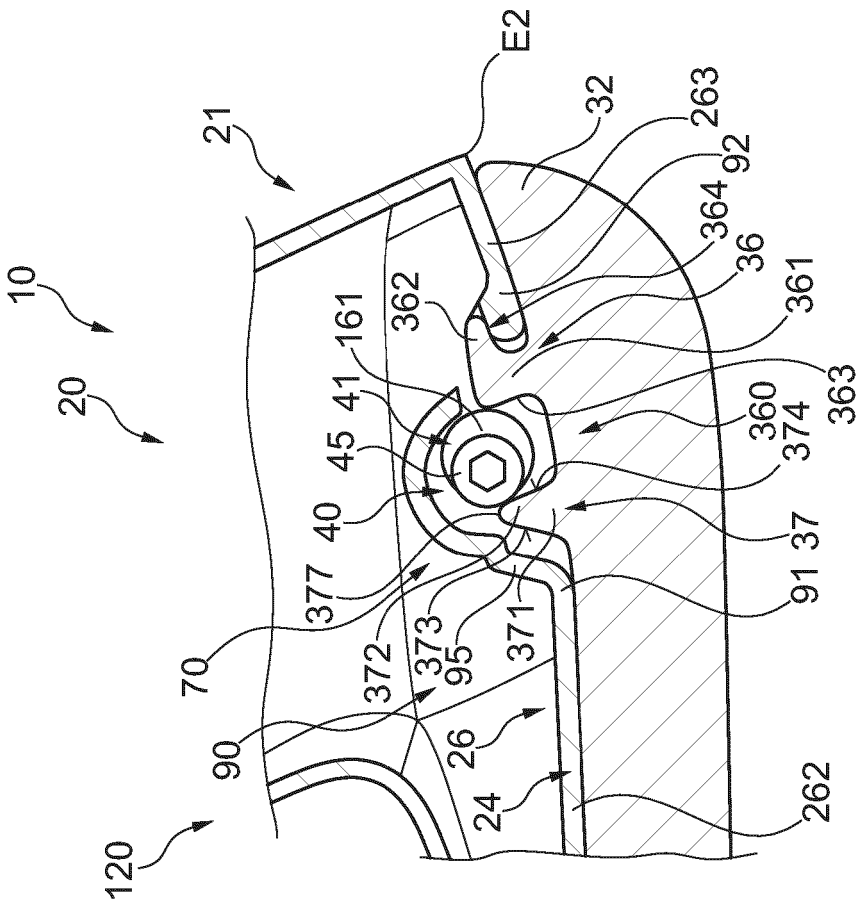
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Fig. 21

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EUROPEAN SEARCH REPORT

Application Number
EP 24 21 8508

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X A	US 2019/351313 A1 (ROUZIER EDOUARD [CA] ET AL) 21 November 2019 (2019-11-21) * paragraph [0071]; figures *	15 1-14	INV. A63C1/02 A63C1/30 A63C1/32
A	US 2021/401109 A1 (LABONTE IVAN [CA] ET AL) 30 December 2021 (2021-12-30) * figures 131-137 *	1-15	
A	CN 113 262 460 A (DECATHLON SA) 17 August 2021 (2021-08-17) * figures *	1-15	
A	US 2008/191431 A1 (SMITH GEORGE T [US]) 14 August 2008 (2008-08-14) * figures *	1-15	
A	CA 3 143 058 A1 (TRIGOLD MFT CO LTD [CN]) 30 September 2022 (2022-09-30) * figures 21-23 *	1-15	

TECHNICAL FIELDS SEARCHED (IPC)

A63C

The present search report has been drawn up for all claims

1

Place of search	Date of completion of the search	Examiner
Munich	2 April 2025	Endrizzi, Silvio

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- CA 3065238 A1 **[0004]**
- WO 2019218070 A1 **[0005]**
- US 10894200 B2 **[0006]**