

- [54] **METHOD OF CORRECTING A
NUMBER OF REVOLUTION OF A
SCREW PROPELLER**
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51/281, 416/223
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- [58] Field of Search**29/156.8 B, 156.8 P, 156.8 H,**
29/156.8 R, 401; 416/223; 51/100 R, 281 R

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[57] **ABSTRACT**
A method of adjusting the number of revolutions of a screw propeller having the steps of cutting the trailing edge of each blade of the propeller from and along the trailing edge, and working and shaping the face of the blade to a curvature to provide a proper setback.

1 Claim, 5 Drawing Figures

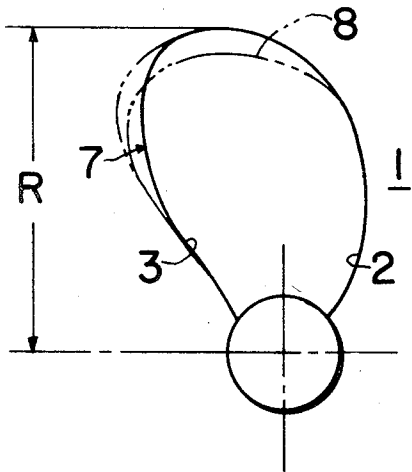


FIG. 1A

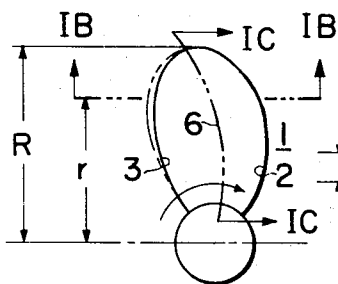


FIG. 1B

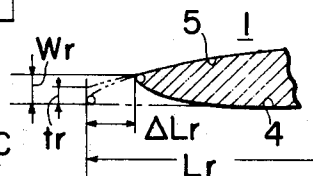


FIG. 1C

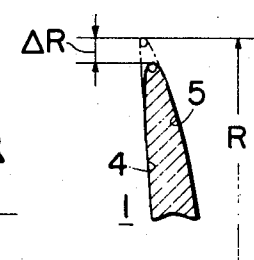


FIG. 2

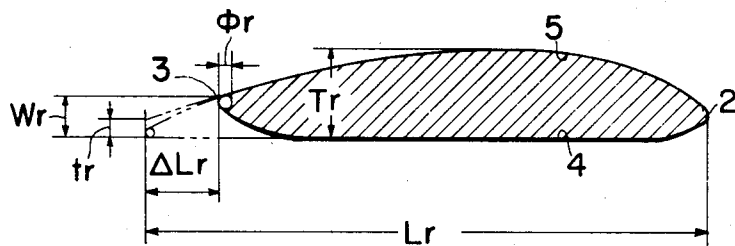
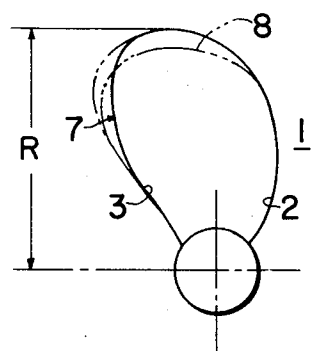


FIG. 3



METHOD OF CORRECTING A NUMBER OF REVOLUTION OF A SCREW PROPELLER

BACKGROUND OF THE INVENTION

This invention relates to a method of adjusting the number of revolutions of a screw propeller, and more particularly to a method of increasing the number of revolutions of a fixed pitch screw propeller mounted on a vessel.

It is known that a fixed pitch screw propeller mounted on a vessel tends to twist more or less after several years in service. This is so-called a "torquerich" which is caused both by the increase of a hull frictional resistance due to the fouling of the surface of the shell of the vessel under water and by the increase of the propeller torque due to the fouling of the surface of the propeller, and it means that in order to maintain a predetermined number of revolutions of the propeller, the vessel is required to have a main engine having a larger torque than initially required or in other words, a power.

This phenomenon of "torquerich" is not related to the type of main engine and it tends to occur in a vessel having a fixed pitch screw propeller. When the "torquerich" occurs in a vessel, particularly in a vessel having a diesel engine, the mean effective pressure of the main engine and exhaust temperature are increased so that it tends to introduce an overload state. Therefore, in order to prevent it, the output of the engine must be reduced with the result that a sustained sea speed is reduced.

In order to avoid such disadvantages of the operation of the propeller, the tip of the propeller blade has heretofore been cut so as to shorten the diameter of the propeller or the propeller has been mechanically torqued in high temperature so as to reduce the pitch of the propeller.

Upon occurrence of the "torquerich", the torque of the engine is generally decreased to approximately 3-4 percent of the initial torque of the engine in 3-4 years, and the required amount of adjusting to increase the number of revolutions is more or less 3-4 rpm.

In order to accomplish a desired adjusting of a propeller used for 3-4 years and subject to torquerich, a large amount of the tip of the propeller blade must be cut and a large amount of shaping must be done by the former method as will hereinafter be described, so that large number of steps must be accomplished and yet unfavorable cavitation will occur due to the decrease of the area of the blade, and the efficiency of the screw propeller is also decreased, with the result that even though the number of revolutions is corrected, the vessel speed will be considerably decreased.

The latter method is actually impossible to accomplish in the dock, and it not only requires much time and many days of working and considerable expense, but also introduces unsolved serious problems such as the effect of the residual stress due to the torsion working of the blade, and of the strength and materials.

SUMMARY OF THE INVENTION

This invention eliminates the aforementioned disadvantages of the conventional method for the correction of the "torquerich" of the propeller of the vessel, and provides a new and improved method of adjusting a number of revolutions of a screw propeller for over-

coming the deterioration of the performance of the propeller so that a small area of the trailing edge of the blade of the propeller may be cut, worked and shaped even though the vessel is afloat on the sea, with relatively less and easier steps so that the performance of the propeller is improved.

According to one aspect of the present invention, there is provided a method of adjusting a number of revolutions of a screw propeller, which comprises the steps of cutting each blade of the propeller a small amount from and along its trailing edge, and working and shaping the face of the blade to a curvature to provide a predetermined setback.

BRIEF DESCRIPTION OF THE DRAWINGS

FIGS. 1A, 1B and 1C are views of schematic shapes of fixed pitch screw propellers prior to the correction of the number of revolutions in accordance with this invention and after the correction thereof wherein FIG. 1A is a view of a blade configuration.

FIG. 1B is a sectional view of the blade in FIG. 1A taken along the line $a-a$ in the neighborhood of the trailing edge of the blade in FIG. 1A, and

FIG. 1C is a sectional view of the blade taken along the line $b-b$ in the neighborhood of the tip of the blade in FIG. 1A;

FIG. 2 is an enlarged sectional view of the blade for the explanatory purpose of actual examples of two vessels to which this invention is applied taken along the line $a-a$ in FIG. 1A; and

FIG. 3 is a view of a blade configuration in comparison of cutting range of the blade required for correcting the number of revolutions of the propeller according to the conventional method and the method of the present invention.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Reference is now made to FIGS. 1A, 1B and 1C, which show schematic shapes of fixed pitch screw propellers prior to the correction of number of revolutions in accordance with this invention and after the correction thereof.

A screw propeller 1 of a vessel comprises a radius R prior to the correction according to this invention, a leading edge 2 thereof, a trailing edge 3 thereof, a rear face 4 and a front face 5. Line $b-b$ designated by numeral 6 is a curve plotting the locations of the maximum thickness Tr of the blade 1 along a longitudinal curved section of the blade 1, and Lr is the disposition of the radius r (rSR) or the width of the section of the blade along the line $a-a$ in FIG. 1A.

As shown in FIG. 2, tr is an imagined thickness of the trailing edge of the blade 1 prior to the application of this invention. ΔLr depicts a distance from the trailing edge 3 of the blade 1 at the section of the radius r of the section line cut along the configuration of the blade on the basis of the present invention. Wr is an amount of a setback cut at the radius r and provided by working and shaping properly the proper curvature of the rear face 4 along the trailing edge of the blade of this invention after cutting as previously described.

An actual example will now be described for further clarifying the present invention with respect to actual vessels X and Y corrected according to this invention.

EXAMPLE

As seen in the following Table, radius, width, thickness of the blade of the propeller and the other items are already described heretofore and shown in FIGS. 1 and 2, but in the Table, the representative example of width, maximum thickness at the section of the blade at the disposition of radius r equal to $0.7R$, distance from the trailing edge of the section of the cut portion along the configuration of the trailing edge and setback formed at the trailing edge of a novel blade are shown.

Type	X Cargo of Wood (16,000 ton)	Y Cargo of Oil (100,00 ton)
Ship Length (Lpp) between perpendicular	136.0 m	245.0 m
Main Engine Type	Diesel	Turbine
Output $\times$ revolution (N) (M. C. R.)	7,500 ps $\times$ 135 rpm	24,000ps $\times$ 110 rpm
Screw Propeller Number of Blade	4	6
Radius (R)	2,500 mm	3,450 mm
Width (LO.7R)	1,459 mm	1,606 mm
Thickness (TO.7R)	74.2 mm	116.2 mm
Correction of required Number of Revolution (ΔN)	+4rpm	+3rpm
Ratio of Correction of Number of Revolution ($\Delta N/N \times 100$)	2.9%	2.7%
Setback of novel Trailing edge (WO.7R)	5.0 mm	6.6 mm
Width from Trailing edge to sectional line (LO.7R)	10 mm	15 mm

As seen from the above Table, in both vessels X and Y, the blade is cut at the sectional cut line 10–15 mm from the initial trailing edge corresponding to 0.7–0.9 percent of the width of the blade in the transverse direction of the blade at the disposition of, for example, $0.7R$ according to the present invention, and the rear face of the blade is worked to a proper curvature along the new trailing edge. A rear radial portion is provided at the cross point of the cutting line and the back face of the blade so that a setback of 5–6mm is provided, whereby the number of revolutions of the respective propellers of the main engine in output was increased by 3 percent required desirably.

If this was done by the conventional method of shortening the diameter, the tip of the blade must be cut at 175mm, 170mm from the top end or 350mm, 340mm of diameter or 7 percent, 5 percent of the original diameters and yet the configuration of the leading and trailing edges of the blade and face and back thereof must be worked and shaped into a fairly good curvature by many steps.

FIG. 3 shows a view of a blade configuration in comparison of cutting range of the blade required for correcting the number of revolutions of the propeller according to the conventional method and the method of the present invention, the former cutting line is designated by 7 and the latter cutting line is designated by 8, but it should be understood readily from the above description that it is possible to work and shape the face and back of the blade after cutting in substantially fewer steps by utilizing the present invention.

Though there are some differences in the extent of working, depending upon the type of the section of the blade or more particularly upon the thickness of the trailing edge in the neighborhood of the width ΔL 0.6–0.7R, or in many cases approximately 10–20mm to the cutting line or imagined thickness at the trailing edge of the section of the blade in the neighborhood of $0.6R$ – $0.7R$ or t 0.6– $0.7R$, generally the larger the cutting width from the trailing edge of the blade ΔL 0.6– $0.7R$, the greater the setback w 0.6– $0.7R$ becomes accordingly, thereby tending to increase the increasing rate of the number of revolutions of the propeller.

In order to accomplish the method of this invention, the setback amount w 0.6– $0.7R$ must first be found to be provided at the trailing edge of the cutting line of the blade at the disposition of $0.6R$ – $0.7R$ from a desired correction amount of the number of revolutions, on the basis of which the width ΔL 0.6– $0.7R$ to the cutting line along the trailing edge of the blade must then be determined. However, according to the experiments, as a required correction amount of the number of revolutions is expected from the previous Table, it is almost unrelated to the type, size of the vessel and output of the main engine. It should be normally 3–4rpm, and the maximum values of the width ΔLr , the cutting line along the trailing edge of the blade, and setback Wr to be provided at the face of the trailing edge should be approximately at 0.6– $0.7R$ of the section, and it is generally understood that the former be 10–20mm and the latter be 5–10mm as a standard value. And, even if the trailing edge from the neighborhood of $0.5R$ to the root of the blade is cut and worked, there are no additional advantages.

In order to accomplish the novel method, it comprises the steps of decreasing gradually the width ΔLr and accordingly, if necessary, ΔR and Wr to the amount of zero from the disposition of 0.6– $0.7R$ to $0.5R$ and in the neighborhood of the tip of the blade by giving proper values within the range with respect to L 0.6– $0.7R$ and W 0.6– $0.7R$ at the section of the disposition 0.6R– $0.7R$, cutting the blade configuration, and working and shaping the face and, if necessary, the back face to a proper curvature.

It should be understood from the foregoing description that according to the present invention, only small cutting, working and shaping of the configuration of the trailing edge of the blade from the disposition of generally $0.5R$ to the tip is necessary to increase the number of revolutions with respect to the output MCR of the main engine to a desired extent. In comparison with the conventional method, the method of the present invention is extremely simple and easy with the result that even if the vessel is afloat, the correction of the propeller is readily performed by less steps than the conventional method.

We claim:

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1. A method of adjusting the number of revolutions of a used, fixed pitch screw propeller of an ocean going marine vessel without removing the same from said vessel, said method comprising the steps of:
smoothly reducing the trailing edge only of each blade of the propeller, a predetermined amount, the maximum extent of reduction of said trailing edge at any one point along said edge being, in terms of blade width, between 0.7 to 0.9 percent,

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and
working and shaping the face of the blade along said trailing edge to a predetermined curvature providing a setback from the trailing edge of which the maximum extent of the same at any one point along said trailing edge, in terms of blade length, is between 0.6 to 0.7 percent.

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