Patent claims

1. A rudder (100) for watercraft (10), in particular for ships (11), comprising a rudder shaft (14) arranged in a trunk pipe (12), a rudder blade (16) connected to the rudder shaft (14) and a bearing bushing (32) arranged between trunk pipe (12) and rudder shaft (14) as well as a bearing clearance measuring device (25), ~~characterized in that~~ wherein the bearing clearance measuring device (25) comprises at least one sensor (26, 26a) for abrasion-free measurement of a bearing clearance, characterized in that the at least one sensor (26, 26a) is an eddy current sensor (36) or an ultrasound sensor (40).

2. The rudder (100) according to Claim 1, characterized in that the at least one sensor (26, 26a) for abrasion-free measurement of a bearing clearance is a sensor (26, 26a) for abrasion-free measurement of a distance (37) between the sensor (26, 26a) and the rudder shaft (14) and/or for abrasion-free measurement of a wall thickness (43) of the bearing bushing (32).

3. The rudder (100) according to Claim 1 or 2, characterized in that the sensor (26, 26a) is arranged in a contact-free manner and at a distance from the rudder shaft (14).

4. The rudder (100) according to ~~one of the previous claims~~any preceding claim, characterized in that the sensor (26, 26a) is arranged on an outer side (41) of the bearing bushing (32), and/or that the at least one sensor (26, 26a) is arranged above or below the bearing bushing (32) when viewed in an axial direction (33) of the rudder shaft (14).

5. The rudder (100) according to any preceding claim~~one of the previous claims~~, characterized in that at least two, preferably at least three, particularly preferably at least four sensors (26, 26a) are provided, wherein the sensors (26, 26a) are arranged in particular at regular angular spacings over a circumference of the trunk pipe (12) and/or the bearing bushing (32) and/or that the at least one sensor (26, 26a), in particular at least one of the sensors (26, 26a) is arranged in an aft region of the in particular fixed trunk pipe (12).

6. The rudder (100) according to any preceding claim~~one of the previous claims~~, characterized in that the at least one sensor (26, 26a) is arranged in a sensor receptacle (34), in particular in a drill hole (35), of the trunk pipe (12) and is preferably is screwed in or to the trunk pipe (12).

~~7. The rudder (100) according to one of the previous claims, characterized in that the at least one sensor (26, 26a) is an eddy current sensor (36) or an ultrasound sensor (40).~~

~~8.~~7. The rudder (100) according to any preceding claim~~Claim 7~~, characterized in that an ultrasound contact means (42), in particular silicone-based, is arranged between the ultrasound sensor (40) and the bearing bushing (32) and/or the rudder shaft (14).

~~9.~~8. The rudder (100) according to any preceding claim~~one of the previous claims~~, characterized in that a signal conducting means (28), in particular a cable (29) is provided, wherein the signal conducting means (28) is preferably arranged to run on an outer side (27) of the trunk pipe (12), wherein the signal conducting means (28) is particularly preferably arranged, at least in sections, in a signal conducting means channel (30), wherein the signal conducting means channel (30) is arranged on the outer side (27) of the trunk pipe (12), wherein quite particularly preferably the signal conducting means channel (30) is a groove, a U-profile (31) or a cable channel.

~~10.~~9. A method for measuring a bearing clearance in a rudder (100), ~~characterized in that~~ wherein an abrasion-free measurement of the bearing clearance is made, characterized in that the abrasion-free measurement is an ultrasound measurement using an ultrasound sensor, or an eddy current measurement using an eddy current sensor.

~~11.~~10. The method according to Claim ~~10~~9, characterized in that the abrasion-free measurement of the bearing clearance is an abrasion-free measurement of a distance (37) between a sensor (26, 26a) and a rudder shaft (14) and/or an abrasion-free measurement of a wall thickness (43) of a bearing bushing (32) ~~and/or the abrasion-free measurement is an ultrasound measurement,~~

~~preferably using an ultrasound sensor, or an eddy current measurement, preferably using an eddy current sensor~~.

~~12.~~11. The method according to any one of Claims ~~10~~ 9 or ~~11~~10, characterized in that the measurement is made automatically, in particular at regular time intervals, and/or that the measurement is made at at least two, preferably at at least three, particularly preferably at at least four positions over a circumference of a bearing bushing (32) and/or a rudder shaft (14) and/or a trunk pipe (12).

~~13.~~12. A bearing clearance measuring device (25), preferably for a rudder (100) according to any one of Claims 1 to ~~9~~8 or for a method according to one of Claims ~~10~~ 9 to ~~12~~11, ~~characterized in~~wherein ~~that~~ the bearing clearance measuring device (25) comprises at least one sensor (26, 26a) for abrasion-free measurement of a bearing clearance, wherein preferably the at least one sensor (26, 26a) for abrasion-free measurement of a bearing clearance is a sensor (26, 26a) for abrasion-free measurement of a distance (37) between the sensor (26, 26a) and a rudder shaft (14) and/or for abrasion-free measurement of a wall thickness (43) of a bearing bushing (32), characterized in that the at least one sensor (26, 26a) is an eddy current sensor (36) or an ultrasound sensor (40).

~~14. The bearing clearance measuring device (25) according to Claim 13, characterized in that the at least one sensor (26, 26a) is an eddy current sensor (36) or an ultrasound sensor (40).~~

~~15.~~13. Use of an eddy current sensor (36) or an ultrasound sensor (40) in a method for measurement of a bearing clearance in a rudder (100), in particular according to one of Claims ~~10~~ 9 to ~~12~~11.