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RUDDER TRUNK FOR A WATERCRAFT, WATERCRAFT HAVING A RUDDER TRUNK, AND
METHOD FOR PRODUCING A RUDDER TRUNK

The present invention relates to a rudder trunk for a vessel, comprising a rudder stock tube, a receiving shaft and a holder for holding the rudder stock tube in the receiving shaft, wherein, in a state of the rudder stock tube being arranged in the receiving shaft between the rudder stock tube and the receiving shaft, an intermediate space is provided. Furthermore, the present invention relates to a vessel with a rudder trunk and a method for manufacturing a rudder trunk.

Technological background

For the storage of large rudders, for example, in merchant ships or container ships, so-called rudder trunks are used in the state of the art. The rudder trunk of a steering gear is used to mount the rudder stock and to transfer the rudder forces into the vessel. In the condition arranged on the ship, a rudder trunk comprises a receiving shaft which is arranged in the hull, as well as a rudder stock tube, which is arranged in the receiving shaft. The rudder stock tube may be fixed by welding or by gluing it in the receiving shaft. The rudder stock is inserted into the rudder stock tube, fixed in the receiving shaft and supported there with axial and radial bearings.

From EP 2 583 892 A1 by the same applicant, a glued rudder trunk is known, wherein a rudder stock tube is arranged in a receiving shaft and wherein between a first part of the rudder stock tube and a wall of the receiving shaft an intermediate space is provided, wherein the intermediate space is filled at least regionally with a bonding agent, wherein the bonding agent is a means for gluing. A similar rudder trunk is also disclosed in KR 101903165 B1.

In the state of the art, the installation of the rudder stock tube in the receiving shaft in the hull is carried out overhead. The stern section of the ship, in which the rudder trunk is arranged, is usually manufactured separately rotated by 180° upside down during the construction of ships, i.e., with the upper deck downwards. Therefore, the rudder stock tube of the rudder trunk is inserted into the stern section from above. Only after the arrangement of the rudder trunk and full completion is the stern section turned into an upright position, meaning with the upper deck facing upwards and connected to the ship's

hull, wherein hull comprises the propeller and the stern tube. The alignment of the rudder stock tube in the receiving shaft has therefore been independent of the actual propeller axis or the stern tube up until this point.

5 For the hydrodynamic efficiency, however, it is favourable if the rudder trunk or the rudder stock tube of the rudder trunk, and thereby, the rudder is aligned or adjusted to the actual propeller axis or the actual stern tube of the ship. In the known installation methods for rudder stock tubes without the possibility of referring to an actual propeller axle or a stern tube, such an adjustment or alignment can only be carried out indirectly
10 and expensively.

Presentation of the invention: Object, solution, advantages

The object of the present invention is to provide a rudder trunk for a vessel, which is easy
15 and inexpensive to produce, and which may be installed in the hull when the stern section is already connected to the hull in such a way that the rudder trunk, in particular, the rudder stock tube, may be aligned or adjusted with relation to the actual propeller axis or the actual stern tube to improve hydrodynamic efficiency.

20 Furthermore, the object of the present invention is to provide a vessel comprising a rudder trunk, a rudder stock tube for a rudder trunk, a receiving shaft for a rudder trunk, a kit for a rudder trunk and a method for manufacturing a rudder trunk, via which the aforementioned advantages are achieved.

25 To solve the underlying object the invention, a rudder trunk for a vessel is proposed, comprising a rudder stock tube, a receiving shaft and a holder for holding the rudder stock tube in the receiving shaft, wherein, in a state of the rudder stock tube being arranged in the receiving shaft between the rudder stock tube and the receiving shaft, an intermediate space is provided, wherein the holder comprises at least one holder element
30 and at least one complementary holder piece, wherein the at least one holder element is arranged on the rudder stock tube, wherein the at least one complementary holder piece is arranged on the receiving shaft, and wherein the at least one holder element and/or

the at least one complementary holder piece in the state of the rudder stock tube being arranged in the receiving shaft projects into the intermediate space.

5 The rudder stock tube can be arranged and/or arranged in the receiving shaft so as to be movable in the axial direction when the intermediate space is not filled, such that the at least one holder element can be arranged on the at least one holder complement, which is in particular aligned, and/or such that the at least one holder element can be placed on the at least one holder complement, which is in particular aligned.

10 It is particularly advantageous that the rotatable arrangement of the rudder stock tube makes it possible for the holder elements to be aligned in alignment with the holder complements by rotating the rudder stock tube before the holder elements and holder complements are arranged against one another after the holder elements have been guided past the holder complements when inserting the rudder stock tube from below
15 into the receiving shaft. The holder provided in this way is similar in function to a bayonet lock.

When inserting the rudder stock tube from below into the receiving shaft, the rudder stock tube is first aligned such that the holder elements can be guided past the holder
20 complements. As soon as the holder elements are located above the holder complements, the rudder stock tube can be rotated such that the holder elements are aligned with the holder complements in the axial direction of the rudder stock tube or the receiving shaft. Subsequently, the rudder stock tube can then be moved downwards in the axial direction, wherein the holder elements form a form- and/or force-fit connection with the holder
25 complements and hold the rudder stock tube in the receiving shaft.

The rudder trunk according to the invention for a vessel comprises a rudder stock tube and a receiving shaft. The receiving shaft is intended to be installed in a vessel, in particular, in a stern section of a vessel, or the receiving shaft is already located in the
30 vessel. In the receiving shaft, the rudder stock tube may be arranged to form a rudder trunk, or the rudder stock tube is already arranged in the receiving shaft. Furthermore, a rudder stock may be arranged in the rudder stock tube if the rudder stock tube is attached to the hull in the receiving shaft.

In the state of the rudder stock tube being arranged in the receiving shaft, an intermediate space is provided between the rudder stock tube and the receiving shaft, in particular, between an outer wall of the rudder trunk and an inner wall of the receiving shaft.

5 Preferably, the entire intermediate space is formed between the outer wall of the rudder stock tube and the inner wall of the receiving shaft. The at least one holder element arranged on the rudder stock tube and/or at least one complementary holder piece arranged on the receiving shaft projects into the intermediate space. The holder element and complementary holder piece form a holder for holding the rudder stock tube within
10 the receiving shaft.

Due to the holder of the rudder stock tube in the receiving shaft by means of the holder comprising the at least one holder element and the at least one complementary holder piece, it is possible to insert the rudder stock tube into the installed or to be installed on
15 the hull, in particular, at the stern section, of the vessel receiving shaft if the stern section is already connected to the hull, that is, if the upper deck of the ship, in particular, the stern section, directed upwards and the keel of the hull is directed downwards, whereas, in the state of the art, the installation of the rudder trunk in the receiving shaft in the hull takes place overhead, that is, when the stern section of the ship, in which the rudder trunk
20 is arranged, rotated by 180° upside-down, that is, being aligned with the upper deck downwards.

The rudder stock tube of the rudder trunk according to the invention may be introduced from below into the receiving shaft and held in the receiving shaft compared to the
25 installation methods known from the state of the art. Since, in particular, the stern section is already connected to the hull when inserting the rudder trunk from below into the receiving shaft, the rudder stock tube held by the holder may be aligned with the actual propeller axis or the actual stern tube of the vessel.

30 With relation to the rudder trunks, known from the state of the art, the hydrodynamic efficiency can thus be improved.

The projection of the at least one holder element and/or the at least one complementary holder piece into the intermediate space in the state of the rudder stock tube being arranged in the receiving shaft provides a space-saving embodiment of the holder for holding the rudder stock tube in the receiving shaft since no other elements of the holder must be arranged outside the receiving shaft.

However, where applicable, for the alignment of the rudder stock tube in the receiving shaft inner side and/or outer side the receiving shaft, alignment aids may be provided with which the rudder stock tube can may held in an alignment position for the alignment and subsequent fixing of the rudder stock tube. However, the alignment aids are preferably removed after alignment and fixing.

After the alignment or adjustment of the rudder stock tube in the receiving shaft to the actual propeller axis or the actual stern tube, the intermediate space may be filled with a bonding agent, preferably in sections, to fix the rudder stock tube in the receiving shaft.

A further advantage of the rudder trunk according to the invention is that the holder remains in the rudder trunk after connecting or after fixing the rudder stock tube and therefore forces can also be diverted via the holder. For example, in the event of failure of the bonding agent, protection against sagging or slipping of the rudder stock tube can be provided.

Preferably, it is provided that the at least one holder element and the at least one complementary holder piece may be arranged and/or are arranged in a force-fit and/or form-fit manner such that, in the state of the rudder stock tube being arranged in the receiving shaft, in particular, in a state of the rudder trunk being arranged on the vessel comprising trunk and receiving shaft, a movement of the rudder stock tube in the receiving shaft in an axial direction of the rudder stock tube is hindered or prevented.

By the force-fit and/or form-fit arrangement of complementary holder piece and holder element, in particular, in a condition arranged on the vessel of the rudder trunk comprising rudder trunk and receiving shaft, the rudder stock tube may be held in an installation situation in a hull aligned downwards with the keel in the receiving shaft. In

this case, the force-fit and/or form-fit arrangement of the holder element and complementary holder piece hinders or prevents movement of the rudder stock tube in an axial direction of the rudder stock tube; in particular, a movement of the rudder stock tube downwards out of the receiving shaft is prevented. In other words, the rudder stock tube in the receiving shaft cannot slip along its axial direction, in particular, it cannot slip downwards in the axial direction. This allows the rudder stock tube to be adjusted against the actual propeller axis or stern tube of the vessel before the rudder stock tube is fixed in the receiving shaft.

10 Being furthermore favourable, it may be provided that at least two, preferably at least three, more preferably at least four, being most preferred exactly four, holder elements are provided, and/or that at least two, preferably at least three, more preferably at least four, being most preferred, exactly four, complementary holder pieces are provided.

15 If at least two holder elements or at least two complementary holder pieces are provided, these may preferably be arranged opposite each other with respect to a central axis of the rudder stock tube or the receiving shaft on the outer wall of the rudder stock tube or on the inner wall of the receiving shaft. Via the force-fit and/or form-fit arrangement of these holder elements and complementary holder pieces a two-point holder of the rudder stock tube is provided in the receiving shaft, which allows a pivoting or moving of the rudder stock tube in the receiving shaft for alignment or adjustment of the rudder stock tube. With at least three holder elements and three complementary holder pieces, a particularly favourable three-point holder is ensured. It is particularly favourable if four holder elements and four complementary holder pieces are provided. In this case, there is a particularly stable support of the rudder stock tube in the receiving shaft.

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30 Being furthermore favourable, it may be provided that the at least one holder element is formed as a single piece with the rudder stock tube and/or is connected to the rudder stock tube in a material-fit and/or force-fit and/or form-fit manner, and/or that the at least one complementary holder piece is formed as a single piece with the receiving shaft and/or is connected to the receiving shaft in a material-fit and/or force-fit and/or form-fit manner.

The material-fit connection of holder element with rudder stock tube or of complementary holder piece with receiving shaft may be made, for example, by welding or gluing.

- 5 If the at least one holder element and/or the at least one complementary holder piece is connected to the rudder stock tube and/or the receiving shaft in a force-fit and/or form-fit manner, this connection may be established by inserting the holder elements or the complementary holder pieces into corresponding receptacles in the outer wall of the rudder stock tube or in the inner wall of the receiving shaft. The form-fit and/or force-fit
10 connection may also be made possible by means of providing fastening elements such as screws, bolts, adhesives, clamps, etc.

- Being furthermore favourable, it may be provided that the at least one holder element and/or the at least one complementary holder piece is a pin or a bolt, preferably a
15 threaded bolt, or a projection or a plate or a bar or a profile body, preferably a U-profile body, and/or that the at least one holder element and/or the at least one complementary holder piece is a receptacle, in particular, a bore hole and/or a blind bore hole, preferably with an internal thread, or a recess, in particular, a groove, and/or a thread, in particular, a thread, and/or that the at least one holder element and/or the at least one
20 complementary holder piece is a clamping element, in particular, a clamping ring.

- The at least one complementary holder piece and the at least one holder element may be designed differently or identically. In a preferred embodiment, the holder element is designed in the form of a pin, a bolt, a projection, a plate or a bar. The pin, the bolt, the
25 projection, the plate or the bar then project from the outer wall of the rudder stock tube in approximately one radial direction. On the other hand, the complementary holder piece may be designed as a profile body, preferably as a U-profile body comprising a contact surface, wherein the profile body, preferably the U-profile body, projects approximately in a radial direction into the interior space of the receiving shaft from the
30 inner wall of the receiving shaft.

In an embodiment of the complementary holder piece as a U-profile body and the holder element as a pin, bolt, projection, plate or bar, the holder element may be hung into the

U-profile body. For this purpose, the holder element is inserted between the limbs of the U-profile body and placed on a base section of the U-profile body. In this embodiment, twisting of the rudder stock tube in the receiving shaft can also be prevented or restricted, since the holder element formed as a pin, bolt, plate, bar or projection strikes the limbs
5 of the U-profile body in an attempt to twist the rudder stock tube. Through the interaction of holder element and complementary holder piece, a rotary brake is provided.

In principle, it is also possible that the holder element on the rudder stock tube is formed as a U-shaped profile body, while the complementary holder piece is formed at the
10 receiving shaft as a pin, bolt, projection, plate or bar. With both options, only the orientation of the U-profile body must be taken into account.

If the U-profile body is arranged on the receiving shaft as a complementary holder piece, the limbs of the U-profile body in the receiving shaft must be oriented upwards in a
15 vertical direction such that the holder element of the rudder stock tube formed as pin, bolt, projection, plate or bar can be inserted from above into the U-profile body.

If, on the other hand, the U-profile body is arranged as a holder element on the rudder stock tube, the limbs of the U-profile body on the rudder stock tube must be aligned
20 downwards in a vertical direction such that the U-profile body can be placed from above on the complementary holder piece of the receiving shaft formed as a pin, bolt, projection, plate or bar. The terms "vertical direction", "up" and "down" refer to the condition of the rudder stock tube in the receiving shaft located on the vessel.

25 In addition to these preferred embodiments, however, other embodiments of holder element and complementary holder piece are also possible.

Thus, either the holder element or the complementary holder piece may be a threaded bolt. The corresponding complementary holder piece or the corresponding holder
30 element is then formed as a receptacle, in particular as a bore hole, preferably with an internal thread. The threaded bolt may be screwed to the internal thread in the holder or in the bore hole. By determining the screw-in depth, the rudder stock tube may be aligned or adjusted in the receiving shaft, in particular, in a radial direction of the receiving shaft.

A further preferred possibility is that the holder element is a recess, in particular a circumferential one, preferably being a groove around the rudder stock tube. The complementary holder piece may be formed as a clamping element, in particular as a clamping ring, which is further preferably also arranged in a groove in the inner wall of the receiving shaft. If the rudder stock tube is inserted into the receiving shaft, the clamping element formed as complementary holder piece can intervene both in the recess on the rudder stock tube as well as in the recess, in particular in the groove, of the receiving shaft and thereby favour or ensure a form-fit and/or force-fit holder of the rudder stock tube in the receiving shaft. In principle, however, the complementary holder piece designed as a clamping element and the corresponding holder element may also be designed differently from a clamping ring and a recess, as long as the clamping element and the corresponding holder element together cause a force- and/or form-fitting clamping between the rudder stock tube and the receiving shaft.

Another possibility is that the holder element and/or the complementary holder piece are formed as a thread, wherein an external thread is provided on the rudder stock tube and an internal thread in the receiving shaft. In this case, the rudder stock tube can be screwed into the receiving shaft, wherein the holder elements and complementary holder pieces formed as internal and external threads provide a form-and force-fit connection. With appropriate embodiment of the thread, in particular, the divisions of the threads, a mobility of the rudder stock tube in the receiving shaft can may be made possible in such a way that this can be aligned on the vessel at the actual propeller axis and the actual stern tube. The rudder stock tube can be fixed using bonding agent within the receiving shaft after alignment.

Being furthermore favourable, it is provided that the at least one holder element and the at least one complementary holder piece project into the intermediate space between the rudder stock tube and the receiving shaft, wherein the at least one complementary holder piece and/or the at least one holder element are arranged inclined to the respective radial direction with respect to the rudder stock tube or the receiving shaft in the direction of the axial direction of the rudder stock tube or the receiving shaft.

In the state arranged on the hull of the receiving shaft and the rudder stock tube, the holder elements and/or the complementary holder pieces are preferably aligned slightly downwards and/or upwards inclined. Due to this slight inclination in the axial direction, a particularly favourable alignment and adjustment of the rudder stock tube in the receiving shaft can be ensured. If, for example, two U-profile bodies are arranged opposite each other in the receiving shaft as complementary holder pieces, wherein the limbs of the U-profile bodies point upwards, and wherein the course of the U-profile bodies in the radial direction into the interior space of the receiving shaft have a slight inclination downwards and, on the other hand, two bolts are arranged as holder elements on an outer wall of the rudder stock tube, the bolts can be inserted into the U-profile bodies from above, to establish a form- and force-fit connection or holder. If the rudder stock tube is now aligned, that is, in particular a central axis of the rudder stock tube is aligned with a central axis of the receiving shaft, this can be done by moving the rudder stock tube approximately in a radial direction in the receiving shaft. One of the bolts is then guided slightly downwards along the slightly downward inclined U-profile body, while the other bolt is guided slightly upwards in the second U-profile body. By means of this, the central axis of the rudder stock tube is inclined with relation to the central axis of the receiving shaft. A corresponding effect also occurs with at least three or at least four or exactly four holder elements or complementary holder pieces.

Furthermore favourable, it may be provided that the at least two holder elements are arranged across an outer circumference of the rudder stock tube, preferably uniformly, and/or that the at least two complementary holder pieces, are arranged over an inner circumference of the receiving shaft, preferably uniformly.

An even arrangement of holder elements and complementary holder pieces allows easy production as well as easy alignment and adjustment of the rudder stock tube in the receiving shaft.

It is favourably provided that the at least two holder elements are spaced apart in the circumferential direction over the outer circumference of the rudder stock tube, and/or that the at least two complementary holder pieces are spaced in the circumferential direction over the inner circumference of the receiving shaft are arranged in such a way

that when inserting the rudder stock tube into the receiving shaft, the holder elements can be guided past the complementary holder pieces in the axial direction.

5 In the state of the receiving shaft being arranged on the hull, in particular on the stern section, and in an alignment of the stern section or the hull with the keel downwards, the rudder stock tube can be inserted from below into the receiving shaft. The holder elements are thereby guided past the complementary holder pieces of the receiving shaft and can then be brought into a form-fit and/or force-fit arrangement with the complementary holder pieces, preferably hinders or prevents movement of the rudder
10 stock tube against the insertion direction.

Being particularly favourable, it is provided that the rudder stock tube may be configured to be arranged or may be arranged to be rotatable in the receiving shaft if the intermediate space is not filled such that the at least one holder element and the at least
15 one complementary holder piece can be aligned with each other by rotating the rudder stock tube seen in the axial direction.

According to the invention, it is provided that the rudder stock tube can be adjusted, in particular aligned, in the receiving shaft in the state arranged in the receiving shaft, in
20 particular in a state of the rudder trunk arranged on the vessel, comprising the rudder stock tube and the receiving shaft, further in particular when the intermediate space is not filled.

The adjustment of the rudder stock tube arranged in the receiving shaft may thus be
25 carried out particularly favourably in the state arranged on the vessel, that is, compared to an actual propeller shaft or to an actual stern tube. The adjustment is preferably carried out if the intermediate space is not yet filled with a bonding agent. However, it can also be carried out if the intermediate space, preferably filled in sections with a bonding agent. If the bonding agent is a cast plastic, alignment or adjustment can be carried out while the
30 cast plastic is hardening.

Preferably, for alignment and adjustment, the rudder stock tube can be moved with respect to a radial direction of the receiving shaft inner side the receiving shaft.

Being furthermore advantageous, adjusting means may be provided, wherein the adjustment means are formed such that, in particular, in the case of adjacent holder elements and complementary holder pieces, a position and/or orientation of the rudder stock tube in the receiving shaft, in particular, the position of the rudder stock tube in the receiving shaft with respect to a radial direction of the receiving shaft and/or an angle between a central axis of the rudder stock tube and a central axis of the receiving shaft can be adjusted.

The adjusting means may be additional elements, but the adjusting means may also be part of the holder elements and/or the complementary holder pieces. For example, it is possible that the holder elements and/or the complementary holder pieces are adjustable. In a preferred embodiment, an angle of inclination of the holder elements and/or the complementary holder pieces can be adjusted.

Being furthermore favourable, it may be provided that the adjustment means adjusting screws and/or washers, preferably washers, wherein the adjustment means are preferably arranged on the at least one holder element and/or at least one complementary holder piece.

It is preferably provided that the intermediate space between the outer wall of the rudder stock tube and the inner wall of the receiving shaft expands or decreases at least in the axial direction of the rudder stock tube. In other words, a gap width of the intermediate space between the outer wall of the rudder stock tube and the inner wall of the receiving shaft increases or decreases, at least in some regions, in the axial direction of the rudder stock tube. Being most preferred, the gap width of the intermediate space increases between the outer wall of the rudder stock tube and the inner wall of the receiving shaft at least regionally viewed in the axial direction of the rudder stock tube upwards, that is, in the state of the rudder trunk or the receiving shaft being arranged on the vessel, in particular, on the ship, in the direction of the vessel body, in particular, of the hull.

The increase in the gap width may be carried out in that the inner diameter of the receiving shaft in the state arranged on the ship in the direction of the hull increases at

least regionally, and/or that the outer diameter of the rudder stock tube in the state arranged on the ship in the direction of the hull decreases at least in sections. Being most preferred, a wall thickness of the rudder stock tube viewed in the axial direction of the rudder stock tube decreases, wherein the inner diameter of the rudder stock tube remains constant in the axial direction and the outer diameter decreases.

In a state of the rudder stock tube being arranged in the receiving shaft, the rudder stock tube is arranged over a clamping height in the receiving shaft. The clamping height is preferably formed between a lower end or an outer side of the receiving shaft and an upper region, in particular, an upper end of the rudder stock tube. Preferably, the gap width increases at least in sections across the course of the clamping height. In this case, being most preferred, a lower region of the clamping height can have a constant gap width. In order to increase the gap width by region, it increases above the region of the constant gap width.

Furthermore, in an upper range of the clamping height seen in the axial direction, the gap width can decrease again. The decrease of the gap width in the upper region of the clamping height can be caused by the complementary holder pieces and/or holder elements of the holder protruding into the intermediate space. Furthermore, the decrease of the gap width in the upper region of the clamping height can also be carried out by a, in particular circumferential, flange on the inner wall of the receiving shaft or the outer wall of the rudder stock tube in the upper region.

In principle, however, it is also conceivable that the gap width of the intermediate space increases between the outer wall of the rudder stock tube and the inner wall of the receiving shaft at least regionally in the axial direction of the rudder trunk seen downwards, that is, in the state of the rudder trunk or the receiving shaft being arranged on the vessel, in particular on the ship, in the direction leading away from the vessel, in particular, away from the hull.

Being furthermore favourable, it may be provided that the intermediate space is fillable or filled with a bonding agent, preferably with a cast plastic, in particular cast resin, at least in some regions.

The intermediate space is filled with the bonding agent, in particular the cast plastic, preferably only after the alignment and adjustment of the rudder stock tube in the receiving shaft, at least regionally. As soon as a firm connection of the rudder stock tube and the receiving shaft is made by the bonding agent, for example as soon as the cast plastic has hardened, a fixed and aligned or adjusted rudder stock tube is obtained in the receiving shaft, whereby a particularly high hydrodynamic efficiency is provided. In addition, by the preferably still remaining in the intermediate space holder elements and complementary holder pieces, slipping of the rudder stock tube is prevented even in the event of failure of the bonding agent, for example when the cast plastic escapes.

Being most preferred, the intermediate space is filled with the bonding agent solely in the lower region of the clamping height with a constant gap width. In addition, or as an alternative, the intermediate space can also be filled only in the upper region of the clamping height, in particular, in the region of the holder element and/or the complementary holder piece and/or the flange with the bonding agent. Being most preferred, the intermediate space in the region of the expanding gap width is not filled with the bonding agent.

Being furthermore favourable, it can be provided that a sealing element, in particular a sealing sleeve, is provided, wherein the sealing element is attached to an outer side of the rudder trunk such that when filling the intermediate space, a leakage of the bonding agent to the outer side by the sealing element is preventable, wherein, preferably, the sealing element can be removed, in particular, after filling the intermediate space.

The outer side of the rudder trunk corresponds to the outer side of the ship's hull in the state of the rudder trunk being arranged on the vessel, preferably the region of the ship's hull which encloses the external opening of the receiving shaft. In the position of the receiving shaft on the ship, the rudder stock tube can be inserted into the receiving shaft from below. Subsequently, a sealing element, in particular, a sealing sleeve, is attached to the outer side of the ship's hull and thus to an outer side of the rudder trunk, which seals the intermediate space between the rudder stock tube and the receiving shaft from below. After attaching the sealing element, the intermediate space between the rudder

stock tube and the receiving shaft can be filled with a bonding agent, in particular, with a cast plastic, wherein the sealing element prevents escape by the bonding agent from the intermediate space, in particular, downwards to the outer side of the rudder trunk or to the outer side of the hull. After filling the intermediate space with the bonding agent, the sealing element can remain on the hull or on the outer side of the rudder trunk. However, it is also possible that the sealing element is removed after filling the intermediate space with the bonding agent. If the sealing element remains on the hull or on the outer side of the rudder trunk, further protection against leakage of the bonding agent, in particular, the cast plastic, is offered. If, on the other hand, the sealing element is removed, it is reusable.

Being furthermore advantageous, it is provided that the sealing element is designed as single piece, in particular, consisting of one part or a plurality of parts.

A multi-part design of the sealing element allows a particularly simple attachment of the sealing element on the outer side of the rudder trunk or on the outer side of the hull.

Being furthermore advantageous, it can be provided that the sealing element comprises a frame and/or an O-ring and/or an elastomer, particularly one that is ring-shaped.

A further advantage is provided if the sealing element has at least one breakthrough, in particular an opening or a passage, wherein the bonding agent may be introduced through the opening, in particular, into the intermediate space.

If the sealing element is located on the outer side of the rudder trunk or on the outer side of the hull in the region of the rudder trunk, the bonding may can be introduced through the breakthrough, in particular, through the opening or the passage, into the intermediate space from the outer side of the vessel into the intermediate space. This provides a particularly easy way to fill the intermediate space.

The openings may be closable to prevent leakage of the bonding agent, in particular, the cast plastic, after filling the intermediate space. Furthermore, hoses for the introduction

of the bonding agent may be passed through the openings. As a result, bubble formation in the bonding agent, in particular, in the cast plastic, can be prevented.

5 Being further advantageous, it is provided that the bonding agent, in particular, the cast plastic, may be liquified, preferably via heat input such that the rudder stock tube can be removed from the receiving shaft after liquefaction of the bonding agent.

10 An exchange of the rudder stock tube is simplified if the bonding agent, in particular, the cast plastic, can be liquified via heat input. Thus, if an exchange of the rudder stock tube should be necessary, the bonding agent can be liquefied via heat input. The rudder stock tube can then be removed from the receiving shaft on the hull. For this purpose, in a preferred embodiment, the rudder stock tube must be raised vertically after liquefying the bonding agent such that the rudder stock tube moves upwards in the receiving shaft. Subsequently, the rudder stock tube is rotated such that the previously aligned holder
15 elements and complementary holder pieces are twisted towards one another. Subsequently, the rudder stock tube may be led down from the receiving shaft in the axial direction, wherein the holder elements are guided past the complementary holder pieces. A new rudder stock tube may then be inserted.

20 Being furthermore favourable, it is provided that heating elements, in particular heating wires, are arranged in the intermediate space, and are preferably embedded in the bonding agent.

25 By providing heating elements, in particular heating wires, an exchange of the rudder stock tube is further simplified. Through the heating elements, in particular, the heating wires, heat energy may be homogeneously introduced into the bonding agent for the exchange in such a way that it liquefies evenly.

30 Being furthermore favourable, it may be provided that recesses, in particular grooves or bore holes, are arranged on the outer side and/or on the inner side of the rudder stock tube and/or the receiving shaft, wherein signal conductive means, in particular cables, are preferably arranged in the recesses.

For sensors to be attached to the rudder trunk or to the rudder stock tube or to the receiving shaft or to the rudder shaft, grooves or bore holes in the rudder stock tube or in the receiving shaft may be provided in order to guide appropriate signal conductors, such as cables. Preferably, the signal conductors may be guided in the intermediate space
5 between the rudder stock tube and the receiving shaft and be led out being furthermore favourable at the least loaded points of the receiving shaft or the rudder stock tube.

It is preferably provided that the adjacent holder elements, in particular the bolts or bars, and complementary holder pieces, in particular the profile bodies or U-profile bodies,
10 restrict or prevent rotation of the rudder stock tube when rotational or torsional forces act on the rudder stock tube.

The holder elements and complementary holder pieces thus preferably represent rotary brakes. This further improves the transmission of force of the rudder stock into the hull.
15 In particular, if the complementary holder pieces are formed as U-profile bodies and if the holder elements are formed as bolts, pins, projections, bars or plates which are arranged between the limbs of the as U-profile bodies formed complementary holder pieces, a twisting of the rudder stock tube in the receiving shaft is prevented. However, a slight twist may be allowed. This can be done by when the distance between the limbs of the
20 U-profile bodies is greater than the width of the holder elements arranged between the limbs. Due to a low permitted rotation, manufacturing tolerances may be compensated for when aligning the rudder stock tube in the receiving shaft.

A further solution to the object underlying the invention is to provide a rudder
25 arrangement for a vessel, in particular a ship, with a rudder and a rudder trunk described above.

A further solution to the object underlying the invention is the provision of a vessel, in particular a ship, with a previously described rudder trunk.

30 An additional solution to the object underlying the invention is to provide a rudder stock tube for a rudder trunk described above, wherein the rudder stock tube comprises at least one holder element.

The holder element may be formed according to the embodiments described above.

5 A further solution to the object underlying the invention is the provision of a receiving shaft for a rudder trunk described above, wherein the receiving shaft has at least one complementary holder piece.

The complementary holder piece may be formed according to the embodiments described above.

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A further solution of the object underlying the invention consists in a kit for a previously described rudder trunk comprising at least one, in particular pre-described, holder element and comprising at least one, in particular pre-described, complementary holder piece, wherein the kit preferably comprises a rudder stock tube and/or a receiving shaft.

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Rudder stock tube and receiving shaft may also be formed according to one of the embodiments described above.

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In addition, the object underlying the invention is achieved by providing a method for producing a, in particular pre-described, rudder trunk with a pre-described receiving shaft and a pre-described rudder stock tube in a vessel, wherein a vessel, in particular a ship, further in particular a stern section, is provided, wherein the receiving shaft is arranged in the vessel, wherein the rudder stock tube into the receiving shaft is introduced, wherein the at least one holder element is passed by the at least one complementary holder piece, 25 wherein the rudder stock tube is rotated such that the at least one holder element and the at least one complementary holder piece are aligned in an axial direction of the rudder stock tube and/or the receiving shaft aligning, wherein the rudder stock tube is moved in the axial direction, such that the at least one holder element and the at least one complementary holder piece onto one another, in particular, being set on top of one 30 another.

With the above-described vessel, the rudder stock tube, the receiving shaft, the kit for a rudder trunk and with the method for producing a rudder trunk, the inventive advantages according to the invention are achieved.

5 The method according to the invention allows in particular that a rudder stock tube is inserted into a receiving shaft, wherein the receiving shaft is arranged in a stern section of a hull and wherein the stern section with the upper deck upwards or wherein the hull is aligned with the keel downwards. In particular, in the method according to the invention compared to the state of the art, the rudder stock tube must not be inserted
10 from above into a receiving shaft of a stern section turned upside down but can be inserted in an orientation of the ship's hull with the keel down from below into the receiving shaft. This makes it possible to align the rudder stock tube with the actual propeller shaft and the actual stern tube.

15 This particularly increases the hydrodynamic efficiency of a rudder arrangement.

Favourably, it may be provided that the vessel is aligned with a keel downwards, and that the rudder stock tube is inserted vertically from below into the receiving shaft.

20 The possibility of inserting the rudder stock tube vertically from below into the receiving shaft allows the rudder stock tube to be adjusted or aligned with respect to the actual propeller shaft and the actual stern tube.

Being furthermore favourable, it may be provided that the rudder stock tube in the
25 receiving shaft is aligned with adjusting means, wherein the alignment is made to a propeller axis and/or a stern tube of the vessel.

The adjusting means can be part of the holder elements or the complementary holder pieces or be identical to the holder elements or complementary holder pieces.
30 Furthermore, the adjusting means can also be designed as washers or the like.

Being furthermore favourable, it is provided that an intermediate space between the rudder stock tube and the receiving shaft is filled with a bonding agent, in particular, a cast plastic, and wherein the bonding agent, in particular, the cast plastic, is cured.

- 5 By filling the intermediate space with the bonding agent, in particular, with the cast plastic, the rudder stock tube aligned to the actual propeller axle, or the actual stern tube can be fixed in the receiving shaft.

- 10 Being furthermore favourable, it is provided that a sealing element is arranged on an outer side of the rudder trunk, in particular, on an outer side of the vessel, in particular, furthermore being on an outer side of a hull such that, when filling the intermediate space, a leakage of the bonding agent to the outer side by the sealing element is prevented.

- 15 Being furthermore favourable, it can be provided that the sealant remains or is removed after hardening of the bonding agent, in particular, the cast plastic, on the outer side of the rudder trunk, in particular, on the outer side of the vessel, furthermore, being on the outer side of the hull in particular.

- 20 It is most preferred that heating elements, in particular, heating wires, are arranged in the intermediate space.

Brief description of the figures

- 25 The present invention is explained in more detail on the basis of the figures. The figures show

Fig. 1 a hull with a rudder trunk comprising a rudder stock tube and a receiving shaft,

- 30 Fig. 2a a view along an axial direction on a rudder trunk with a holder for a rudder stock tube,

Fig. 2b a holder element and a complementary holder piece for a holder of a rudder stock tube,

Fig. 2c a rudder stock tube aligned within a receiving shaft,

Fig. 2d another rudder stock tube aligned within a receiving shaft,

Fig. 3 a rudder stock tube within a receiving shaft arranged in a rotated manner.

Fig. 4 a rudder stock tube arranged within a receiving shaft with a
5 holder,

Fig. 5a another rudder stock tube (arranged in a receiving shaft) with a holder
comprising a clamping element,

Fig. 5b a clamping element for a holder of a rudder stock tube,

Fig. 6 a rudder trunk with an increasing gap width between a rudder stock tube and
10 a receiving shaft, and

Fig. 7 a perspective view of a rudder trunk with an increasing gap width between a
rudder stock tube and a receiving shaft.

Detailed description of the figures

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Fig. 1 shows a rudder trunk 100 comprising a rudder stock tube 10 and a receiving shaft 11. The rudder trunk 100 is arranged in a hull 12 of a vessel 13. The hull 12 comprises an outer side 14. The rudder stock tube 10 is formed as a hollow tube 15 and inserted in a vertical direction 16 from the outer side 14 of the hull 12 from below into the receiving shaft 11. Between the outer wall 17 of the rudder stock tube 10 and the inner wall 18 of the receiving shaft 11, an intermediate space 19 is formed in a state of the rudder stock tube 10 being arranged in the receiving shaft 11. The rudder trunk 100 comprises a holder 20 for holding the rudder stock tube 10 within the receiving shaft 11. The holder 20 comprises holder elements 21, which are attached to the outer wall 17 of the rudder stock tube 10 in a material-fit, form-fit or force-fit manner. Furthermore, the holder comprises 20 complementary holder pieces 22, which are arranged on the inner wall 18 of the receiving shaft 11 in a force-fit, material-fit or form-fit manner. Each of the complementary holder pieces 22 projects in a radial direction 23 from the inner wall 18 of the receiving shaft 11 into the intermediate space 19. Likewise, each of the holder elements 21 projects from the outer wall 17 of the rudder stock tube 10 in the radial direction 23 into the intermediate space 19. Furthermore, in the intermediate space 19, there is a bonding agent 24, which is formed as cast plastic 25 and ensures a secure fixing

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of the rudder stock tube 10 in the receiving shaft 11. Additionally, the rudder stock tube 10 extends in an axial direction 26.

A first embodiment of the holder 20 is shown in Fig. 2a and 2b.

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Fig. 2a shows a view of the rudder stock tube 10 and the receiving shaft 11 opposite to the axial direction 26. Fig. 2b shows a view of the complementary holder piece 22 arranged on the inner wall 18 of the receiving shaft 11 and the holder element 21 arranged on the outer wall 17 of the rudder stock tube 10 along the section line A-A from Fig. 2a.

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The rudder stock tube 10 comprises four holder elements 21a to 21d, which project from the outer wall 17 of the rudder stock tube 10 into the intermediate space 19. On the inner wall 18 of the receiving shaft 11, four complementary holder pieces 22a to 22d are arranged, which also project into the intermediate space 19. The holder elements 21a to 21d and the complementary holder pieces 22a to 22d are arranged evenly spaced across the outer circumference of the rudder stock tube 10 or across the inner circumference of the receiving shaft 11. As can be seen from Fig. 2b, the complementary holder pieces 22 or 22a to 22d are formed as profile body 29 and in particular as U-profile body 28. The U-profile body 28 comprise limbs 30 and a base section 31. The holder elements 21 or 21a to 21d are formed as bars 32 and are deposited on the base section 31 of the complementary holder pieces 22 or 22a to 22d formed as U-profile body 28. By resting the bars 32 on the base section 31 of the U-profile body 28, a movement of the rudder stock tube 10 in the axial direction 26 downwards is hindered or prevented. The limbs 30 of the U-profile body 28 also serve as a rotary brake 33. Thus, the rudder stock tube 10 in the arrangement shown in Fig. 2a and 2b can be rotated only slightly in the receiving shaft 11 before the bars 32 of the holder elements 21a to 21d hit the limbs 30 of the U-profile body 28. In Fig. 2a, the intermediate space 19 between the rudder stock tube 10 and the receiving shaft 11 is not filled. Accordingly, the rudder stock tube 10 can be aligned or adjusted within the receiving shaft 11. For this purpose, the washers 34 shown in Fig. 2b can be provided. By arranging the washers 34 between the bar 32 and the base section 31 of the U-profile body 28, the rudder stock tube 10 can be adjusted in the receiving shaft 11. In Fig. 2c and 2d, the possibilities of adjusting the rudder stock tube 10 in the

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receiving shaft 11 are shown. Thus, as in Fig. 2c, the rudder stock tube 10 can be moved laterally in the receiving shaft 11 in such a way that the central axis 35 of the rudder stock tube 10 is offset laterally with relation to the central axis 36 of the receiving shaft 11. In Fig. 2d, it is shown in a strongly exaggerated manner that, by arranging washers 34
5 between the holder elements 21 and the complementary holder pieces 22, an angle α between the central axis 35 of the rudder stock tube 10 and the central axis 36 of the receiving shaft 11 can be adjusted. After alignment, the intermediate space 19 can be filled with a bonding agent 24, in particular with a cast plastic 25. After the bonding agent 24 hardens, the rudder stock tube 10 is fixed within the receiving shaft 11.

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For the production of the rudder trunk according to Fig. 1 to 2d, the rudder stock tube is inserted from the outer side 14 of the hull 12 in the vertical direction 16 (Fig. 1) into the receiving shaft 11. For this purpose, as shown in Fig. 3, the rudder stock tube 10 is rotated opposite the receiving shaft 11 in such a way that the holder elements 21a to 21d and the
15 complementary holder pieces 22a to 22d are not aligned with each other. In this position, the rudder stock tube 10 can be introduced into the receiving shaft 11 in the vertical direction 16 in such a way that the holder elements 21a to 21d are guided past the complementary holder pieces 22a to 22d until the holder elements 21a to 21d are arranged above the complementary holder pieces 22a to 22d. Subsequently, the holder
20 elements 21a to 21d can be aligned by rotating the rudder stock tube 10 around the central axis 35 of the rudder stock tube 10 with the holder elements 22a to 22d, as shown in the view in Fig. 2a. Subsequently, the rudder stock tube 10 can be moved downwards in the axial direction 26 or against the vertical direction 16, such that the holder elements 21a to 21d, in particular, those formed as bars 32, are arranged at the complementary
25 holder pieces 22a to 22d, in particular, those formed as U-profile bodies 28. By arranging the holder elements 21a to 21d at the complementary holder pieces 22a to 22d, a holder 20 is formed, which prevents or hinders movement of the rudder stock tube in the axial direction 26 within the receiving shaft 11 (Fig. 1). Subsequently, the rudder stock tube 10 can be aligned, in particular, on a propeller axis or on a stern tube. To fix the rudder stock
30 tube 10 in the receiving shaft, the intermediate space 19 is then filled with a bonding agent 24.

A further embodiment of the holder 20 is shown in Fig. 4. With to the embodiment of Fig. 1 and 2a, the embodiment according to Fig. 4 differs only in that the holder elements 21 or 21a to 21d formed as bars 32, which project in the radial direction 23 into the intermediate space 19 between the rudder stock tube 10 and the receiving shaft 11, are additionally inclined upwards against the axial direction 26. This leads to the fact that, by moving the rudder stock tube 10 in the receiving shaft 11 in the radial direction 23, the holder elements 21 or 21a to 21d in the formed as U-profile body 28 complementary holder pieces 22 or 22a to 22d due to the inclination receive an additional component of the movement in or against the axial direction 26. As a result, the central axis 35 of the rudder stock tube 10 is aligned with the centre axis 36 of the receiving shaft 11.

A further embodiment of the holder 20 is shown in Figs. 5a and 5b. Figs. 5a and 5b show a possible embodiment of the holder 20 using a clamping element. The holder element 21 in the rudder stock tube 10 is formed as a recess 37, in particular, as a groove 38. The recess 37 is circumferentially formed around the rudder stock tube 10. The complementary holder piece 22 is formed as a clamping element in the form of a clamping ring 39 and arranged via a second groove 40 circumferential around the inner wall 18 of the receiving shaft 11 at the receiving shaft 11 in a form-fit manner. The clamping ring 39 is not fully closed, but comprises, in accordance with Fig. 5b, a gap 41 at one point, which allows that the clamping ring 39 can be widened. When inserting the rudder stock tube 10 into the receiving shaft 11, the clamping ring 39 is then first to be widened such that the rudder stock tube 10 can be guided through the clamping ring 39. As soon as the recess 37 or the groove 38 of the rudder stock tube 10 is arranged at the level of the clamping ring 39, the clamping ring 39 is relaxed, such that this, as shown in Fig. 5a, intervenes in the recess 37 or the groove 38 of the rudder stock tube 10. This prevents movement of the rudder stock tube 10 in the axial direction 26 of the rudder stock tube 10 in the receiving shaft 11. Instead of the clamping ring 39 and the groove 38, other clamping elements and suitably formed holder elements 21 can also be used as complementary holder piece 22, which cause a form-fit and/or non-positive-locking clamp between rudder stock tube 10 and receiving shaft 11.

Furthermore, in Fig. 1, a sealing element 42 is shown, which is arranged on the outer side 14 of the hull 12. The sealing element 42 is designed as a sealing sleeve 43 and comprises

a breakthrough 44 through which the bonding agent 24, in particular the cast plastic 25, can be introduced into the intermediate space 19 between the rudder stock tube 10 and the receiving shaft 11. After the bonding agent hardens 24, the sealing sleeve 43 can either remain on the outer side 14 of the hull 12. Alternatively, it is possible that the sealing sleeve 43 is removed from the outer side 14 of the hull 12.

Fig. 6 and 7 show another rudder trunk 100. The rudder trunk 100 comprises a receiving shaft 11, which is arranged on a hull 12 of a vessel 13. A rudder stock tube 10 is arranged in the receiving shaft 11 in such a way that an intermediate space 19 is formed between the outer wall 17 of the rudder stock tube 10 and the inner wall 18 of the receiving shaft 11. The rudder stock tube 10 is arranged across a clamping height 45 within the receiving shaft 11. In a lower region 46 of the clamping height 45, the intermediate space 19 between the inner wall 18 of the receiving shaft 11 and the outer wall 17 of the rudder stock tube 10 has a constant gap width 47. In the axial direction 26 upwards towards the hull 12 or viewed in the vertical direction 16 of the rudder stock tube 10, above the lower region 46 of the clamping height 45, a middle region 48 is provided, in which the gap width 47 between the outer wall 17 of the rudder trunk 10 of the inner wall 18 of the receiving shaft 11 increases in the direction of the hull 12. For the increase in the gap width 47, the rudder stock tube 10 has a wall thickness 49 that decreases upwardly. Holder elements 21 are arranged on the outer side of the rudder stock tube 10 in an upper region 50 of the clamping height 45. Corresponding complementary holder pieces 22 are arranged on the inner wall 18 of the receiving shaft 11. Via the holder elements 21 or complementary holder pieces 22, a decrease in the gap width 47 in the upper region 50 of the clamping height 45 results. Instead of the holder elements 21 and/or the complementary holder pieces 22, a circumferential flange can also be provided. A bonding agent 24, such as cast plastic 25 for example, is arranged within the upper region 50 in the region of the holder elements 21 and complementary holder pieces 22. Similarly, a bonding agent 24 is provided within the lower region 46 of the gap width 47. The middle region 48 of the clamping height 45 is between the upper region 50 and the lower region 46 of the clamping height 45, wherein the intermediate space 19 in the middle region 48 is not filled with a bonding agent 24.

In the perspective view of Fig. 7, the increasing gap width between the outer wall 17 of the rudder stock tube 10 and the inner wall 18 of the receiving shaft 11 can be clearly seen. In addition, in the lower region 46 constant gap width 47 and in the upper region 50 in the region of the holder elements 21 or complementary holder pieces 22, the bonding agent 24 formed as cast plastic 25 are shown.

List of reference numerals

	100	Rudder trunk
10		
	10	Rudder stock tube
	11	Receiving shaft
	12	Hull
	13	Watercraft
15	14	Outer side
	15	Hollow tube
	16	Vertical direction
	17	Outer wall
	18	Inner wall
20	19	Intermediate space
	20	Holder
	21	Holder element
	21a	Holder element
25	21b	Holder element
	21c	Holder element
	21d	Holder element
	22	Holder complement
	22a	Holder complement
30	22b	Holder complement
	22c	Holder complement
	22d	Holder complement
	23	Radial direction

	24	Bonding agent
	25	Cast plastic
	26	Axial direction
	27	Upper region
5	28	U-profile body
	29	Profile body
	30	Limb
	31	Base section
	32	Bar
10	33	Rotation brake
	34	Washer
	35	Central axis
	36	Central axis
	37	Recess
15	38	Groove
	39	Clamping ring
	40	Second groove
	41	Gap
20	42	Sealing element
	43	Sealing collar
	44	Opening
	45	Clamping height
	46	Lower region
25	47	Gap width
	48	Middle region
	49	Wall thickness
	50	Upper region

Patentkrav

- 5 **1.** Rorstamme (100) til et vandfartøj (13), omfattende et stammerør (10), en modtageaksel (11) og en holder (20) til at holde stammerøret (10) i modtageakslen (11), hvor der i en tilstand af stammerøret (10), der er anbragt i modtageakslen (11), er tilvejebragt et mellemrum (19) mellem stammerøret (10) og modtageakslen (11), hvor holderen (20) omfatter mindst et holderelement (21, 21a, 21b, 21c, 21d) og mindst et holderkomplement (22, 22a, 22b, 22c, 22d), hvor det mindste ene holderelement (21, 21a, 21b, 21c, 21d) er anbragt ved stammerøret (10), hvor det mindst ene holderkomplement (22, 22a, 22b, 22c, 22d) er anbragt ved modtageakslen (11), og at det mindst ene holderelement (21, 21a, 21b, 21c, 21d) og/eller det mindst ene holderkomplement (22, 22a, 22b, 22c, 22d) rager ind i mellemrummet (19) i tilstanden af stammerøret (10), der er anbragt i modtageakslen (11), hvor stammerøret (10) er anbragt drejeligt i modtageakslen (11), når mellemrummet (19) ikke er udfyldt, således at det mindst ene holderelement (21, 21a, 21b, 21c, 21d) og det mindst ene holderkomplement (22, 22a, 22b, 22c, 22d) ved at dreje stammerøret (10) kan rettes ind til at flugte med hinanden set i aksial retning (26), **kendetegnet ved, at** stammerøret (10) er anbragt i modtageakslen (11) således, at det er bevægeligt i aksial retning (26), når mellemrummet (19) ikke er udfyldt, således at det mindst ene holderelement (21, 21a, 21b, 21c, 21d) kan sættes ned på den mindst ene holderkomplement (22, 22a, 22b, 22c, 22d), som er positioneret, især på linje.
- 25 **2.** Rorstamme (100) ifølge krav 1, **kendetegnet ved, at** det mindst ene holderelement (21, 21a, 21b, 21c, 21d) og det mindst ene holderkomplement (22, 22a, 22b, 22c, 22d) kan være anbragt og/eller er anbragt tvangslåsende og/eller formlåsende på hinanden, således at i tilstanden af stammerøret (10), der er anbragt i modtageakslen (11), især i en tilstand, hvor rorstammen er anbragt på vandfartøjet (13) omfattende stammerør (10) og modtageaksel (11), hindres og/eller forhindres en bevægelse af stammerøret (10) i modtageakslen
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(11) i en aksial retning (26) af stammerøret (10).

at der er tilvejebragt mindst to, fortrinsvis mindst tre, yderligere fortrinsvis mindst fire, især fortrinsvis nøjagtigt fire holderelementer (21, 21a, 21b, 21c, 21d), og/eller at der er tilvejebragt mindst to, fortrinsvis mindst tre, yderligere fortrinsvis mindst fire, især fortrinsvis nøjagtigt fire, holderkomplementer (22, 22a, 22b, 22c, 22d).

3. Rorstamme (100) ifølge et af de førnævnte krav, **kendetegnet ved, at** det mindst ene holderelement (21, 21a, 21b, 21c, 21d) er udformet i ét stykke med stammerøret (10) og/eller er materialelåsende og/eller tvangslåsende og/eller formlåsende forbundet med stammerøret (10), og/eller at det mindst ene holderkomplement (22, 22a, 22b, 22c, 22d) er udformet i ét stykke med modtageakslen (11) og/eller er materialelåsende og/eller tvangslåsende og/eller formlåsende forbundet med modtageakslen (11), og/eller

at det mindst ene holderelement (21, 21a, 21b, 21c, 21d) og/eller det mindst ene holderkomplement (22, 22a, 22b, 22c, 22d) er en stift eller en bolt, fortrinsvis en gevindbolt, eller et fremspring eller en plade eller en bane (32) eller et profileret legeme (29), fortrinsvis et U-formet profileret legeme (28), og/eller at det mindst ene holderelement (21, 21a, 21b, 21c, 21d) og/eller det mindst ene holderkomplement (22, 22a, 22b, 22c, 22d) er en beholder, især en boring og/eller et blindhul, fortrinsvis med et indvendigt gevind, eller en udsparring (37), især en rille (38) og/eller et gevind, især en gevindgang, og/eller at det mindst ene holderelement (21, 21a, 21b, 21c, 21d) og/eller det mindst ene holderkomplement (22, 22a, 22b, 22c, 22d) er et spændeelement, især en spændering (39).

4. Rorstamme (100) ifølge krav 2 eller 3, **kendetegnet ved, at** de mindst to holderelementer (21, 21a, 21b, 21c, 21d) er anbragt, fortrinsvis ensartet, over en udvendig omkreds af stammerøret (10), og/eller at de mindst to holderkomplementer (22, 22a, 22b, 22c, 22d) er anbragt, fortrinsvis ensartet, over en indvendig omkreds af modtageakslen (11),

hvor fortrinsvis de mindst to holderelementer (21, 21a, 21b, 21c, 21d) er anbragt med indbyrdes afstand i omkredsretningen over den udvendige omkreds af stammerøret (10), og/eller hvor fortrinsvis de mindst to holderkomplementer (22, 22a, 22b, 22c, 22d) er anbragt med indbyrdes afstand i omkredsretningen over den indvendige omkreds af modtageakslen (11) på en sådan måde, at når stammerøret (10) er ført ind i modtageakslen (11), kan holderelementerne (21, 21a, 21b, 21c, 21d) føres forbi holderkomplementerne (22, 22a, 22b, 22c, 22d) i aksial retning (26).

5. Rorstamme (100) ifølge krav 1, **kendetegnet ved, at** stammerøret (10) kan anbringes og/eller er anbragt i modtageakslen (11) således, at det kan bevæges i aksial retning (26), når mellemrummet (19) ikke er udfyldt, således at det mindst ene holderelement (21, 21a, 21b, 21c, 21d) kan anbringes på det mindst ene holderkomplement (22, 22a, 22b, 22c, 22d), som især er på linje, og/eller at det mindst ene holderelement (21, 21a, 21b, 21c, 21d) kan sættes ned på det mindst ene holderkomplement (22, 22a, 22b, 22c, 22d), som især er på linje,

hvor fortrinsvis stammerøret (10), i den tilstand, hvor det er anbragt i modtageakslen (11), især i en tilstand, hvor rorstammen omfattende stammerøret (10) og modtageakslen (11) er anbragt på vandfartøjet (13), kan justeres i modtageakslen (11), især rettes ind, især når mellemrummet (19) ikke er udfyldt.

6. Rorstamme (100) ifølge krav 5, **kendetegnet ved, at** der er tilvejebragt justeringsmidler, hvor justeringsmidlerne er udformet således, at især i tilfælde af holderelementer (21, 21a, 21b, 21c, 21d) og holderkomplementer (22, 22a, 22b, 22c, 22d) er anbragt ved siden af hinanden, kan en position og/eller justering af stammerøret (10) i modtageakslen (11), især stammerørets (10) position i modtageakslen (11) i forhold til en radialretning (23) af modtageakslen (11), og/eller en vinkel (α) mellem en midterakse (35) af stammerøret (10) og en midterakse (36) af modtagelsesakslen (11), justeres,

hvor justeringsmidlerne fortrinsvis er justeringsskruer og/eller underlægnings-elementer (34), fortrinsvis underlægningsskiver, hvor justeringsmidlerne fortrinsvis er anbragt på det mindst ene holderelement (21, 21a, 21b, 21c, 21d) og/eller på det mindst ene holderkomplement (22, 22a, 22b, 22c, 22d).

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7. Rorstamme (100) ifølge et af de førnævnte krav, **kendetegnet ved, at** mellemrummet (19) kan udfyldes eller er udfyldt med et forbindelsesmiddel (24), fortrinsvis med et støbt plastmateriale (25), især støbeharpiks,

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hvor der fortrinsvis er tilvejebragt et tætningselement (42), især en tætningsmuffe (43), hvor tætningselementet (42) ligger an mod en yderside af rorstammen, således at når mellemrummet (19) er udfyldt, kan en lækage af forbindelsesmidlet (24) til ydersiden forhindres af tætningselementet (42), hvor fortrinsvis tætningselementet (42) kan fjernes, især efter udfyldning af mellemrummet (19), hvor tætningselementet (42) er formet i én del, især i ét stykke eller i flere stykker, og/eller

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hvor forbindelsesmidlerne (24), især det støbte plastmateriale (25), kan gøres flydende, fortrinsvis ved tilførsel af varme, således at stammerøret (10) kan fjernes fra modtageakslen (11) efter fortætning af forbindelsesmidlet (24).

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8. Rorstamme (100) ifølge et af de foregående krav, **kendetegnet ved, at** varmeelementer, især varmetråde, er anbragt i mellemrummet (19) og er fortrinsvis indlejret i forbindelsesmidlerne (24), og/eller

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at udsparinger, især riller eller borer, er anbragt på ydersiden og/eller på indersiden af stammerøret (10) og/eller af modtageakslen (11), hvor der fortrinsvis er anbragt signalledningsmidler, især kabler, i fordybningerne, og/eller at holderelementerne (21, 21a, 21b, 21c, 21d), som er anbragt ved siden af hinanden, især boltene eller banerne (32), og holderkomplementerne (22, 22a, 22b, 22c, 22d), især de profilerede legemer (29) eller U-formede profilerede legemer (28) begrænser eller forhindrer en drejning af stammerøret (10), når rotations- eller torsionskræfter virker på stammerøret (10).

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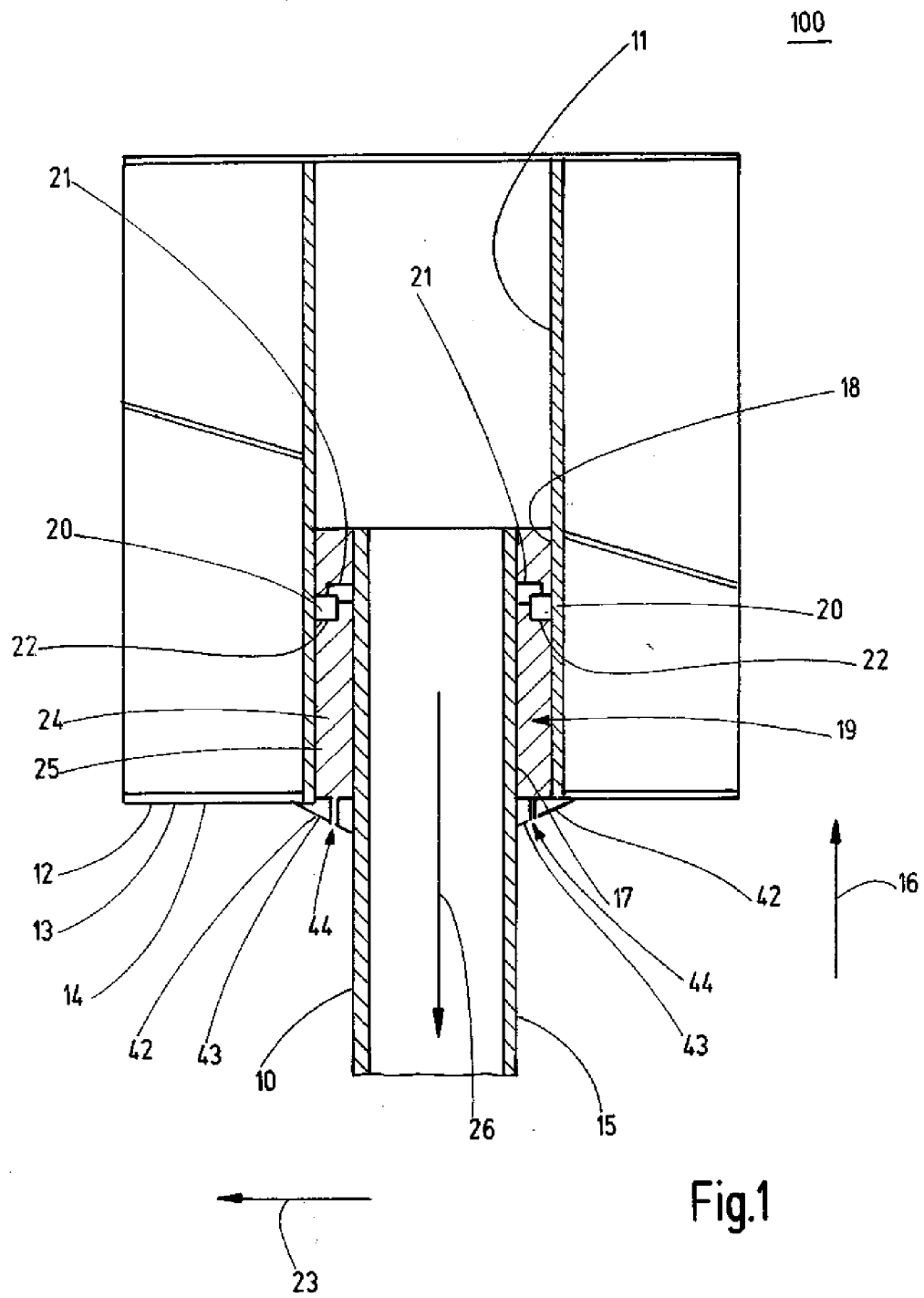
9. Vandfartøj (13) med en rorstamme (100) ifølge et af kravene 1 til 8.

10. Fremgangsmåde til fremstilling af en rorstamme (100) ifølge et af kravene 1 til 8 med en modtageaksel (11) og et stammerør (10) i et vandfartøj (13),
 5 hvor der er tilvejebragt et vandfartøj (13), især et skib, yderligere især en agtersektion, hvor modtageakslen (11) er anbragt i vandfartøjet (13), hvor stammerøret (10) indføres i modtageakslen (11), hvor det mindst ene holderelement (21, 21a, 21b, 21c, 21d) føres forbi det mindst ene holderkomplement (22, 22a, 22b, 22c, 22d), hvorved stammerøret (10) drejes, således at det
 10 mindst ene holderelement (21, 21a, 21b, 21c, 21d) og det mindst ene holderkomplement (22, 22a, 22b, 22c, 22d) rettes ind for at flugte med hinanden i en aksial retning (26) af stammerøret (10) og/eller modtageakslen (11), hvor stammerøret (10) bevæges i den aksiale retning (26), således at det mindst ene holderelement (21, 21a, 21b, 21c, 21d) og det mindst ene holderkomplement (22, 22a, 22b, 22c, 22d) er anbragt ved siden af hinanden, især forskudt
 15 fra hinanden.

11. Fremgangsmåde ifølge krav 10, hvor vandfartøjet (13) er rettet ind med en køl, der peger nedad, og hvor stammerøret (10) indsættes i modtageakslen
 20 (11) nedefra set i lodret retning (16), og/eller
 hvor stammerøret (10) er rettet ind i modtageakslen (11) med justeringsmidler, hvor justeringen sker i forhold til en propelakse og/eller et hækrør på vandfartøjet (13), og/eller
 hvor et mellemrum (19) mellem stammerøret (10) og modtageakslen (11) er
 25 udfyldt med et forbindelsesmiddel (24), især et støbt plastmateriale (25), og hvor forbindelsesmidlet (24), især det støbte plastmateriale (25), er hærdet, hvor der fortrinsvis er anbragt varmeelementer, især varmetråde, i mellemrummet (19).

12. Fremgangsmåde ifølge et af kravene 10 eller 11, hvor et tætningselement (42) er anbragt på en yderside af rorstammen (100), især på en yderside (14)

5 af vandfartøjet (13), yderligere især på en yderside af et skibsskrog (12), således at når mellemrummet (19) udfyldes, kan en lækage af forbindelsesmidlet (24) til ydersiden forhindres af tætningselementet (42), hvor tætningselementet (42) fortrinsvis efter hærdningen af forbindelsesmidlet (24) på ydersiden af rorstammen (100), især på ydersiden (14) af vandfartøjet (13), yderligere især på ydersiden af skibsskroget (12), forbliver eller fjernes.



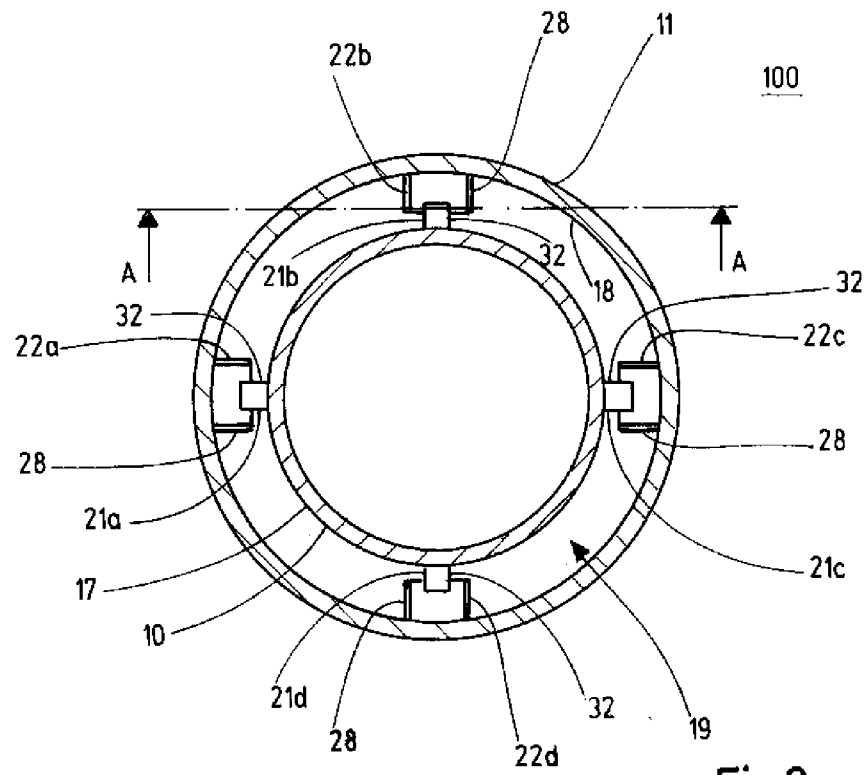


Fig.2a

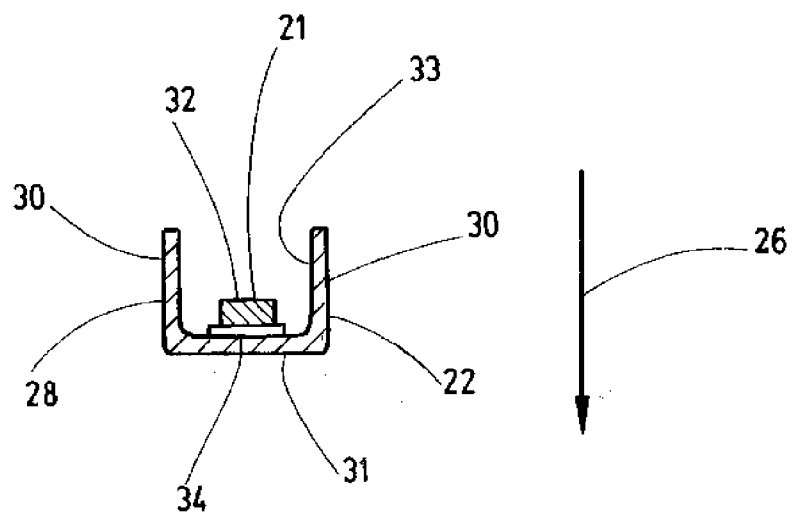


Fig.2b

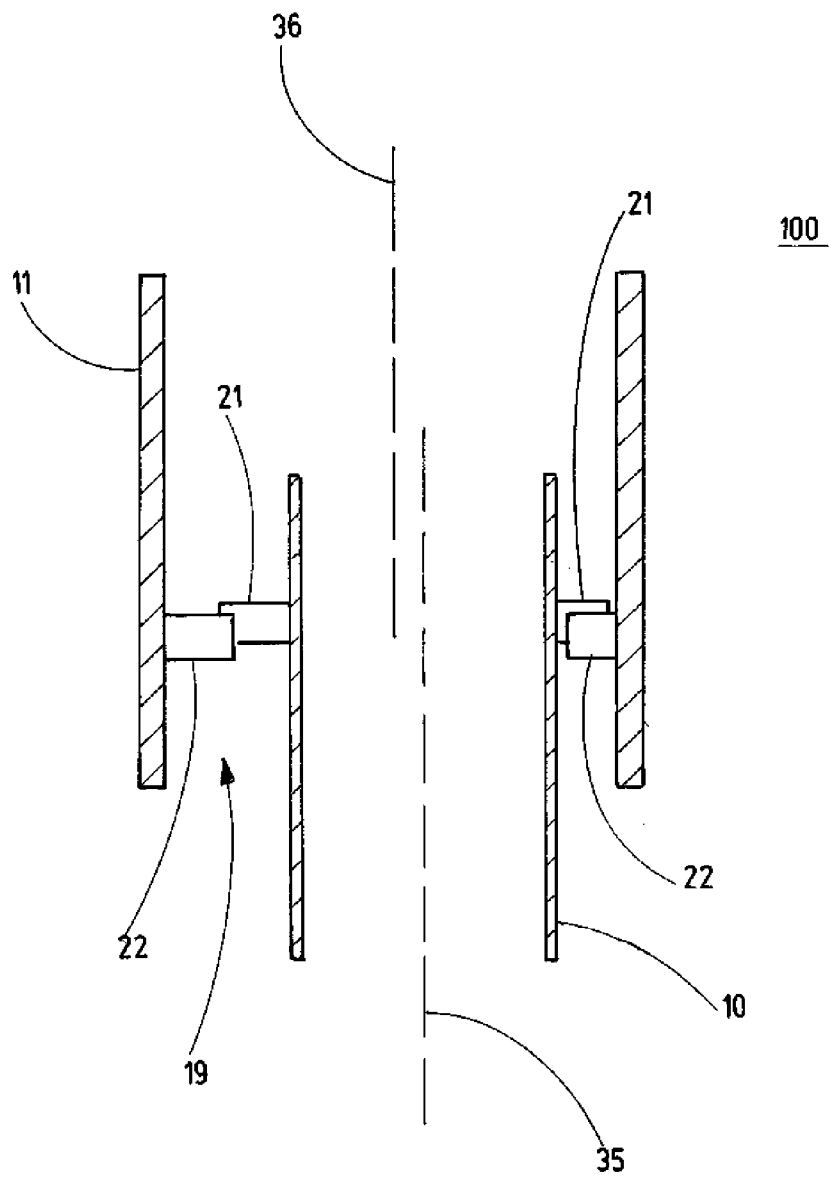


Fig.2c

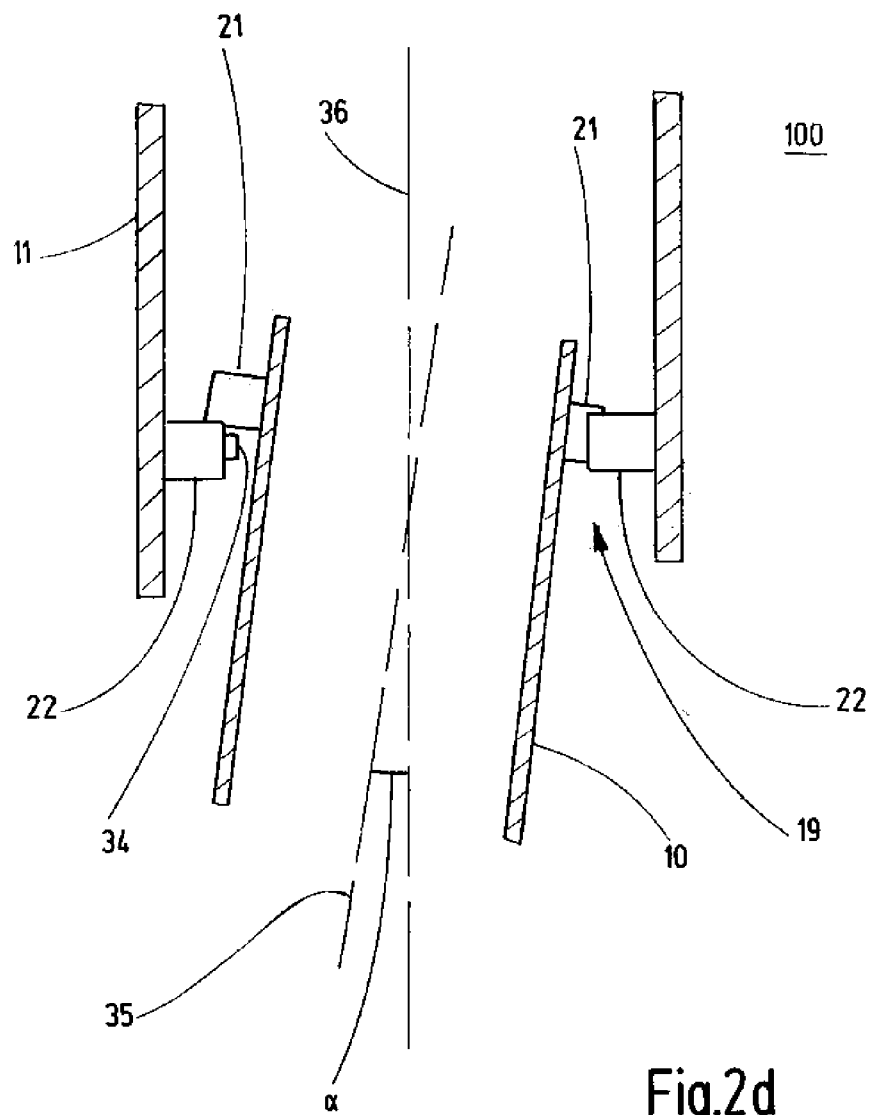


Fig.2d

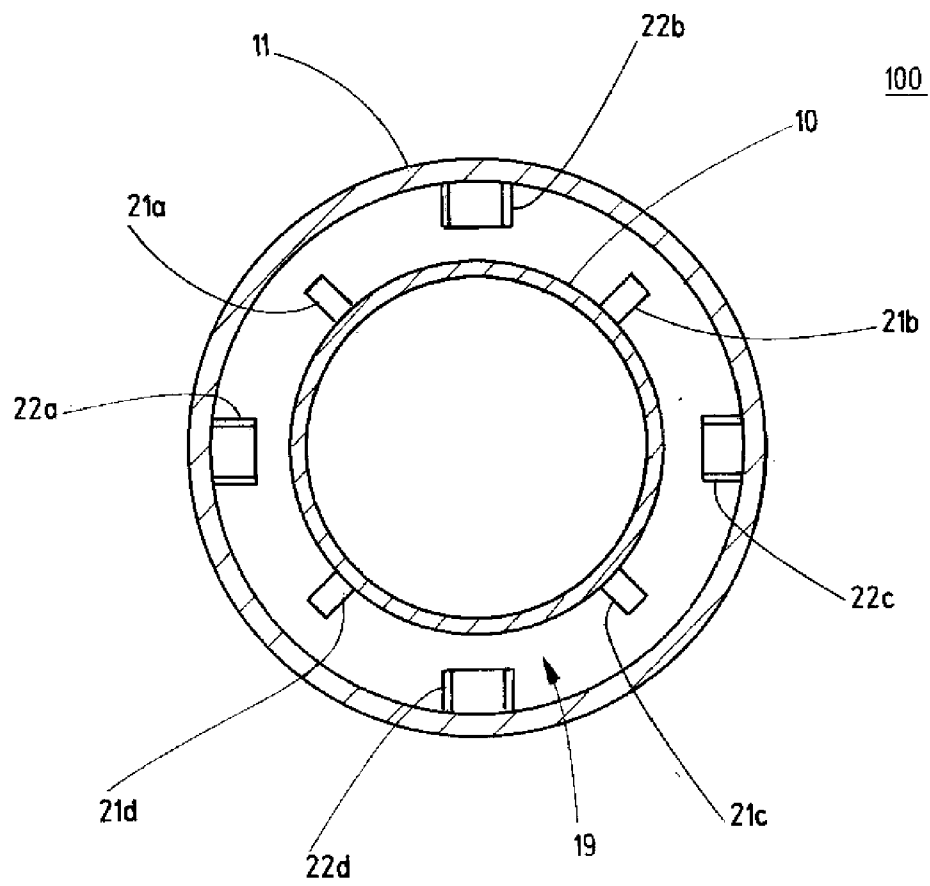
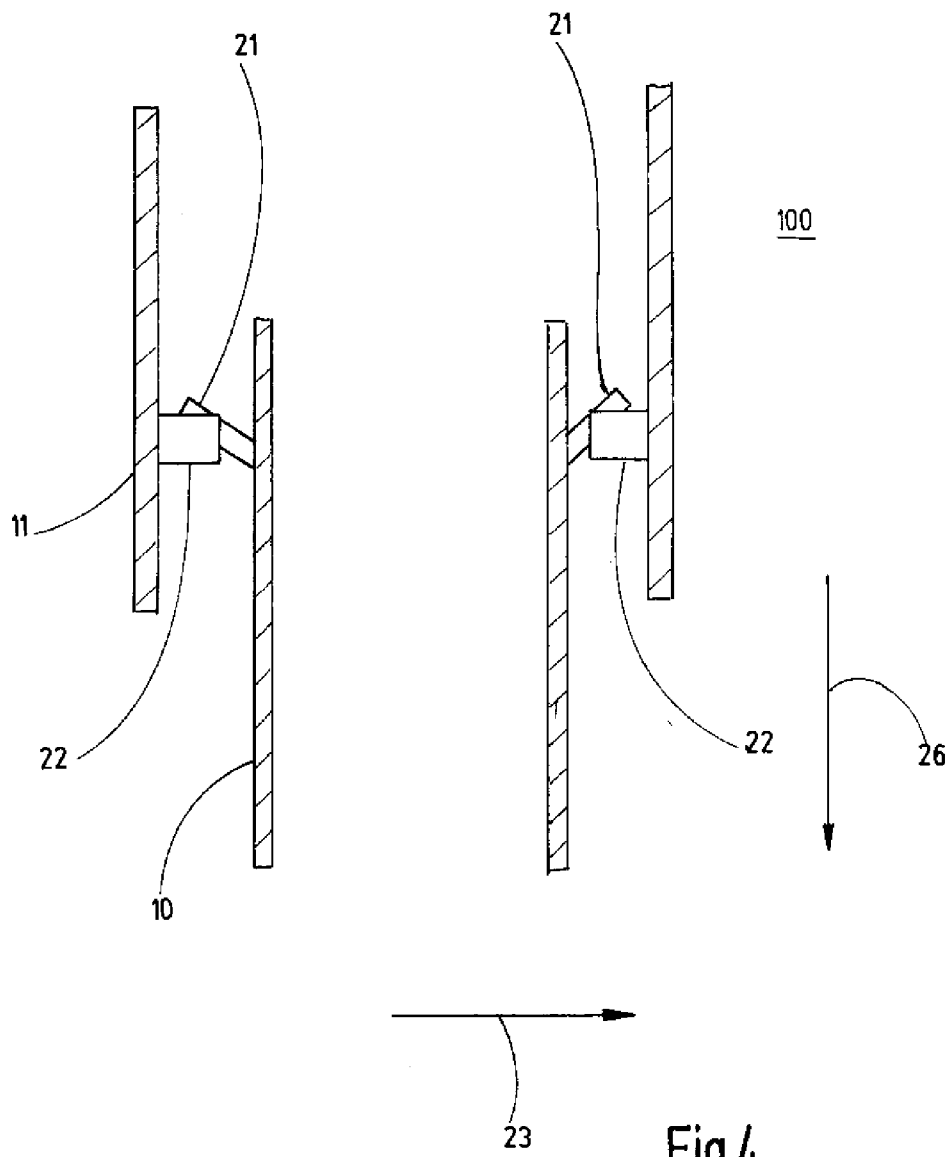


Fig.3



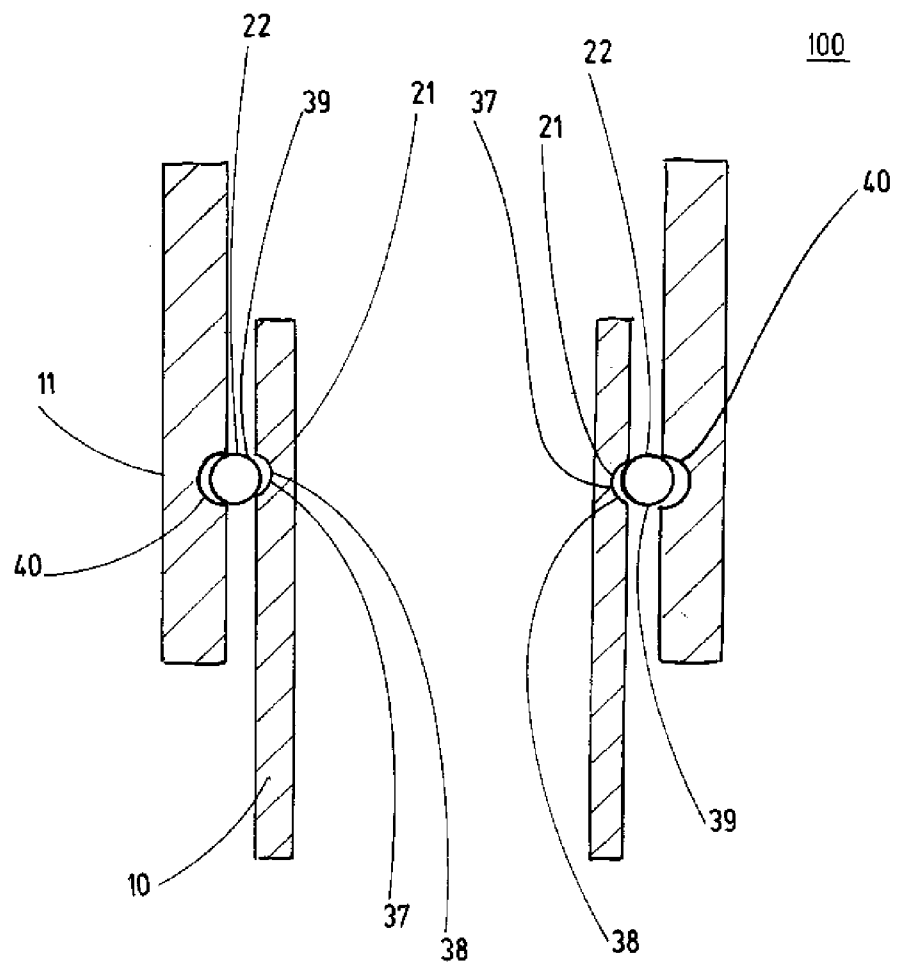


Fig.5a

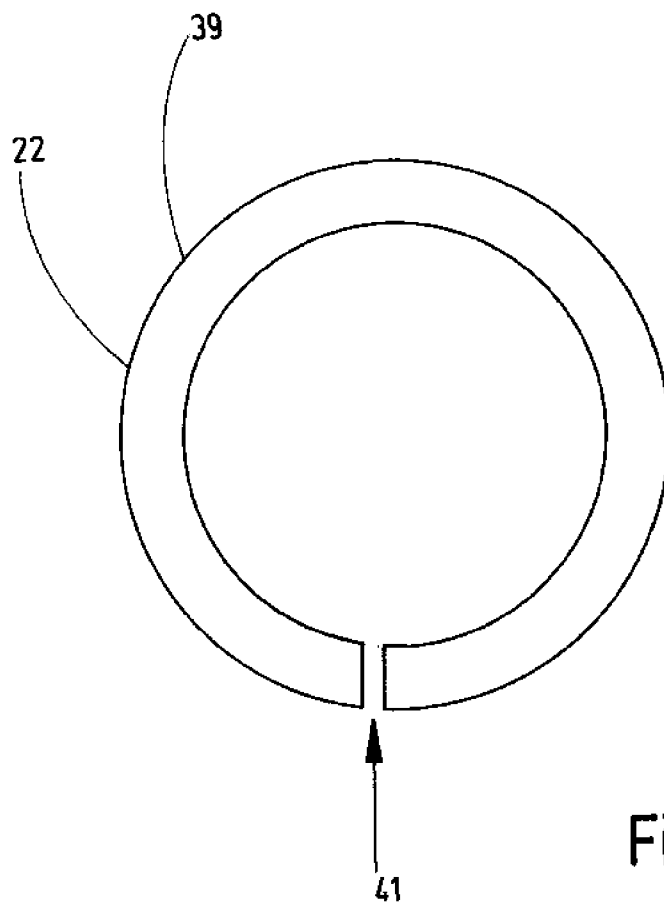
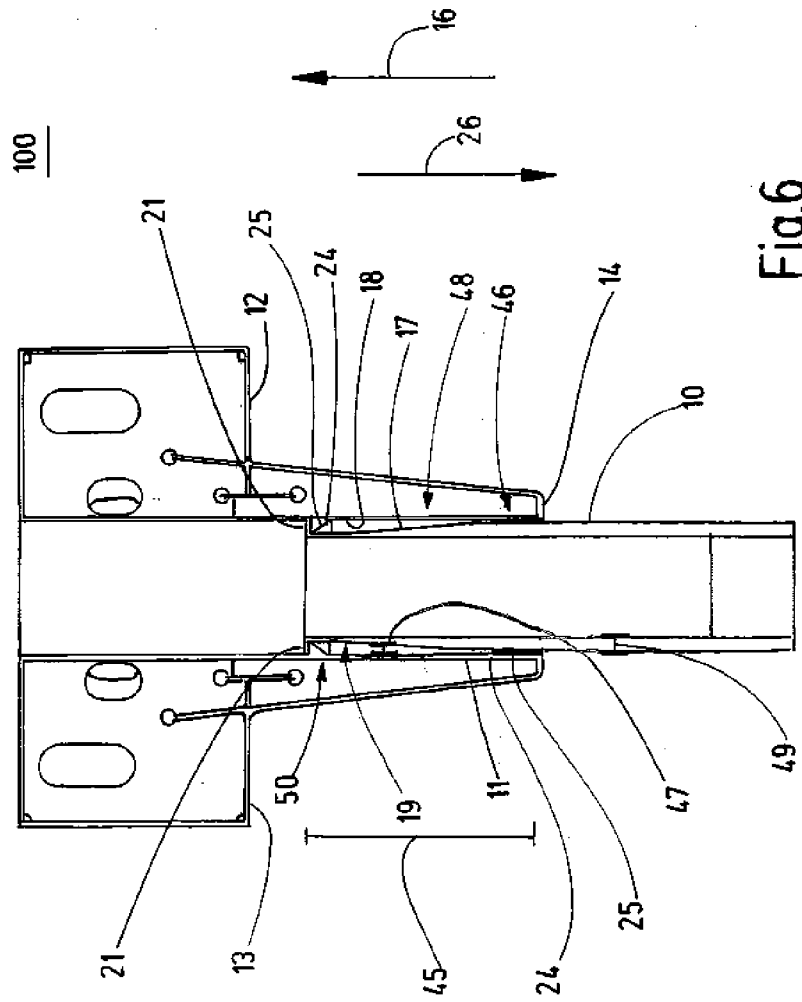


Fig.5b



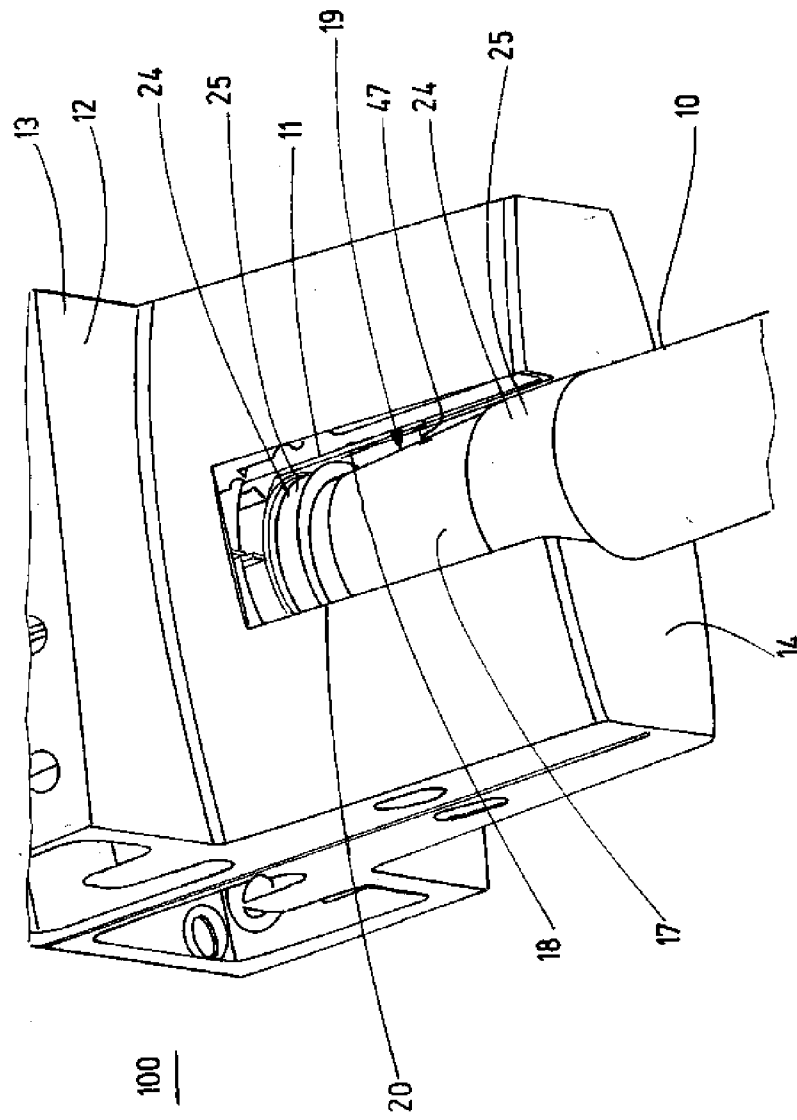


Fig.7