

Rudder for ships

Technical Field

The invention relates to a rudder for ships in accordance with the preamble of Claim 1.

Prior Art

Rudders of ships with a propeller drive these days often have a so-called Costa bulb. The purpose of the so-called Costa bulb or propulsion bulb is that a bulge, which is designed bulb-shaped or zeppelin-shaped and constitutes a flow body, is configured as an extension of the propulsion axis in the region of the rudder blade. The purpose of this flow body is that the overall profile of the hub is extended to the point where there is only minimal turbulence of the wake.

This type of Costa bulb is known for example from patents DE 198 44 353 A1, DE 84 23 818 U and DE 82 24 238 U.

The effect of the Costa bulb rests on its bead-shaped configuration, by which it is distinguished from the rudder or respectively rudder blade, resulting in favourable flow.

The Costa bulb however thus protrudes laterally relative to the rudder blade and in the event of the effect of an impact or a blow or pressure it is in the immediate danger zone, before the actual rudder blade would be jeopardised.

But in the event of the effect of an impact or a blow or pressure on the Costa bulb the rudder blade would also be affected, because the Costa bulb transfers the force acting on it to the rudder blade and there is thus the added danger of damage to the rudder blade, before a rudder blade without Costa bulb would be jeopardised.

Description of the Invention, Task, Solution, Advantages

The task of the invention is to provide a rudder blade for ships, which in spite of favourable flow relative to external effects due to the effect of an impact or a blow or pressure is less susceptible with respect to damage or destruction and the flow body is independently destroyed in the event of pressure or impact.

At the same time it is advantageous if the flow body divides the rudder blade, viewed in the direction of height, into two areas (A, B), whereby both areas are designed identically or not identically in profile. In this respect it is effective if the longitudinal middle lines of the areas of the rudder blade do not match the middle lines of the flow body and form an angle α .

It is also effective if the angle α between the longitudinal middle line of a region of the rudder blade and the middle lines of the flow body are different for the both areas (A, B).

In terms of the invention it is advantageous if the flow body has predetermined break-off sites, which lead to the destruction of the flow body in the event of the increased effect of force, blow, impact or pressure. At the same time it is a further advantage if the predetermined break-off sites are designed as predetermined break-off lines. Also, it is effective if the predetermined break-off lines are oriented in the longitudinal and/or transverse

direction of the flow body. But it is also advantageous if the predetermined break-off lines are distributed reticulated over the flow body.

In terms of the invention it is effective if the predetermined break-off sites or predetermined break-off lines are designed as material weaknesses, material reductions and/or shear lines.

In an advantageous embodiment it is effective if the flow body comprises metal or a non-metallic material or a metal-non-metal mixture.

In another advantageous embodiment it is effective if the flow body comprises a carbon-fibre composite material.

In a further advantageous embodiment it is effective if the material has embedded carbon fibres, graphite fibres and/or fibreglass.

In yet another advantageous embodiment it is effective if the flow body comprises a synthetic material or synthetic materials.

In an advantageous embodiment it is effective if the flow body comprises POM synthetic material, such as polyoxymethylene, polyformaldehyde or polyacetates.

Advantageous further developments are described in the independent claims.

A particularly advantageous configuration of the flow body is one where the latter comprises two individual bowl-shaped longitudinal bodies conforming to the flow body, held in the region of their longitudinal edges via predetermined break-off lines on the outer wall faces of the rudder blade, whereby the edge regions of both bowl-shaped longitudinal bodies facing the propeller are connected via predetermined break-off lines to a spheri-

cal cap-shaped component, in turn connected solidly or detachably to the rudder blade.

The advantage of the inventive configuration of the flow body of a rudder blade of a rudder for ships is that due to the possibility of the flow body being destroyed the rudder is not impaired in the event of pressure, blow or impact effect. There is also the possibility that conventional rudder blades can be retrofitted with the inventive flow body.

Brief Description of the Diagrams

The invention will be explained in greater detail hereinbelow on the basis of an embodiment by way of the diagrams, in which:

- Fig. 1 is a diagrammatic view of the stem of a ship with a drive propeller, the rudder blade of a rudder, whereby the rudder blade is fitted with the inventive bulb-shaped flow body,
- Fig. 2 is a diagrammatic view of the rudder blade with a flow body comprising three components in the state of destruction in an exploded view,
- Fig. 3 is a frontal elevation of the rudder blade with the flow body in the state of destruction,
- Fig. 4 is a diagrammatic view of the rudder blade with the flow body,
- Fig. 5 is a rear elevation of the rudder blade with the flow body,
- Fig. 6 is a side elevation of the rudder blade with the flow body,
- Fig. 7 is a frontal elevation of the rudder blade with the flow body,
- Fig. 8 is a plan view from above of the rudder blade with the flow body, and
- Fig. 9 is a plan view from below of the rudder blade with the flow body.

Preferred Embodiment of the Invention

Fig. 1 shows the stem 11 of a ship 10 with a drive propeller 12 and a rudder 13, whereof the rudder blade 15 is fitted with a bulb-shaped or zeppelin-shaped flow body 20, preferably designed as a hollow body and which can be integrated into the rudder blade 15 and can comprise two or more components 21, 22, attached to the outer wall faces 15a, 15b of the rudder blade 15. The flow body 20 can also be designed as a full body. In extension of the propulsion axis a bulge, which forms the flow body 20, also known as propulsion bulb or Costa bulb, is designed in the region of the rudder blade 1.

The flow body 20 is designed such that in the event of pressure, blow or impact effect it is self-destroying.

To achieve the possibility of self-destruction, the wall 25 of the flow body 20 comprises individual wall sections 30, interconnected via predetermined break-off lines 40 in the form of material weaknesses or shear lines (Fig. 6). The predetermined break-off lines are configured in a longitudinal direction and/or running transversely to the longitudinal direction of the flow body 20 in the wall 25 of the flow body 20, whereby the predetermined break-off lines 40 can also be irregular. The predetermined break-off lines 40 can also be distributed reticulated over the flow body 20.

The predetermined break-off lines 40 are designed and arranged such that in the outer wall face of the flow body 20 there are no wrinkles, depressions, grooves or the like and thus the smooth outer wall face remains intact.

An essential element of the inventive design of the rudder blade 15 is that the flow body 20 self-destructs or detaches in the event of the effect of an impact or a blow or pressure. This ensures that no excessive force is transferred to the rudder blade itself, so that any impairment to the rudder blade resulting in substantial damage or destruction can be prevented.

Fig. 2 shows the view of a rudder blade 15 having a flow body 20, made up of three individual parts 50, 51, 55. Here the parts 50, 51 form the sides of the flow body 20 on the sides of the rudder blade 15 and the part 55 forms the front, i.e. the substantially somewhat hemispherical end section facing the propeller 12. Arrows X, X1, X2 indicate that the parts 50, 51, 55 in these directions are disassembled from the rudder blade 15. Typically, the parts 50, 51, 55 of the flow body 20 are bowl-shaped and preferably form no solid bodies, rather just form a hollow body in the assembled state, built onto the rudder blade 15.

Then the flow body 20 comprises two individual bowl-shaped longitudinal bodies 50, 51, conforming to the flow body, which in the region of their longitudinal edges 50a, 51a are held via predetermined break-off lines 40 on the outer wall faces 15a, 15b of the rudder blade 15, whereby the edge regions 50a, 51b of both bowl-shaped longitudinal bodies 50, 51 facing the propeller 12 are connected via predetermined break-off lines 40 to a spherical cap-shaped component, connected solidly or detachably to the rudder blade 15 (Fig. 2 and 3).

It is further evident from Fig. 2 that the rudder blade 15 is not a homogeneous component, but rather is formed from an upper area A and a lower area B. The upper area A has at least on its front side a curve or cut, which is bent or oriented more to the left, and the lower part B has at least one curve or cut, which is bent or oriented more to the right. At the interface of both areas A and B this difference is evident from the fact that both front areas are designed as tabs, which do not match one another congru-

ently, but stand apart from one another approximately y-shaped. The longitudinal middle lines LM1 of both areas A and B are not congruent and parallel, but exhibit an angle α between one another. Also, the longitudinal middle lines LM1 of the areas A and B do not lie on the middle line ML of the flow body 20.

Fig. 3 shows a view of the rudder blade 15 with flow body 20 with parts 50, 51 and 55. It should be noted that in an embodiment the areas A and B can be different so that the longitudinal middle lines LM1 breach the leading edge at LM1 and thus lie outside the middle line ML of the flow body 20. In another embodiment of the invention, not illustrated here, the upper area A can however also be identical to the lower area B, such that either the deviation of the longitudinal middle line LM1 to the middle line ML of the flow body 20 is the same and different at a zero angle, or can be equal to zero.

Fig. 8 and Fig. 9 in each case show a view of the rudder blade 15 from below or respectively from above. Evident in each case is the angle α between the longitudinal middle line LM1 of the rudder blade 15 and the middle line ML of the flow body 20.

Fig. 4 shows a rudder blade 15 with a flow body 20 in a side elevation from the rear left. Here, the areas A and B are apparent. In the rear area the areas A and B are identical, whereas in the frontal region they are designed different (see also Fig. 2).

Fig. 5 shows the rudder blade 15 in a view from behind and Fig. 7 shows a frontal view. In each case the flow body 20 can be clearly viewed.

Fig. 6 shows the inventive rudder blade 15 with the flow body 20, whereby the flow body has predetermined break-off sites for better self-destruction in the event of the effect of an impact or a blow or pressure. The prede-

terminated break-off sites are advantageously provided as predetermined break-off lines 40, and are distributed over the surface of the flow body. These are oriented advantageously in a longitudinal and/or transverse direction of the flow body 20. It is particularly advantageous here if the predetermined break-off sites are formed by material reduction or notching, therefore by shear lines. The predetermined break-off lines 40 are advantageously distributed reticulated over the surface of the flow body 20.

As per Fig. 8 and Fig. 9 the rudder blade 15 has a cross-sectional area 16, the longitudinal middle line LM1 of which is offset at an angle α to the middle line ML of the flow body 20, so that the leading edge stringer strip 70 of the rudder blade 15 facing the drive propeller 12 comes to rest outside the middle line ML of the flow body 20.

The flow body 20 advantageously comprises metal. Though in another embodiment it can also be formed out of a non-metallic material, such as a carbon fibre composite material preferably with embedded carbon fibres, graphite fibres and/or fibreglass. A metal-non-metal mixture can also be employed.

In another embodiment the flow body 20 can also be made of synthetic material or synthetic materials. POM synthetics can be used in this case, such as polyoxymethylene, polyformaldehyde or polyacetates. These materials typically have a high gliding quality, which is advantageous for friction in water.

The inventive rudder blade 15 with the flow body 20 is used advantageously in fully suspended rudders.

It is also effective if the flow body 20 is integrated in the rudder blade 15 or the flow body 20 is attached half and half for example on both sides of the rudder blade 15.

As is evident in Fig. 2, 3 and 4, the leading edge stringer strips 70, 71 of both superposed rudder blade regions A and B facing the propeller 12 are offset to one another such that the leading edge stringer strip 70 of the upper rudder blade region A is offset to the port side P and the leading edge stringer strip 71 is offset to the to the starboard side S, whereby the reverse offsetting is also possible. The outer wall faces 15a, 15b of the rudder blade 15 are united in an end strip 75 averted from the propeller 12 (twisted rudder).

By the leading edge stringer strip 70, 71 of both rudder blade regions A and B being offset to one another, so that the leading edge stringer strip of the upper rudder blade section is offset to the port side and the leading edge stringer strip of the lower rudder blade section is offset to the starboard side or the leading edge stringer strip of the upper rudder blade section is offset to the starboard side and the leading edge stringer strip of the lower rudder blade section is offset to the port side, in each case resulting in two mirror-inverted cross-sectional profiles of both rudder blade regions.

The advantage of such a rudder blade 15 designed according to the invention having two mirror-inverted cross-sectional profiles is first that it prevents vapour lock and it also prevents erosion phenomena on the rudder, occurring through cavitation in fast ships with high-load propellers. The special configuration of the rudder blade contributes to a drop in fuel consumption. There is an improvement in efficiency, in addition to considerable cavitation protection. There is also substantial economising in weight.

Claims

1. A rudder for ships, comprising a rudder blade (15), to which is assigned a propeller (12) arranged on a driven propulsion axis, whereby a flow body (20) is arranged on the rudder blade (15), which is designed bulb-shaped or zeppelin-shaped and is arranged as an extension of the propulsion axis in the region of the rudder blade (15),
characterised in that
the flow body (20) is designed to be self-destructive or self-releasing in the event of an increase in the effect of force, blow, impact or pressure.
2. The rudder as claimed in Claim 1,
characterised in that
the flow body (20) divides the rudder blade (15), viewed in the direction of height, into two areas (A and B), whereby both areas (A and B) are identical or non-identical in profile.
3. The rudder as claimed in Claim 1 or 2,
characterised in that
the longitudinal middle lines (LM1) of the areas (A and B) of the rudder blade (15) do not match the middle lines (ML) of the flow body (20) or respectively deviate from one another and form an angle α .
4. The rudder as claimed in Claim 3,
characterised in that
the angle α between the longitudinal middle line (LM1) of a region (A, B) of the rudder blade (15) is different and the middle line (ML) of the flow body (20) for both areas (A, B) is different.

5. The rudder as claimed in any one of Claims 1 to 4, characterised in that
in forming individual wall sections (30) the wall (25) of the flow body (20) has predetermined break-off lines or respectively predetermined break-off sites (40), which in the event of an increase in the effect of force, blow, impact or pressure leads to destruction of the flow body (20) and which are designed as material weaknesses, material reductions, shear lines or perforations.
6. The rudder as claimed in any one of Claims 1 to 5, characterised in that
the predetermined break-off lines (40) are designed running in a longitudinal direction and/or transversely to the longitudinal direction of the flow body (20) in the wall of the flow body (20), whereby the predetermined break-off lines (40) can also be irregular.
7. The rudder as claimed in any one of Claims 1 to 6, characterised in that
the predetermined break-off lines (40) are distributed reticulated over the flow body (20).
8. The rudder as claimed in any one of Claims 1 to 7, characterised in that
the flow body (20) comprises two individual bowl-shaped longitudinal bodies (50, 51), conforming to the flow body, which are held in the region of their longitudinal edges (50a, 51a) by predetermined break-off lines (40) on the outer wall faces (15a, 15b) of the rudder blade (15), whereby the edge regions (50b, 51b) of both bowl-shaped longitudinal bodies (50, 51) facing the propeller (12) are connected by predetermined break-off lines (40) to a spherical cap-shaped component (55), which is connected solidly or detachably to the rudder blade (15).

9. The rudder as claimed in any one of Claims 1 to 8,
characterised in that
the rudder blade (15) has a cross-sectional area (16), whereof the longitudinal middle line (LM1) is offset at an angle α to the middle line (ML) of the flow body (20), so that the leading edge stringer strip (70; 71) of the rudder blade (15) facing the drive propeller (12) comes to rest outside the middle line (ML) of the flow body (20).
10. The rudder as claimed in any one of Claims 1 to 9,
characterised in that
the flow body (20) and its components (50, 51) comprise metallic or non-metallic materials such as carbon fibre composite materials, or fibre composite materials with embedded graphite fibres or fibre-glass, a metal-non-metal mixture, a synthetic material.
11. The rudder as claimed in any one of Claims 1 to 10,
characterised in that
the flow body (20) comprises POM synthetic, such as polyoxymethylene, polyformaldehyde or polyacetates.
12. The rudder as claimed in any one of Claims 1 to 11,
characterised in that
the leading edge stringer strips (70, 71) of both superposed rudder blade regions (A and B) facing the propeller (12) are offset to one another such that the leading edge stringer strip (70) of the upper rudder blade region (A) is offset to the port side (P) and the leading edge stringer strip (71) is offset to the starboard side (S), or also vice versa, whereby the outer wall faces (15a, 15b) of the rudder blade (15) are joined in an end strip (75) averted from the propeller (12).