1,019,233

PATENT SPECIFICATION

DRAWINGS ATTACHED

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COMPLETE SPECIFICATION

Blade Wheel Propeller for Ships

We, J. M. VOITH G.m.b.H., of Heidenheim (Brenz), Germany, a German Company, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to a blade wheel propeller for a ship, comprising a rotatably mounted blade wheel to which are pivoted a number of blades evenly distributed about a circular orbit concentric with the axis of rotation of the blade wheel with their pivot axes at least approximately parallel to the axis of rotation of the blade wheel. In such propellers, the attitude of each blade is continuously regulated by a central control member, such as a control plate, common to all the blades, to which each blade is connected by a blade lever system, the control member being actuable from outside the propeller. When the control member is in a position concentric to the axis of rotation of the blade wheel, all the blades are in a position tangential to the circular orbit, i.e. a chord of the cross-section of each blade touches that orbit. However, when the control member is in a position eccentric to the axis of rotation of the blade wheel, each blade is in a position tangential to the orbit (the so-called tangential position) only when passing a diameter of the orbit normal to the direction of the propeller thrust. Each blade lever system comprises a blade lever rigidly connected with the respective blade, e.g. fastened to the blade pivot, and a double-arm lever linked to the blade wheel by a pivot and having one arm linked to the blade lever by a coupling rod and the other arm linked to the control member.

In ships with more than one blade wheel propeller, for instance with two adjacent and simultaneously driven blade wheel propellers, it is necessary when travelling straight ahead to have two propellers in each case rotating in the opposite direction, for torque compensation. This however, has the disadvantage, when the known blade lever system (for example, the so-called sliding guide lever systems described in British Patent specification No. 501,467, in which said other arm of the double-arm lever is slidably guided in a crosshead rotatably mounted on the control member, or the so-called arcuately moving crank lever system described in British Patent Specification No. 811,538, in which said other arm of the double-arm lever is pivotally connected to the control member and the double-arm lever is pivoted to a link in turn pivoted to the blade wheel) is used, that the blade wheel and blade lever system for a propeller rotating clockwise, have to be constructed differently from those for a propeller rotating counter-clockwise. As a result of this, different working drawings, different models, attachments etc., have to be made for each of these two propellers, which makes it considerably more expensive to manufacture and keep stocks of the propellers.

This invention consists in a blade wheel propeller for a ship comprising a rotatably mounted blade wheel to which are pivoted a number of blades evenly distributed about a circular orbit concentric with the axis of rotation of the blade wheel with their pivot axes at least approximately parallel to the axis of rotation of the blade wheel, each blade being connected to a central control member common to all the blades by a blade lever system, the central control member being actuable from outside the propeller, and each blade lever system comprising a blade lever rigidly connected with the respective blade and a double-arm lever linked to the blade wheel by a pivot and having one arm linked to the blade lever by a coupling rod and the other arm linked to the control member, the axis of the pivot linking the double-arm lever to the blade wheel being at least approximately parallel to the axis of rotation of the blade wheel, the axis of the pivot linking the double-arm lever to the blade wheel intersecting a radius normal to the axis of rotation of the blade wheel and in turn intersecting the pivot axis of the respective blade, and said one arm of the double arm lever lying along a line making an angle other than 90° with said radius when the control member is in its centre position. The axis of the pivot linking the pivot linking the double-arm lever to the blade wheel preferably lies in a radial plane containing the axis of rotation and the pivot axis of the respective blade when the control member is in its centre position.

This construction of the blade lever system makes it possible to manufacture the blade wheel members for both a clockwise and an anti-clockwise propeller in an identical manner, so that not two but one blade wheel member has to be designed and only one supplementary unit need be prepared for the manufacture of each propeller.

It is considerably simpler to keep stocks and obtain spare parts, so that manufacturing and stocking parts are kept down.

If the blade lever system is constructed as a sliding guide lever system, it may be such that when the control member is in its centre position (in which all the blades are tangential to the blade orbit), that arm of the double-arm lever which engages the control plate makes an angle of approximately 10° with said radius, and that the arms of the double-arm are arranged on the same side of said radius. Furthermore, the sliding guide lever system may be so constructed that the double-arm lever's arms include an angle of approximately 100° so that the sliding arm of the double-arm lever either lies in the radial plane containing said radius or makes an angle of about 10° with the radius and is at the same time arranged on the same side of the radius as the first arm.

Where arcuately moving crank lever systems, are used, the blade lever system may be such that the arms of the double-arm lever, which is articulated to the blade wheel by means of a link, include an angle of approximately 170° on the side of the pivot between the link and the blade wheel. Furthermore, the ratio of the length of the lever arm engaging the control plate to the length of the lever arm engaging the coupling rod may here be approximately 1.2:1. (Such a ratio of the arms of the double-arm lever is also an advantage in a blade lever system with a straight double-arm lever).

Such suitable selection of the angles and/or of the lengths of the arms of the double-arm lever makes it possible to set the pitch of the blades at more favourable values than in the known types of blade lever systems, and consequently to obtain greater propeller efficiency than hitherto. Moreover, this construction of the blade lever system means that the moments acting on the control plate, which change several times from positive to negative maximum values at every revolution of the blade wheel when the control centre travels out of its central position, becomes approximately of equal size, and thus that the maximum values of the forces passing backwards and forwards in the individual joints of the lever systems are reduced and at the same time lubrication is improved.

Embodiments of the invention will now be described, by way of example only, with reference to the accompanying drawings. In these:—

Figures 1, 2 and 3 are schematic plan views of embodiments constructed as sliding guide lever systems; and

Figures 1*a*, 2*a* and 3*a* are schematic plan views of embodiments built as, articulately moving crank lever systems.

Parts corresponding to each other are designated by the same reference numerals.

The blade wheel propeller shown in each Figure of the drawings has a blade wheel 1 on which four blades 2 are pivotally mounted, the blades 2 being evenly distributed around a circular orbit 9 concentric with the axis of rotation 11 of the blade wheel 1. A control plate 3, actuable from outside the propeller and common to all the blades 2, and four blade lever systems (one for each blade) are provided, but for clarity, only one blade lever system is shown in each Figure; in addition, the control plate is shown in its centre position with all the blades 2 in positions tangential to the orbit 9. In these tangential positions, chords 13 of the blades 2 are tangent to the orbit 9.

In Figures 1, 2 or 3, each blade lever system has a crosshead 4 rotatably mounted on the control plate 3; a double-arm lever 7 has one of its arms slidably mounted in the crosshead 4 and the other arm linked to a blade lever 8 by a coupling rod 5, and is pivotably mounted on the blade wheel by means of a pivot pin 6. The axis of the pivot pin 6 fastened to the blade wheel 1 lies in a radial plane 10 containing the axis of rotation 11 of the blade wheel 1 and the pivot axis 12 of the relevant blade 2.

At every rotation of the blade wheel 1, a controlled oscillating motion about the tangential position is imparted to the blade 2 by means of the blade lever system and the control plate 3 when the plate 3 is displaced out of the middle centre position by, for instance, a control stick (not shown) engaging the centre of the plate 3.

To give better adjustment of the angles between the chord 13 of the blade 2 and the tangent to the blade orbit 9, that is, to give a good shape to what is known as the angle curve of the blade and thus to obtain high propeller efficiency, and also for the sake of better lubrication of the individual joints of the blade lever system, the arrangement of the embodiment shown in Figure 1, which is constructed like a sliding guide lever system, is such that that arm of the right-angled double-arm lever 7 which engages the control plate 3 is, in the centre position of the control plate 3, inclined relative to the radial plane 10 about an angle of approximately 10°, and the two lever arms lie on the same side of the radial plane.

In the embodiment shown in Figure 2, the two arms of the double-arm lever 7 include an angle of about 100°, and the double-arm lever's arm engaging the control plate 3 lies in the radial plane 10 when the control plate 3 is in the centre position.

In the embodiment shown in Figure 3, the angle included by the two arms of the double-arm lever 7 is about 100°, and the arm engaging the control plate 3 is inclined about an angle of approximately 10° towards the radial plane 10 in the centre position of the control plate 3, both arms again lying on the same side of the radial plane.

Figures 1*a*, 2*a* and 3*a* show arcuately moving crank lever systems in which the double-arm lever 7*a* is connected to the pivot pin 6 by a link 7*b*.

For high efficiency and good lubrication in the different joints of the arcuately moving crank lever systems, the double-arm lever 7*a* in the embodiment shown in Figure 1*a* is constructed so that its lever arms, which are of equal lengths, include, on the side of the link 7*b*, an angle of about 170°. In the embodiment shown in Figure 2*a*, the ratio of the length of the double-arm lever 7*a*'s arm *b*, engaging the control plate 3*a*, to the length of the arm *a*, engaging the coupling rod 5, is approximately 1.2:1, and the arms are straight (included angle is 180°). The pivot of the crosshead 4 and the centre of the control plate 3 coincide. In the embodiment shown in Figure 3*a*, the ratio of the arms is approximately 1.2:1, and they include, on the side of the link 7*b*, an angle of 170°.

WHAT WE CLAIM IS:—

1. A blade wheel propeller for a ship, comprising a rotatably mounted blade wheel to which are pivoted a number of blades evenly distributed about a circular orbit concentric with the axis of rotation of the blade wheel with their pivot axes at least approximately parallel to the axis of rotation of the blade wheel, each blade being connected to a central control member common to all the blades by a blade lever system, the central control member being actuable from outside the propeller, and each blade lever system comprising a blade lever rigidly connected with the respective blade and a double-arm lever linked to the blade wheel by a pivot and having one arm linked to the blade lever by a coupling rod and the other arm linked to the control member, the axis of the pivot linking the double-arm lever to the blade wheel being at least approximately parallel to the axis of rotation of the blade wheel, the axis of the pivot linking the double-arm lever to the blade wheel intersecting a radius normal to the axis of rotation of the blade wheel and in turn intersecting the pivot axis of the respective blade, and said one arm of the double-arm lever lying along a line making an angle other than 90° with said radius when the control member is in its centre position.

2. A propeller as claimed in claim 1, wherein said other arm of the double-arm lever is slidably guided in a crosshead rotatably mounted on the control member, and makes an angle of approximately 10° with said radius when the control member is in its centre position, with both arms of the double-arm lever lying on the same side of said radius.

3. A propeller as claimed in either claim 1 or claim 2, wherein said other arm of the double-arm lever is slidably guided in a crosshead rotatably mounted on the control member, the arms of the double-arm lever including an angle of approximately 100° and arranged such that both arms lie on the same side of said radius when the control member is in its centre position.

4. A propeller as claimed in claim 1, wherein said other arm of the double-arm lever is pivotally connected to the control member and the double-arm lever is pivoted to a link in turn pivoted to the blade wheel.

5. A propeller as claimed in either claim 1 or claim 4, wherein said other arm of the double-arm lever is pivotally connected to the control member and the double-arm lever is pivoted to a link in turn pivoted to the blade wheel, the arms of the double-arm lever including an angle of approximately 170° on the side of the pivot between the link and the blade wheel, and the ratio of the length of said other arm to the length of said one arm being about 1.2:1.

6. A blade wheel propeller for a ship, substantially as herein described with reference to, and as shown in, Figure 1 of the accompanying drawings.

7. A blade wheel propeller for a ship, substantially as herein described with reference to, and as shown in Figure 2 of the accompanying drawings.

8. A blade wheel propeller for a ship, substantially as herein described with reference to, and as shown in Figure 3 of the accompanying drawings.

9. A blade wheel propeller for a ship, sub-

stantially as herein described with reference to, and as shown in, Figure 1*a* of the accompanying drawings.

10. A blade wheel propeller for a ship substantially as herein described with reference to, and as shown in, Figure 2*a* of the accompanying drawings.

11. A blade propeller for a ship, substantially as herein described with reference to, and as shown in, Figure 3*a* of the accompanying drawings.

12. A ship having two adjacent and simultaneously driven blade wheel propellers as claimed in any one of the preceding claims, arranged to rotate in opposite directions.

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Agents for the Applicant(s).

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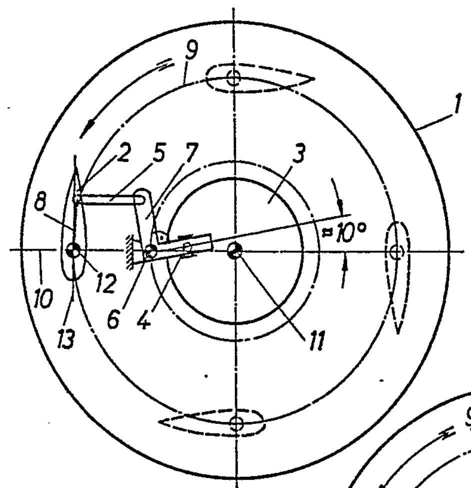

Fig. 1

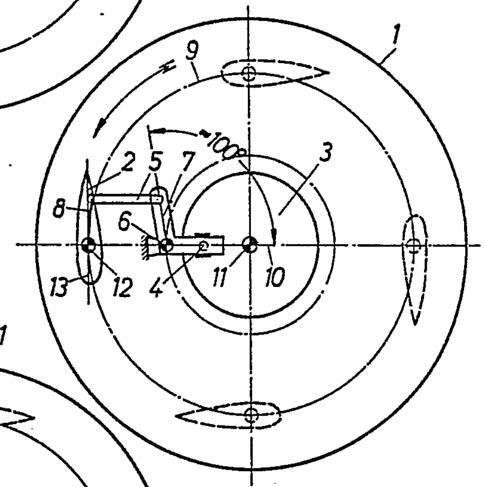

Fig. 2

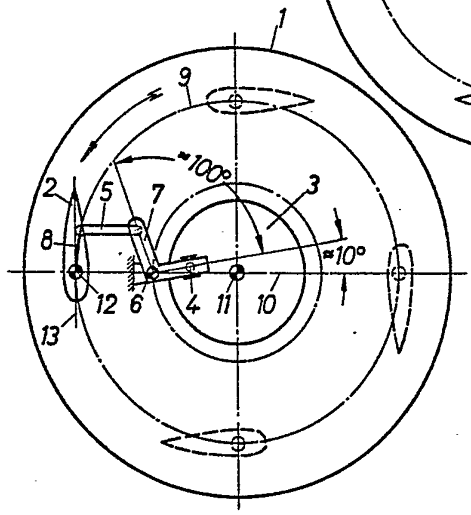

Fig. 3

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2 SHEETS *This drawing is a reproduction of the Original on a reduced scale*

Sheets 1 & 2

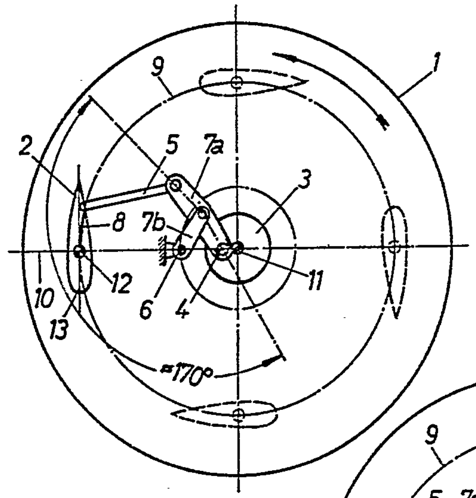
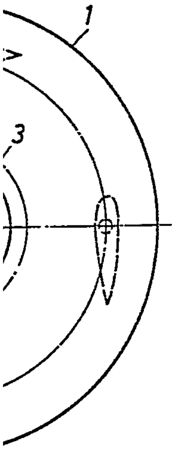


Fig.1a



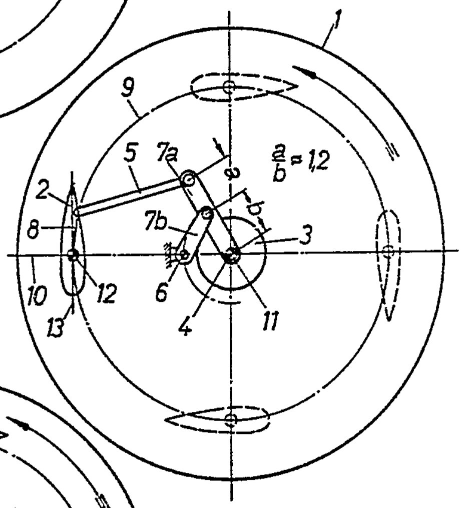


Fig.2a

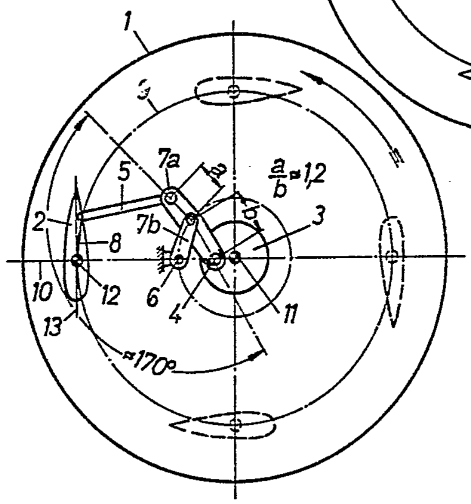


Fig.3a

1019233 COMPLETE SPECIFICATION

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Sheets 1 & 2

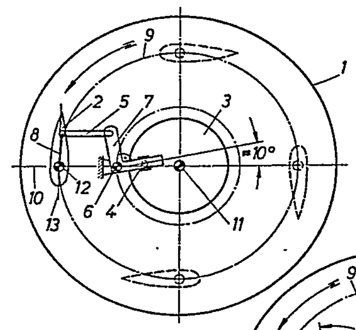

Fig. 1

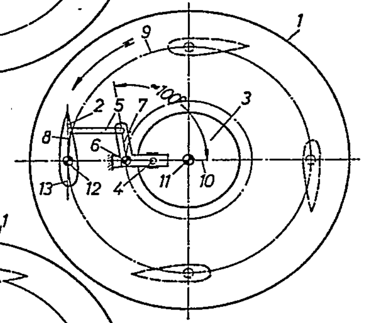

Fig. 2

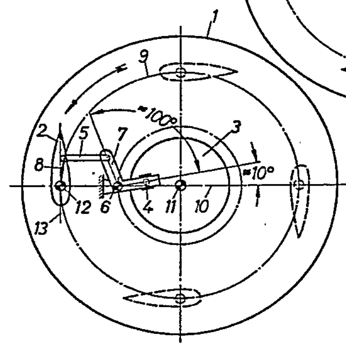

Fig. 3

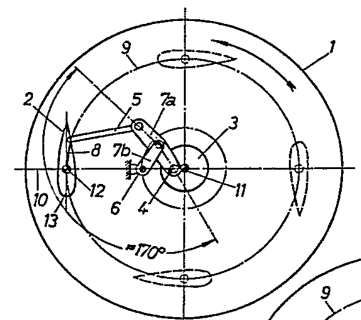

Fig. 1a

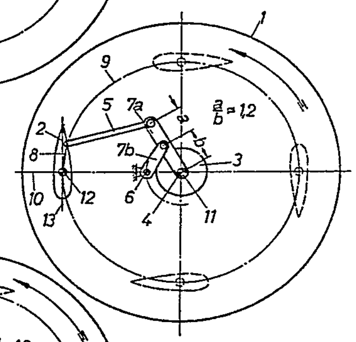

Fig. 2a

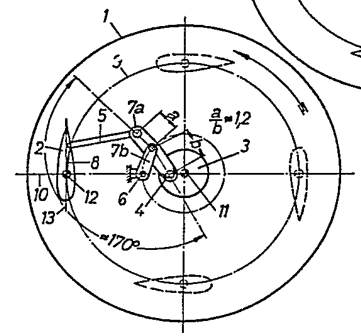

Fig. 3a