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(54) SHIP'S WINCH

(57) Ship's winch comprising a drum, a winding ring and a lifter. The drum (4) has an outer winding surface (42) with a dimensionally fixed winding diameter. On the outer periphery, the winding ring (43) has a bearing surface for bringing the line part to bear against the winding ring. The bearing surface has an outer diameter with a variable size. The lifter is configured for guiding the line from the winding ring to the winding surface. In situations which occur during sailing, loose windings around the drum are a problem. According to the invention, the ship's winch comprises has a winch control (5) with an adjustment drive (51) which is connected to an adjustment mechanism (50) for adjusting the variable size of the outer diameter of the winding ring. When performing sailing manoeuvres, active intervention on the formation of loose windings is possible while paying out or pulling in a line with the winch.

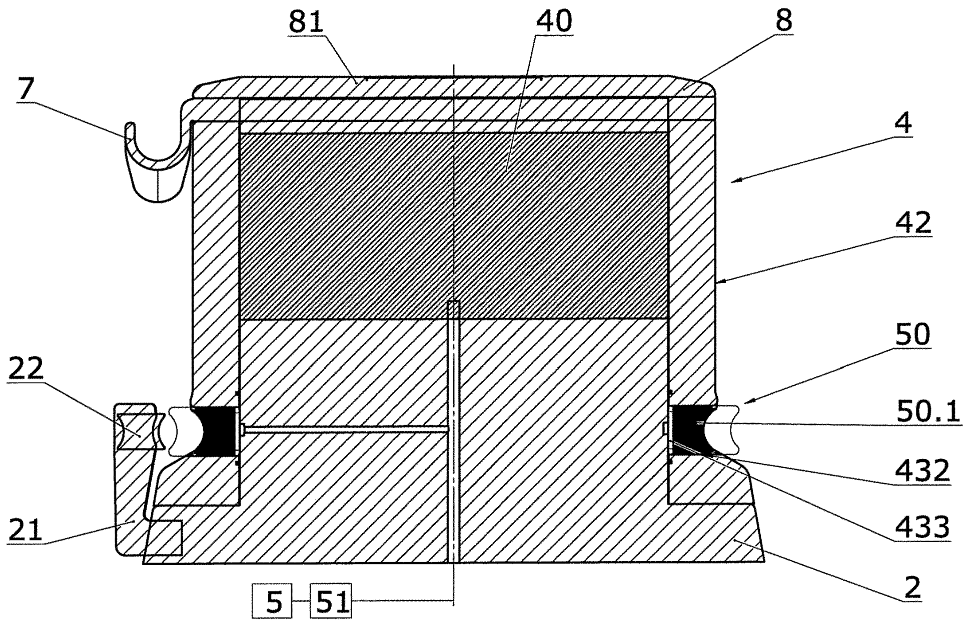

Fig. 1E

Description

[0001] The present invention relates to a ship's winch for conducting a line. The ship's winch comprises a frame which is configured for fixing the ship's winch on board a ship. The ship's winch comprises a drum which is connected to the frame rotatably about an axial shaft. The drum has an outer winding surface with a dimensionally fixed winding diameter. The winding surface extends from a first axial end to a second axial end of the drum. In the axial direction, the winding surface has a length for receiving at least one winding of a line conducted over the winch. The winch comprises a drum drive for driving the drum in rotation. On the first axial end, the drum is provided with a winding ring for guiding a line part of a conducted line in a first coil about the axial shaft. On an outer periphery, the winding ring has a bearing surface for bringing the line part to bear against the winding ring. The bearing surface has an outer diameter with a variable size. At the first axial end, the winch has a lifter. The lifter is designed for guiding a line part of the line over a helical track from the winding ring to the first axial end of the winding surface.

[0002] The invention furthermore relates to an assembly, a yacht and a method for operating a ship's winch.

[0003] NL2001300 discloses a ship's winch with a drum and a winding ring which are rotatable about a common shaft. The winding ring is fitted with a braked freerunning bearing and can rotate independently from the drum. When pulling in a line using the ship's winch, a line part is received on the winding ring and via a lifter transferred to the drum. Because the winding ring can rotate independently of the drum, the winding ring creates a braking effect whereby the line part is wound more tightly around the drum. The winding ring thus functions as a counterhold means. The winding ring has an outer diameter which is variable in size. The variable size of the outer diameter is obtained by forming the winding ring with two rings which are pretensioned against each other by a tension spring, wherein the rings have a tapered outer periphery. Due to the tapered form of the outer periphery of the two rings, a V-shape is formed which constitutes a bearing surface for the line part. The variable size of the outer diameter is determined by a force equilibrium between a pretension force induced by the tension spring and a tensile force exerted by a conducted line. The variable size is favourable when paying out a line from a ship's winch (in the direction of a sail). When the tensile force diminishes on paying out the line, the windings relax and the windings around the drum could become loose and even form loops which lie over each other and disrupt the good function of the ship's winch. Loop formation is also dangerous because one is tempted to hold the formed loops in place by hand, wherein an undesirable situation may arise in which fingers can become trapped between the line and the drum. By enlarging the outer diameter of the bearing surface of the winding ring, the formation of loose windings on the drum is countered. By enlarging the outer diameter of the winding ring which co-rotates with the drum, the line part around the winding ring is paid out with a higher speed than the windings around the drum, whereby the diminishing tensile force in the line is compensated and the windings around the drum become taut again.

[0004] One problem relating to this ship's winch is however that a number of situations remain in which loops can form on the drum. Consequently undesirable situations can also arise in which fingers can become trapped between the windings of a line and the drum. In particular, such situations may arise when a tensile force in a conducted line fluctuates greatly, for example on tacking of a yacht.

[0005] The invention proposes to eliminate the above problems at least partially by providing a usable alternative. In particular the aim of the invention is to produce a ship's winch, wherein the ship's winch is designed to counter the formation of loose windings around the drum.

[0006] At least one of these objects is achieved with a ship's winch as defined in claim 1.

[0007] According to the invention, the ship's winch comprises a winch control. The winch control comprises an adjustment drive which is actively connected to an adjustment mechanism for adjusting the variable size of the outer diameter of the bearing surface of the winding ring. The size of the outer diameter of the bearing surface can be actively controlled by operation of the adjustment drive.

[0008] The active control of the winding ring may provide various advantages. One advantage is that the setting of the size of the outer diameter of the bearing surface is determined by the adjustment drive, and hence it can be set independently of a tensile force occurring in a conducted line.

[0009] A further advantage is for example that adjustment of the winding ring may be operated remotely. A crew member of a yacht, before starting a specific manoeuvre such as tacking, may control the ship's winch from a remote position, for example from the helm. Before performing various sailing manoeuvres, it is advantageous that the winding ring can be adjusted on command. A first ship's winch erected on the port side may thus be operated at the same time as a second ship's winch mounted on the starboard side. For tacking, the first ship's winch can be controlled for example to pay out a line while the second ship's winch can be controlled to pull in a line. The control of the ship's winch may comprise a step wherein the winding ring is first enlarged or reduced before the drum drive is controlled and tensile forces in the line increase or diminish. The winding ring may for example be enlarged on the first ship's winch, while the winding ring on the second ship's winch is reduced before the line is paid out or pulled in respectively. By adjusting the winding ring early, i.e. preferably in advance, to an outer diameter desired for the sailing manoeuvre, advantageously a more reliable function of the ship's winch can be obtained.

[0010] In one embodiment of the ship's winch according to the invention, the size of the outer diameter of the bearing surface may be adjusted by operation of the adjustment mechanism to an outer diameter which is smaller than the winding diameter of the winding surface. In a situation in which the tensile force in a conducted line diminishes, it is possible to adjust the size of the outer diameter of the bearing surface by operating the adjustment drive such that the size of the outer diameter is smaller than the winding diameter of the winding surface. This is advantageous in a situation in which a line is pulled in with the winch and transferred from the winding ring to the drum. The smaller outer diameter of the bearing surface means that a winding held on the winding ring will have a diameter which is smaller relative to the size of the winding diameter. When this relatively small winding is transferred to the drum, this winding will have to assume the size of the winding diameter, whereby the winding will be pulled taut. This effect of tautening the windings on the drum prevents the windings on the drum from looping. The tautening reduces the chance of the occurrence of loose windings on the drum. Advantageously, the reliability of the function of the ship's winch is thus increased.

[0011] In one embodiment of the ship's winch according to the invention, the winding ring is formed integrally with the drum. The drum and the winding ring may be made of one piece or comprise two components fixedly connected together. Preferably, the drum has a cylindrical casing surface, wherein a part of the cylindrical casing surface forms a winding surface and wherein an adjacent part forms the winding ring. Typically, the winding surface has a constant winding diameter or the winding surface is formed slightly conical in a direction away from the winding ring. Preferably, on an outer periphery, the winding ring has a groove for receiving a line part. The groove may be contained in the drum for integral formation of the winding ring in the drum. The groove preferably has a rounded cross section. The groove has a round groove base and groove walls. The groove base has an outer diameter which is smaller than the winding diameter of the winding surface. The groove walls ensure an axial confinement of a line part held in the groove.

[0012] The embodiment in which the drum and the winding ring are formed integrally is advantageous because both the winding ring and the drum can be mounted on the same bearing. The drum is mounted rotatably relative to the frame. The bearing of the drum is dimensioned such that this is suitable for resisting high loads. It is advantageous to form the winding ring integrally with the drum because the winding ring is then also mounted on the bearing of the drum, and hence also configured to resist high loads on the winding ring. It is also advantageous that when a drum and a winding ring are made of one piece, no separate bearing is required for mounting the winding ring.

[0013] In an alternative embodiment of the ship's winch according to the invention, the winding ring is a separate component. The winding ring is then mounted rotatably relative to the frame separately from the drum. In one embodiment thereof, the winding ring comprises a free-running bearing, wherein the winding ring is rotatable in a first drum rotation direction independently of the drum, and wherein in an opposite second drum rotation direction, the winding ring co-rotates with the drum. In the first drum rotation direction, a line connected to a sail is pulled in and transferred from the winding ring to the drum. In the first rotation direction, the winding ring may have a rotation speed which is lower than the rotation speed of the drum. This has the favourable effect that the windings are pulled taut on the drum while the line is being pulled in. In the second drum rotation direction, a line connected to a sail is paid out and transferred from the drum to the winding ring. Because the winding ring co-rotates with the drum, the winding ring contributes to paying out the line, countering bunching of the line and promoting the function of the winch.

[0014] In one embodiment of the ship's winch according to the invention, the adjustment mechanism of the winding ring comprises at least one winding cam. Preferably the adjustment mechanism comprises several adjustment cams distributed over the periphery. The at least one cam is held in a chamber. The chamber is positioned on the outer periphery of the winding ring. Preferably the chamber is positioned in the groove of the outer periphery of the winding ring. The at least one adjustment cam is moveable from a first cam end state I to a second cam end state II. Preferably the adjustment cam is moveable in a radial direction. In the first end state I, the bearing surface has a first outer diameter d1. In the second cam end state II, the bearing surface has a second outer diameter d2. The second outer diameter d2 is greater than the first outer diameter d1. The variable size of the outer diameter of the bearing surface is dependent on the position of the at least one adjustment cam relative to the chamber.

[0015] In one embodiment of the ship's winch according to the invention, the first outer diameter d1 of the bearing surface in the first cam end state I is smaller than the winding diameter of the winding surface, and the second outer diameter d2 of the bearing surface in the second cam end state II is larger than the winding diameter of the winding surface. When using the winch to pull in a line connected to a sail, it is advantageous if the outer diameter of the bearing surface of the winding ring is set to the first outer diameter d1, because the windings are thus pulled taut on the drum. When using the winch to pay out a line connected to a sail, it is advantageous if the outer diameter of the bearing surface of the winding ring is set to the second outer diameter d2, because the line is thus paid out from the winding ring at a higher speed, whereby the windings on the drum are pulled taut. Advantageously, with this embodiment of the winch, the risk of formation of loose windings around the drum can therefore be reduced both when pulling in and when paying out a line.

[0016] In one embodiment of the ship's winch according to the invention, the adjustment drive comprises a hydraulic circuit. The hydraulic circuit contains a hydraulic pump. Via at least one line, the pump is in fluidic connection with a pressure chamber for exerting a pressure force on the at least one adjustment cam of the adjustment mechanism. The pressure chamber is positioned on an inwardly facing side of the at least one adjustment cam. By the exertion of pressure, the adjustment cam can be moved out against the counter-pressure provided by the line part so that the winding of the line part has a greater diameter. In this way, the control and adjustment of the size of the outer diameter of the bearing surface of the winding ring are hydraulic. The hydraulic control allows a robust and reliably functioning configuration of the winch.

[0017] In an advantageous embodiment of the ship's winch according to the invention, the winch has at least one sensor actively connected with the winch control. The sensor is configured for measuring a force occurring which is representative of a tensile force occurring in the conducted line. Consequently, the variable size of the outer diameter of the bearing surface of the winding ring can be adjusted by the adjustment drive and the adjustment mechanism as a function of the tensile force occurring in the conducted line. Due to the presence of the at least one sensor, the size of the outer diameter of the bearing surface of the winding ring may be adjusted to a situation in which a tensile force in a conducted line changes. Using the at least one sensor, a changing situation is detected directly. In comparison with a human intervention, by use of the winch control with at least one sensor, a rapid and precise response can be made to changing situations. In particular, during sailing manoeuvres such as tacking, the tensile force in a line can change quickly. Due to the presence of the at least one sensor, changes are detected quickly and there is a smaller risk that the changing tensile forces can lead to disruption in the function of the winch. Advantageously, the presence of the at least one sensor contributes to an autonomous function of the winch.

[0018] In a further embodiment of the ship's winch according to the invention, the winch control is actively connected to a motor of the drum drive for controlling the rotation speed of the drum. As well as controlling the adjustment drive of the winding ring, the rotation speed of the drum can also be controlled. This creates further possibilities for anticipating changing situations. The size of the outer diameter of the bearing surface of the winding ring can be adjusted in combination with adjustment of the drum rotation speed. When paying out a line, the size of the outer diameter of the bearing surface may for example be increased, wherein also the rotation speed of the drum is reduced in a situation in which the tensile force in the line diminishes. Controlling the rotation speed of the drum using the winch control further improves the possibility of autonomous function of the winch.

[0019] In one embodiment of the ship's winch according to the invention, the winch control is connected to a display screen for displaying at least one parameter. Preferably, the display screen is positioned on a top of the winch, such that the display screen is in the line of sight of a user during use. Preferably the display screen is positioned on a cap of the winch. The parameter is a parameter relevant to sailing. The parameter shown is for example a line speed, a tensile force in the line etc. The line speed may for example be derived from the rotation speed of the drum. Preferably, the parameter is a value measured by the at least one sensor, for example a load occurring on the winch.

[0020] In one embodiment of the ship's winch according to the invention, the winch control may be actively coupled to a main control of a ship. By integrating the winch control in the main control, the winch control and hence the winch can be controlled centrally and remotely. The winch may for example be operated from a cabin of a ship.

[0021] The invention also relates to an assembly of a ship's winch according to the invention and at least one storage drum for storage of a line conducted over the winch. The storage drum furthermore ensures a tensile force on the line coming from the winch, which contributes to keeping the windings on the drum taut.

[0022] In one embodiment of the assembly according to the invention, the assembly comprises a ship's winch according to the invention in combination with at least two storage drums. The ends of lines coming from different types of sails of a yacht may remain continuously connected to the storage drums. The line coming from a main sail may remain continuously connected to an associated storage drum. The line coming from a gennaker sail may remain continuously connected to an associated storage drum. The winch may be used successively for paying out a first line and pulling in a second line, in combination with the different storage drums.

[0023] The invention furthermore relates to a yacht comprising a ship's winch according to the invention. In one embodiment of the yacht, the yacht comprises a main control which is actively connected to the winch control. In this way the winch can be advantageously operated remotely by means of the main control of the yacht. In one embodiment, the yacht comprises an assembly of a winch according to the invention and at least one storage drum for storage of a line conducted via the winch. In one embodiment, both the winch and the storage drum are positioned on the deck of the yacht. The at least one storage drum may be positioned on the deck behind the winch. In another embodiment, the winch may be positioned on the deck of the yacht and the storage drum below deck. In another embodiment, both the storage drum and the winch may be positioned below deck.

[0024] The invention furthermore relates to a method for operating a ship's winch, wherein the method comprising steps of providing a ship's winch according to the invention and adjusting the size of the outer diameter of the bearing surface of the winding ring by operating an adjustment drive of the adjustment mechanism by means of the winch control.

[0025] In one embodiment of the method according to the invention, the size of the outer diameter is adjusted such that the outer diameter of the bearing surface is smaller than the winding diameter of the winding surface of the drum. This has the advantage that when the line is pulled in, the windings can be conducted more tightly around the winding surface of the drum. This is advantageous in particular with high pulling-in speeds.

[0026] In one embodiment of the method according to the invention, the winch control is operated from a main control of the yacht. This has the advantage that the winch may be controlled remotely without a crew member needing to be present at the winch.

[0027] In one embodiment of the method according to the invention, by means of a sensor a force is measured which is representative of a tensile force occurring in a line conducted over the winch. The sensor emits a control signal to the winch control, wherein the drum drive and/or the adjustment drive are controlled on the basis of the control signal emitted by the sensor.

[0028] In one embodiment of the method according to the invention, the winch control is actively connected to a display screen and technical information is shown on the display screen. The technical information relates to the sailing conditions. The display screen for example shows a parameter such as line speed and/or a tensile force occurring during operation.

[0029] A first aspect of the invention relates to a ship's winch according to claim 1.

[0030] A second aspect of the invention relates to a ship's winch according to the preamble of claim 1 with the feature that the ship's winch comprises a winch control with an adjustment drive which is connected to an adjustment mechanism for adjusting the variable size of the outer diameter of the bearing surface of the winding ring, wherein the size of the outer diameter of the bearing surface can be adjusted by operating the adjustment mechanism, wherein the outer diameter can be adjusted to an outer diameter which is greater than or equal to the winding diameter of the winding surface.

[0031] A third aspect of the invention relates to a ship's winch according to the preamble of claim 1 with the feature that the ship's winch comprises a winch control, wherein the winch control is connected to a display screen for displaying at least one parameter such as a line speed and/or tensile force.

[0032] A fourth aspect of the invention relates to a ship's winch according to the preamble of claim 1 with the feature that the ship's winch comprises a winch control, wherein the winch control may be actively coupled with a main control of a ship such that the winch can be operated remotely.

[0033] It will be clear to the person skilled in the art that the technical details discussed here with reference to the ship's winch according to the first aspect of the invention may, if required, be combined with a ship's winch according to one or more of the other aspects according to the invention.

[0034] Further embodiments of a ship's winch, the assembly, the yacht and the method according to the invention are described in the subclaims.

[0035] The invention will be explained in more detail below with reference to the enclosed drawings. The drawings illustrate a practical embodiment of a ship's winch according to the invention and may not be considered as restrictive for the scope of protection, wherein:

Figure 1A shows a perspective view of an embodiment of a ship's winch according to the invention;
Figures 1B-1E are respectively a front, side, top and diagrammatic view in cross section of a ship's winch as shown in Figure 1A;
Figure 1F shows in detail a view of a first and second cam end state I and II of an adjustment mechanism of the ship's winch.

[0036] Figures 1A-1E show in various views an embodiment of a ship's winch 1 according to the invention. Figure 1A shows the winch 1 in a perspective view. Figures 1B, 1C and 1 D show respectively a side view, a front view and a top view of the winch 1 as shown in Figure 1A. Figure 1E shows a cross section view of the winch 1 along line B-B as shown in Figure 1 D.

[0037] The winch 1 is configured to conduct a line, in particular a clew of a sail on board a ship, in particular a yacht, more particularly a large yacht of at least 15 metres length.

[0038] The ship's winch 1 has a frame 2. The frame 2 forms a foot of the winch 1. The frame 2 has a flat underside for positioning of the winch 1 on a deck of a ship, in particular on the deck of a yacht. The frame 2 has bolt holes for fixing the frame 2 by a bolt connection. The type of winch 1 shown is also called a capstan winch. The winch 1 is also called a clew winch.

[0039] The ship's winch 1 has a drum 4. The drum 4 is rotatable about an axial shaft 41 connected to the frame 2. The winch 1 comprises a drum drive 40 for driving the drum 4 in rotation. The drum drive 40 is partly positioned in an internal space of the drum 4. The drum drive 40 comprises for example a gear transmission, preferably a planetary gear transmission between a motor or winch handle-driven shaft and the drum.

[0040] The drum 4 has an external casing surface. The casing surface forms a winding surface 42. The winding surface 42 has a set winding diameter for receiving at least one winding of a conducted line. The winding diameter of the winding surface 42 is set, which means that the winding diameter of the winding surface 42 is dimensionally fixed. The outer dimension of the winding surface 42 is static, non-dynamic, non-adjustable and non-variable.

[0041] The winding surface 42 has a winding diameter with a constant dimension which for example lies between 15 cm and 60 cm, so that the winding surface 42 is cylindrical. The winding surface 42 may have a winding diameter which increases slightly in the axial direction, so that the winding surface 42 is conical in one direction. The winding surface 42 extends from a first axial end to a second axial end. In the axial direction, the winding surface has a length for receiving at least one winding of the conducted line. Typically, the winding surface 42 has a length for receiving at least three windings, in particular at least five windings of the conducted line.

[0042] The drum 4 at the first axial end is provided with a winding ring 43. The winding ring 43 is configured for conducting a line part of the conducted line in a first coil around the axial shaft 41. The winding ring 43 conducts the line part over at least a portion of a circular track. On the outer periphery, the winding ring 43 has a bearing surface 431. The bearing surface serves for bringing the line part to bear against the winding ring 43. The bearing surface 431 has a variable outer diameter. The outer diameter is variable in size. The size of the outer diameter of the bearing surface 431 may be adjusted during operation.

[0043] Near the axial end of the winding surface, the ship's winch has a lifter 6. The lifter 6 is configured for guiding a line part. During use of the winch 1, a line is wrapped around the winding ring 43, the lifter 6 and at least once around the winding surface 42 or at least a portion thereof. The line follows a helical track. The lifter 6 serves for guiding the line part over the track in the form of a helix. The lifter 6 conducts the line part from the bearing surface 431 of the winding ring 43 to the first end of the winding surface 42 of the drum 4. The size of the variable outer diameter of the bearing surface 431 can be adjusted by means of a winch control 5. The winch control 5 comprises an adjustment drive 51 which is actively connected to an adjustment mechanism 50 for adjusting the size of the variable diameter of the bearing surface 431. The size of the variable outer diameter of the bearing surface 431 may be actively controlled thanks to the presence of the winch control 5.

[0044] By operating the adjustment drive 51, the adjustment mechanism 50 can be adjusted such that the outer diameter of the bearing surface 431 is set smaller than the winding diameter of the winding surface 42. When a line is pulled in with the winch 1, it is advantageous for the outer diameter of the bearing surface 43 to be smaller than the winding diameter of the winding surface 42, because the line can thus be received tautly on the winding surface 42. This is advantageous in particular in situations in which the tensile force of the line fluctuates and may temporarily disappear. When a line is conducted over the winch 1, the initially small diameter of a winding of the line around the bearing surface 431 of the winding ring 43 can be transferred via the lifter 6 to the winding surface 42. Due to the larger winding diameter of the winding surface 42 relative to the bearing surface 431, the line is pulled taut in a winding on the winding surface 42. By tautening the windings on the winding surface 42, the risk is reduced that the windings on the winding surface 42 will slip or even loop over each other. By reducing the outer diameter of the bearing surface 43 to a size which is smaller than the winding diameter of the winding surface 42, the formation of loose loops on the winding surface 42 is countered and the risk is reduced that the line will slip or seize on the winch during operation.

[0045] In the embodiment of the winding ring 43 shown, the bearing surface 431 has a groove. The groove extends around the outer periphery of the winding ring 43. The groove-like bearing surface 431 has groove walls which confine a conducted line at the side, i.e. in an axial direction of the drum. This prevents a conducted line from moving in the axial direction relative to the winding ring 43. The groove has a groove base which is rounded for uniform distribution of the forces occurring over the winding ring.

[0046] In the embodiment shown, the adjustment mechanism 50 has at least one adjustment cam 50.1. In the embodiment shown, the adjustment mechanism 50 has twelve adjustment cams 50.1, 50.2, 50.3... 50.11, 50.12 distributed around the periphery. The at least one adjustment cam 50.1 is held in a chamber 432 which is positioned on the outer periphery of the winding ring 43. The chamber 432 is positioned in the groove which forms the bearing surface 431. The adjustment cam 50.1 is held in the chamber 432 moveably in the radial direction.

[0047] During operation, the size of the outer diameter of the bearing surface 431 can be adjusted via the actively set position of the at least one adjustment cam 50.1. The adjustment cam 50.1 may move relative to the chamber 432, so that the adjustable cam 50.1 protrudes to an adjustable extent outside the outer periphery of the winding ring 43. The adjustment cam 50.1 may also, in an end state, be held fully inside the chamber 432 so that the outer periphery of the winding ring 43 is decisive for the smallest dimension of the size of the outer diameter of the bearing surface 431. Thus the outer diameter of the bearing surface 431 has a minimum dimension. The adjustment cam 50.1 may protrude in the radial direction outside the chamber 432 such that then the adjustment cam 50.1 is decisive for the size of the outer diameter of the bearing surface 431.

[0048] As shown in further detail in Figure 1F, the adjustment cam 50.1 is moveable in the chamber 432 in the radial direction between a first cam end state I and a second cam end state II. In the first cam end state I, the bearing surface has a first or smallest outer diameter d1. In the second cam end state II, the adjustment cam 50.1 is moved outward and the bearing surface 431 has a second or largest outside diameter d2. In the first cam end state I, the adjustment cam 50.1 does not protrude or protrudes only over a limited distance outside the chamber 432. In the second cam end state II, the adjustment cam 50.1 protrudes further in the radial direction outside the chamber 432 than in the first cam end state I, such that the outer diameter of the bearing surface 4323 is enlarged. In the second cam end state II, the second outer diameter d2 is greater than the first outer diameter d1.

[0049] The first outer diameter of the bearing surface 431, in the first cam end state I, has a size which is at least 1 cm, in particular 2 cm smaller than the smallest winding diameter of the winding surface 42.

[0050] The second outer diameter of the bearing surface 431, in the second cam end state, has a size which is at least 1 cm, in particular at least 2 cm greater than the winding diameter of the winding surface 42.

[0051] The at least one cam 50.1 is moveable in the radial direction from the first to the second cam end state over a distance of at least 1 cm, in particular at least 2 cm and/or at most 6 cm, in particular at most 4 cm. This dimension is favourable for the use of the winch on a yacht with a drum with a winding diameter of at least 30 cm, in particular at least 40 cm, for example around 45 cm, wherein high line speeds can be reached when pulling in and paying out a conducted line. The outer diameter of the bearing surface may be enlarged or reduced sufficiently to absorb high peaks in line speed of up to 5 m/s.

[0052] The adjustment drive 51 in the embodiment shown is configured hydraulically. The adjustment drive 51 comprises a hydraulic pump which is contained in a hydraulic circuit. The hydraulic circuit comprises a pressure chamber 433. The pressure chamber 433 is provided to create a hydraulic pressure on an adjustment cam for setting the position of the adjustment cam 50.1. The pressure chamber 433 is positioned on an inwardly facing side of the at least one adjustment cam 50.1. The pressure chamber 433 is annular. The annular pressure chamber 433 is positioned on an inner peripheral surface of the winding ring 43. In this way an integral pressure chamber 433 is provided for operating a variety of adjustment cams 50.1... 50.12. In a variant, a spindle drive of each adjustment cam may be provided in combination for example with an electric motor.

[0053] As shown in Figures 1B and 1C, the winch control 5 has at least one sensor 52. The sensor 52 is configured for measuring a force occurring which is representative of a tensile force occurring in the line conducted over the winch 1. The sensor 52 is for example configured for measuring during operation a force occurring between the drum 4 and the lifter 6. The force measured by the sensor 52 is representative of the tension of the windings around the drum 4 and the lifter 6, and indicative of the extent to which the windings are conducted tautly around the drum.

[0054] In one variant, the sensor 52 may be configured for measuring a force occurring between the drum 4 and the frame 2. In another variant, the sensor 52 may be configured for measuring during operation a force occurring between the frame 2 and a foundation on which the frame is mounted. The foundation is a fixed base such as a deck of a ship. The sensor 52 may be positioned in one of the fixing bolts with which the frame 2 is secured to the fixed base. A total tensile load on the winch 1 can be measured with the sensor 52.

[0055] The winch control 5 is actively connected to the sensor 52. A sensor signal output by the sensor 52 is converted by the winch control 5 into a control signal with which the adjustment drive 51 is controlled or regulated. By controlling the adjustment drive 51, the adjustment mechanism 50 is operated and hence the variable size of the outer diameter of the bearing surface 431 of the winding ring 43 is adjusted. The size of the outer diameter of the bearing surface 431 is set during operation partly depending on a measured force occurring which is representative of a tensile force occurring in the conducted line. Using the sensor 52, the adjustment drive 51 may be controlled in real time to allow direct anticipation of a changing situation of a reducing or increasing tensile force in a line.

[0056] Advantageously, the ship's winch 1 may be operated autonomously thanks to the presence of the sensor 52 and winch control 5. In addition, the winch control 5 may be operated remotely by means of a remote control. The remote control is preferably integrated in a main control of a yacht.

[0057] Furthermore, the winch control 5 comprises a display screen 81. The display screen 81 is positioned on the top of the winch 1. The display screen 81 is here positioned centrally on a cap 8. The cap 8 is positioned on the drum 4 and the lifter 6 on a side facing away from the frame 2. By positioning on the top, the display screen 81 is clearly visible during operation. The display screen 81 is configured to display at least one parameter. The parameter is a parameter representative for sailing, such as for example a measured line speed or tensile force of the line conducted over the winch 1. In particular, the parameter comprises at least one value measured by the sensor 52. The display screen 81 has at least one display field. Here the display screen 81 has two display fields for displaying a load occurring and a line speed.

[0058] As shown in Figures 1A-1C, in the embodiment shown, the lifter 6 is designed as a roller 6. The roller 6, also called a free-running roller 6, is mounted freely rotatable relative to the frame 2. The free-running roller is freely rotatable on a roller shaft 61. The free-running roller 6 is mounted next to the drum 4. As shown in Figure 1C, the roller shaft 61 stands slanting at an acute angle α relative to the axial shaft 41 of the drum 4 and the winding ring 43. Because of the slant of the free-running roller 6 relative to the drum 4 and the winding ring 43, a line part which is pulled in during use and wrapped around the free-running roller 6 by rotation of the drum 4 is moved from the winding ring 43 to the winding surface 42. The free-running roller 6 has a peripheral surface which forms at least one line guidance groove 62 for guiding a conducted line. In the embodiment shown, the peripheral surface comprises several, here six, line guidance grooves 62. The at least one line guidance groove 62 extends in a circular track around the peripheral surface of the free-running roller 6. The line guidance groove 62 has groove walls for laterally enclosing a line part. The groove walls prevent a line part from shifting in a direction parallel to the roller shaft 61, and thus contribute to a precise guidance of the line part to the winding surface 42 of the drum 4.

[0059] Furthermore, the ship's winch 1 comprises an inlet element 21. The inlet element 21 is positioned at the first axial end of the drum 4. Usually, the first axial end of the drum 4 is the inlet end, at which a line coming from a sail is introduced to the winch 1. The inlet element 21 is positioned in the radial direction opposite the winding ring 43. The inlet element 21 serves for guiding the line on conduction of the line over the drum 4. A conducted line lies confined in the radial direction between the inlet element 21 and the winding ring 43. The inlet element 21 here comprises a running wheel with a concave running profile. Because of the concave running profile, the line is also confined in the axial direction. The inlet element 21 prevents the line from deviating from the winding ring 43 and further guarantees the conduction of the line along the winding ring 43.

[0060] The winch 1 shown furthermore comprises an outlet element 7 for guiding a line on conduction of a line over the drum 4. The outlet element 7 is positioned at the second axial end of the drum 4, opposite the winding ring 43 which is positioned at the first axial end. Usually, the second axial end of the drum 4 is an outlet end at which a line coming from the drum 4 of the winch 1, when pulling in a line, is paid out from the winch 1. Via the outlet element 7, the line can be guided to a storage drum which may be mounted in series with the winch 1 and forms an assembly with the ship's winch 1.

[0061] As well as the embodiment shown in the figures, many variants are possible. The configuration of the frame of the ship's winch is suitable for placing the winch on a deck of a yacht. In one variant, the frame of the winch may have a configuration which is designed for fixing below a deck of a yacht, for example on its head. In the embodiment of the winch shown, the drum is formed integrally with the winding ring. In a variant, the winding ring and drum may be separate components. The winch shown has a lifter in an embodiment of an free-running roller mounted slanting. In one variant, the lifter may have an embodiment as a profiled chain path or a presser wheel as known from NL2001300, for transferring a conducted line part from the winding ring to the winding surface of the drum.

[0062] The scope of protection for the invention is not restricted to the embodiments shown and described, but the scope of protection extends to all embodiments which fall within the definition of the attached claims.

Claims

1. Ship's winch (1) for conducting a line, comprising:

   - a frame (2) which is configured for fixing the ship's winch on board a ship;
   - a drum (4) which is connected to the frame (2) rotatably about an axial shaft (41), wherein on the outside, the drum (4) has a winding surface (42) with a fixed winding diameter, wherein the winding surface (42) extends from a first axial end to a second axial end of the drum (4) and in the axial direction has a length for receiving at least one winding of a line;
   - a drum drive (40) for driving the drum (4) in rotation;
   - wherein at the first axial end, the drum (4) is provided with a winding ring (43) for guiding a line part of the line in a first coil about the axial shaft (41), wherein the winding ring (43) on the outer periphery has a bearing surface (431) for bringing the line part to bear on the winding ring (43), wherein the bearing surface (431) has an outer diameter with a variable size; and
   - a lifter (6) for guiding a line part of a line over a helical track from the winding ring (43) to the first axial end of the winding surface (42) of the drum (4),

   characterized in that the ship's winch (1) has a winch control (5) with an adjustment drive (51) which is connected to an adjustment mechanism (50) for adjusting the variable size of the outer diameter of the bearing surface (431) of the winding ring (43), wherein the size of the outer diameter of the bearing surface (431) is adjustable by operation of the adjustment mechanism (50).

2. Ship's winch (1) according to claim 1, wherein the size of the outer diameter of the bearing surface (431) can be adjusted to an outer diameter which is smaller than the winding diameter of the winding surface (42).

3. Ship's winch (1) according to claim 1 or 2, wherein the winding ring (43) is formed integrally with the drum (4).

4. Ship's winch (1) according to at least of claims 1 to 3, wherein the adjustment mechanism (50) of the winding ring (43) comprises at least one adjustment cam (50.1...50.12), preferably several adjustment cams distributed over the periphery, wherein the at least one cam (50.1) is held in a chamber (432) positioned on the outer periphery of the winding ring (43), wherein the at least one adjustment cam (50.1) is moveable from a first cam end state (I) in which the bearing surface (431) has a first outer diameter d1, to a second cam end state (II) in which the bearing surface (431) has a second outer diameter d2, such that the variable size of the outer diameter of the bearing surface (431) is dependent on the position of the at least one adjustment cam relative to the chamber (432).

5. Ship's winch (1) according to claim 4, wherein the first outer diameter d1 of the bearing surface (431) in the first cam end state (I) is smaller than the winding diameter of the winding surface (42), and the second outer diameter d2 of the bearing surface (431) in the second cam end state (II) is larger than the winding diameter of the winding surface (42).

6. Ship's winch (1) according to claim 4 or 5, wherein the adjustment drive (51) comprises a hydraulic circuit with a hydraulic pump (51), wherein the pump (51) is in fluidic connection with a pressure chamber (433) for exerting a pressure force on the at least one adjustment cam (50.1) of the adjustment mechanism (50), wherein the pressure chamber (433) is positioned on an inwardly facing side of the at least one adjustment cam (50.1).

7. Ship's winch (1) according to at least one of the preceding claims, wherein the ship's winch (1) has a sensor (52) actively connected with the winch control (5) and configured for measuring a force occurring which is representative of a tensile force occurring in the conducted line, so that the variable size of the outer diameter of the bearing surface (431) of the winding ring (43) can be adjusted by the adjustment drive (51) and the adjustment mechanism (50) as a function of the tensile force occurring in the conducted line.

8. Ship's winch (1) according to at least one of the preceding claims, wherein the winch control (5) is actively connected to a motor of the drum drive (40) for controlling the rotation speed of the drum (4), and/or wherein the winch control (5) is connected to a display screen (81) for displaying at least one parameter such as a line speed and/or tensile force, and/or wherein the winch control (5) can be actively coupled with a main control of a ship such that the ship's winch can be operated remotely.

9. Assembly of a ship's winch (1) according to at least one of the preceding claims and at least one storage drum for storage of a line conducted over the ship's winch.

10. Yacht comprising a ship's winch (1) according to at least one of the preceding claims, wherein the ship's winch (1) operates a sail clew, wherein in particular the yacht comprises a main control which is actively connected to the winch control.

11. Method for operating a ship's winch, comprising the steps of:

- providing a ship's winch according to at least one of the preceding claims, wherein the ship's winch (1) comprises a drum (4) with a winding surface (42) with a specific winding diameter, a winding ring (43) with a bearing surface (431), a winch control (5), an adjustment mechanism (50) with an adjustment drive (51);
- adjusting the outer diameter of the bearing surface (431) of the winding ring (43) by operating the adjustment drive (51) of the adjustment mechanism (50) by means of the winch control (5).

12. Method according to claim 11, wherein the outer diameter is adjusted such that the outer diameter of the bearing surface (431) is smaller than a winding diameter of the winding surface (42) of the drum (4).

13. Method according to claim 11 or 12, wherein the winch control (5) is controlled from a main control of a yacht.

14. Method according to at least one of claims 11 to 13, wherein by means of a sensor (52), a force is measured which is representative of a tensile force occurring in a conducted line, wherein the sensor (52) emits a control signal to the winch control (5), wherein the drum drive (40) and/or the adjustment drive (50) are controlled on the basis of the control signal emitted by the sensor (52).

15. Method according to at least one of claims 14 to 17, wherein the winch control (5) is connected to a display screen (81), wherein a parameter such as line speed and/or tensile force occurring during operation is displayed on the display screen (81).

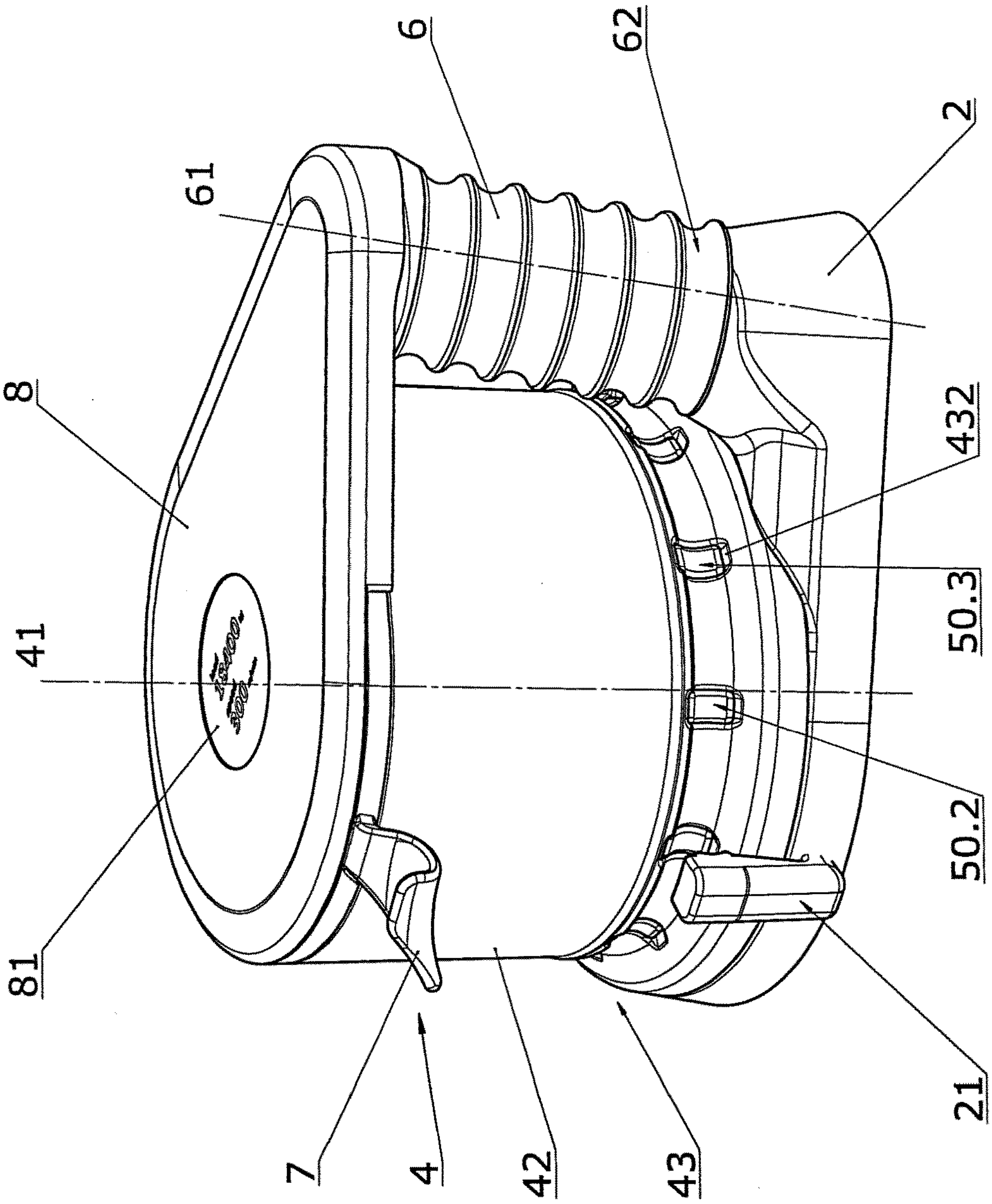

Fig. 1A

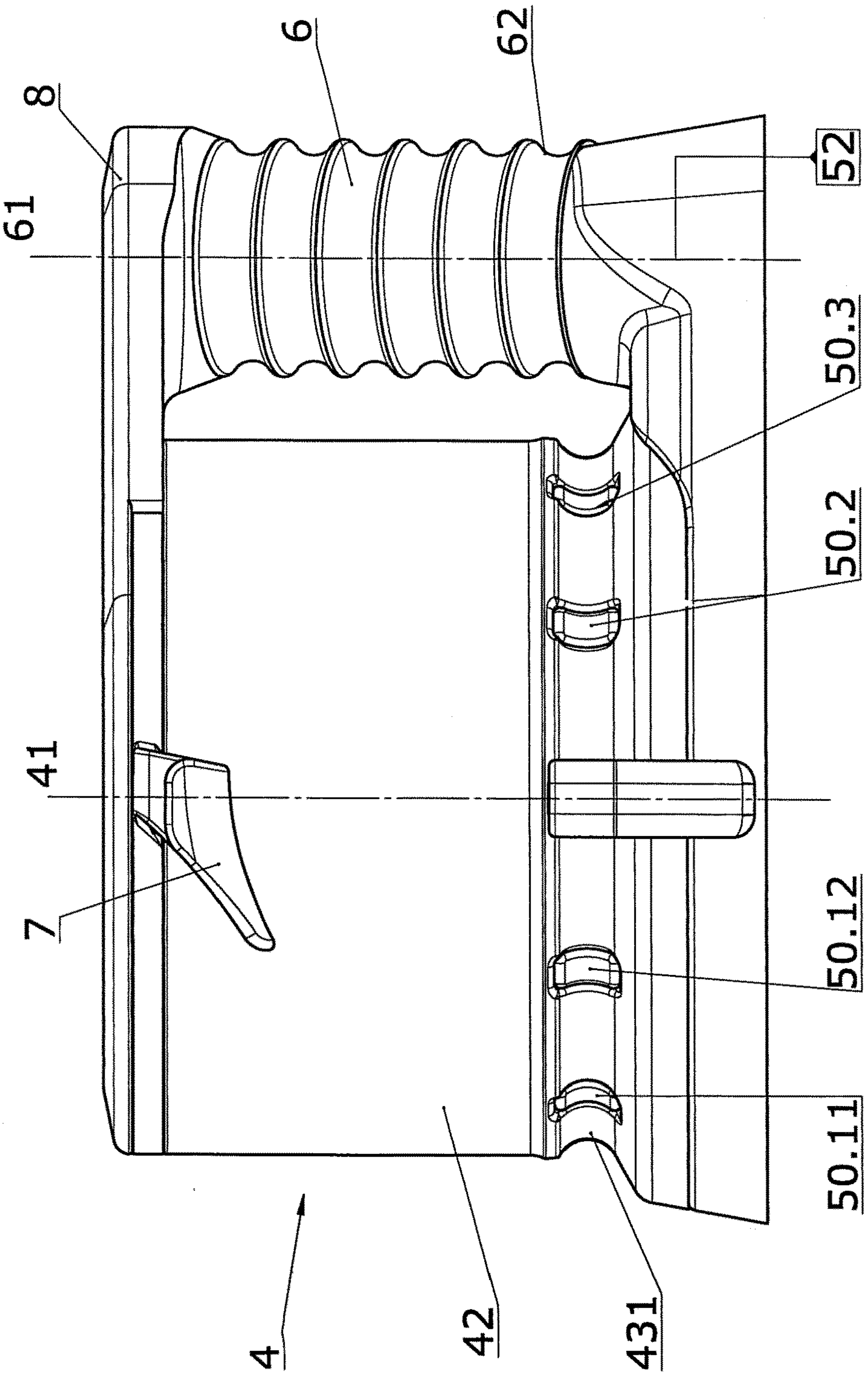

Fig. 1B

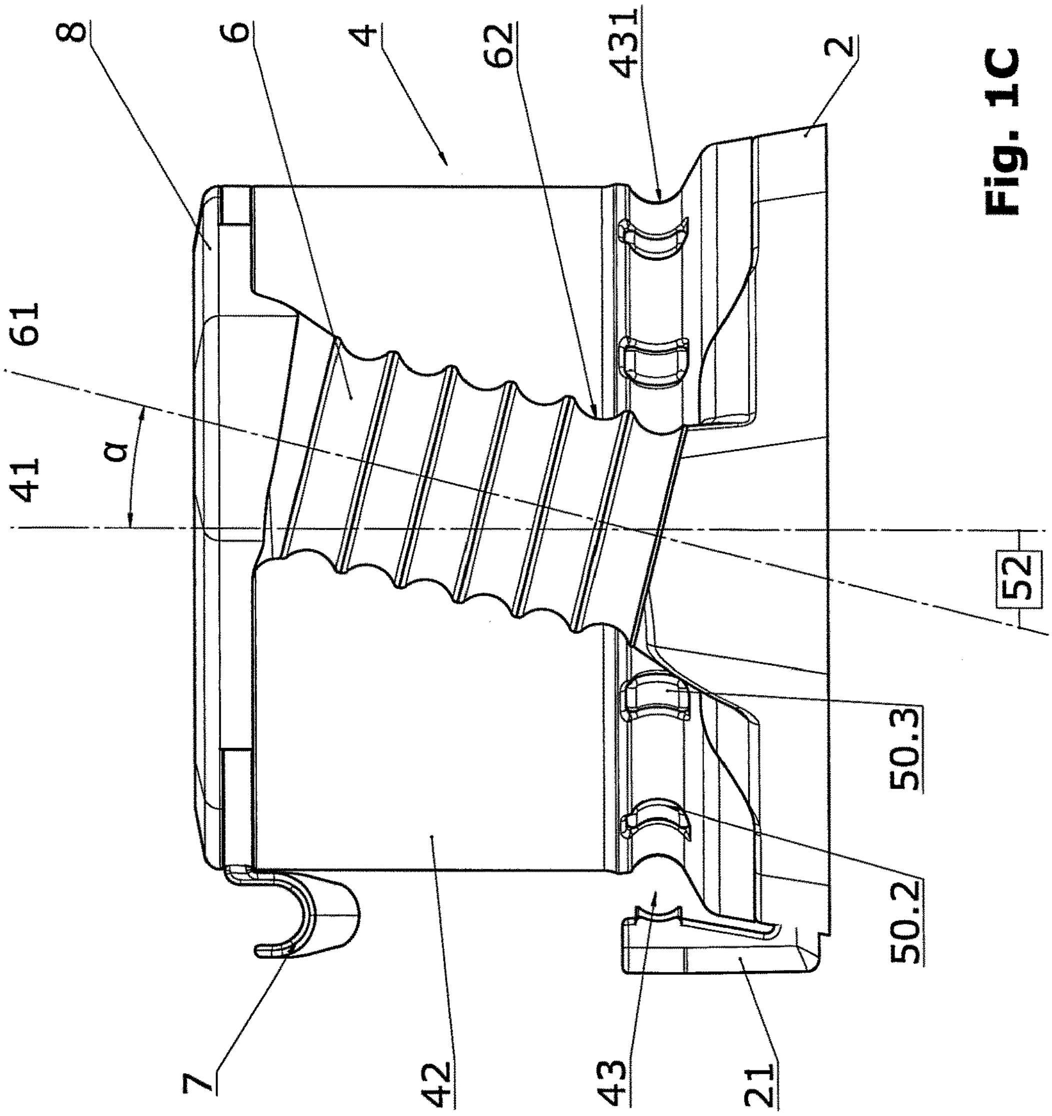

Fig. 1C

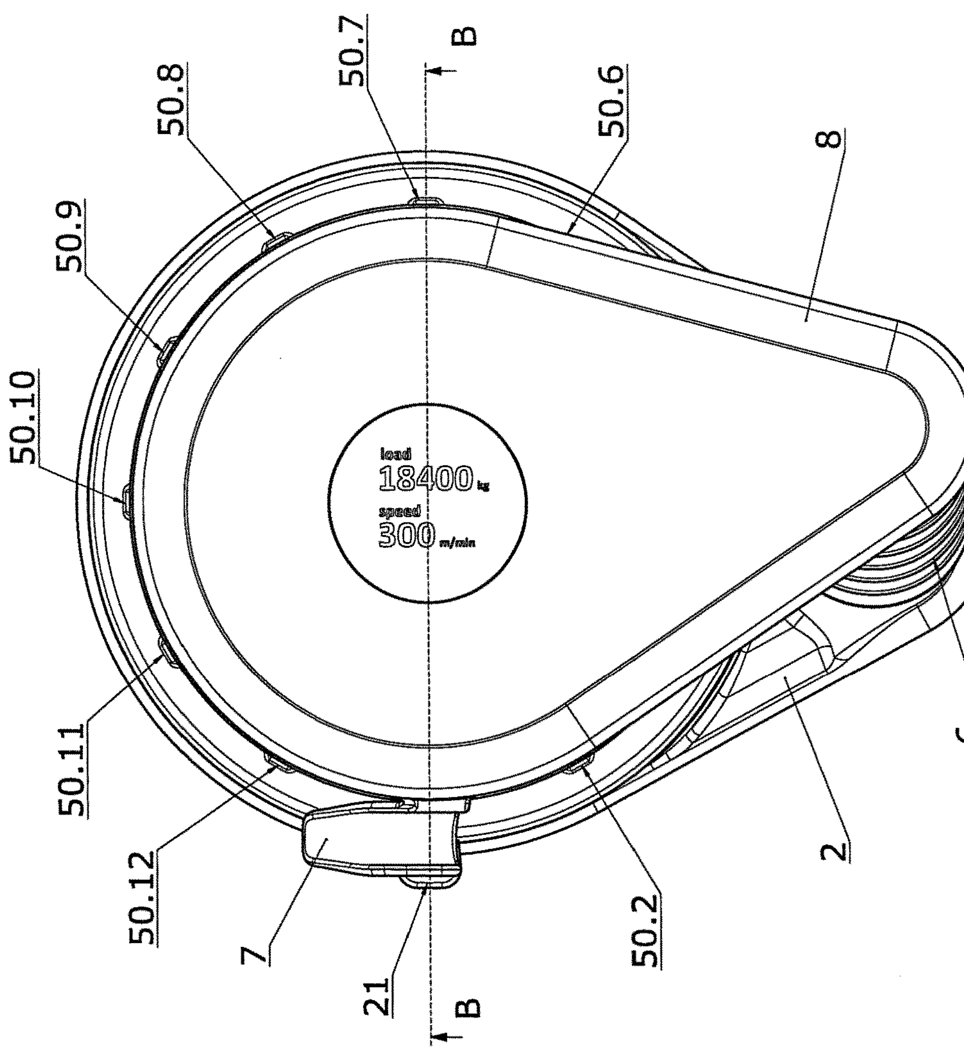
50.7
B
50.8
50.6
50.9
8
50.10
load
18400 kg
speed
300 m/min
50.11
6
50.12
2
7
50.2
21
B

Fig. 1D

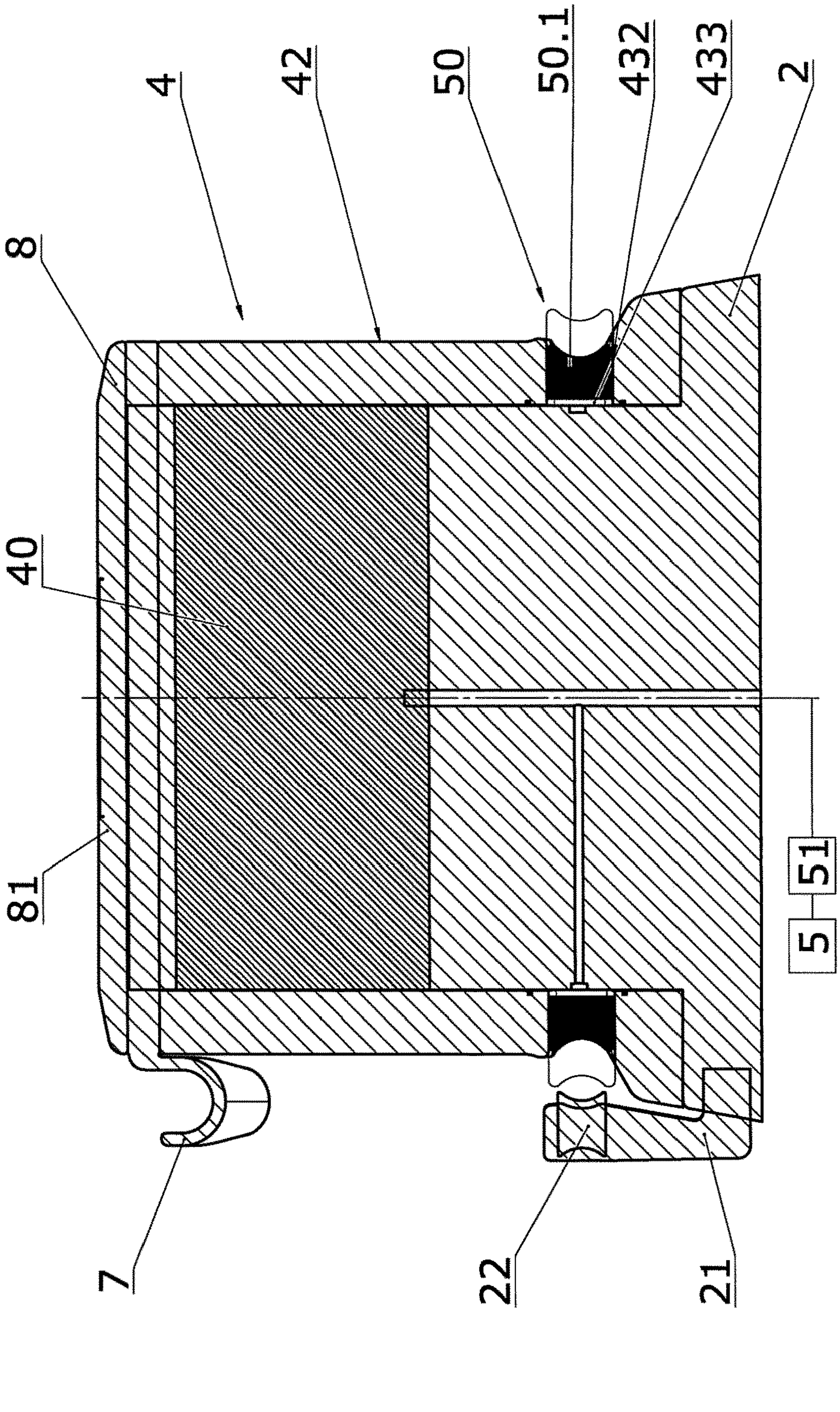

Fig. 1E

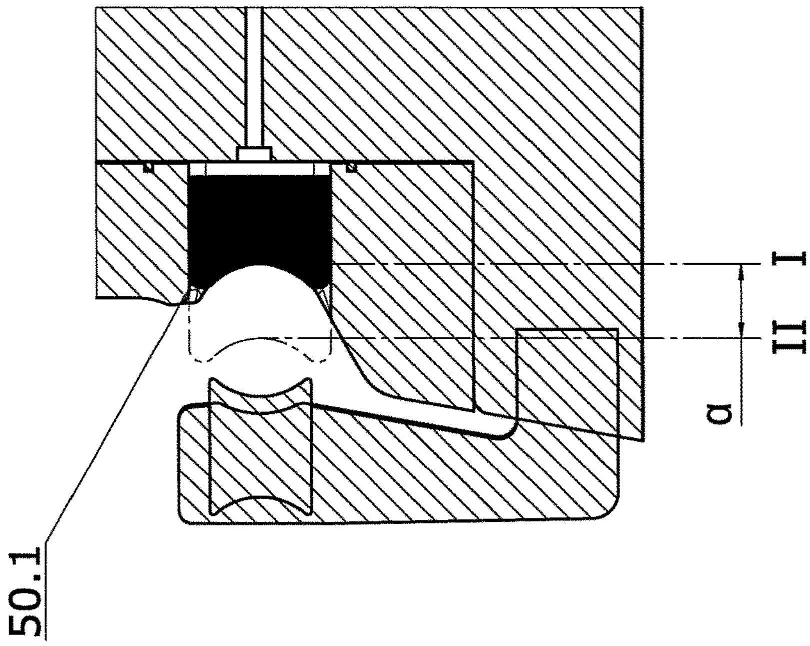

Fig. 1F

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EUROPEAN SEARCH REPORT

Application Number
EP 15 16 4284

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The present search report has been drawn up for all claims

1

Place of search	Date of completion of the search	Examiner
The Hague	25 November 2015	Özsoy, Sevda

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