A variable-pitch propeller having feathering blades.

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Description

The present invention relates to a propeller having adjustable (or variable-pitch) feathering blades, particularly for use in sail boats, such as in the first part of claim 1. Such a propeller is known from US-A-4140434.

Propellers of the above type have already been known in the art and in these propellers the collapsible character of the blades is necessary in order to reduce as much as possible the resistance thereof to the boat moving forward when said boat is pushed by other propulsory means such as, in this case, the sails. In addition, the possibility of varying the blade orientation, that is the propeller pitch is an essential feature for optimizing the propeller efficiency, based on the mechanical characteristics of the propulsor used and the hydrodynamic characteristics of the boat.

Therefore in propellers of this type there is the presence of means enabling the blades to be automatically adjusted to the previously set correct positions for the two directions of rotation of the propulsor's drive shaft corresponding to the forward and reverse speed respectively.

These known propellers usually comprise a hub fixedly mounted to the end of the drive shaft and externally carrying a bevel pinion with which respective bevel pinions mesh, the axes of which are perpendicular to the hub axis and which are provided at the end of the propeller blades and surrounded by a multi-section shell covering the hub.

The hub can freely rotate within said shell making the blades rotate about their own axes in either direction through a given predetermined angle, and is subsequently brought into engagement with the outer shell driving it in rotation integrally therewith. The stroke stops disposed between the hub and the shell therefore define the orientation of the blades, that is the propeller pitch in the two directions of rotation of the drive shaft corresponding to the boat movements.

In some propellers of the above type the stroke stops disposed between the hub and the outer shell cannot be modified and consequently they do not enable the propeller to be adapted to different propulsors and/or boats.

In other known propellers it is possible to modify the angular positions of said stroke stops and, as a result, the propeller pitch, but in this case it is necessary to resort to the propeller dismantling and remounting, which needs the boat to be beached.

In addition, also available are variable-pitch propellers having collapsible blades, in which the propeller pitch can be modified without resorting to the complete dismantling thereof and therefore without being obliged to beach the boat.

For example the Italian Patent Application No. 83647-A/87 filed on August 11, 1987 describes a variable-pitch propeller having collapsible blades, in which the propeller pitch can be modified by acting on the end of a rod issuing from the ogive-shaped end portion of the propeller and connected, at the other end thereof, to the hub fitted to the drive shaft.

Such an embodiment is rather complicated and a great number of components are required so that the adjustment of the propeller pitch may be carried out. In addition, in this embodiment the outer shell covering the hub consists of longitudinal sectors to be coupled and fixed by means of tangentially-disposed screws. Such a conformation of the shell in the long run can give rise to breaks or at least untightenings involving infiltrations that may be damaging for a good operation of the propeller.

The object of the present invention is to provide a variable-pitch propeller having collapsible blades, in which the propeller pitch can be adjusted from the outside, said propeller also being of compact and easy construction from a mechanical point of view, having a reduced weight and allowing the propeller pitch to be adjusted in a very simple manner.

The above object is attained by the inventive variable-pitch propeller having feathering blades, as described in the appended claim 1.

In particular, the hub-covering shell is formed of two circumferential portions having opposite semicircular housings for receiving the pinion shanks of the blades. Fastened to a front portion of said shell is the ogive-shaped point of the propeller, while a rear portion of the shell carries an outer circumferential toothing meshing with a corresponding toothing belonging to an adjusting element axially movable relative to said rear portion by untightening the securing screws.

Further features and advantages of the invention will become more apparent from the following detailed description of a preferred embodiment given by way of non-limiting example with reference to the accompanying drawings, in which:

- fig. 1 is a partly longitudinal sectional view of a variable-pitch propeller having collapsible blades in accordance with the invention;
- Fig. 2 shows a section taken along line A-A in Fig. 1; and
- Fig. 3 is a sectional view taken along line B-B in Fig. 1.

Referring to the drawings, reference numeral 1 generally denotes a variable-pitch propeller having feathering blades, in accordance with the invention. It comprises a hub 2 fitted by a key 3 for example, to the conical end 4 of a drive shaft 5. The shaft 5 projects beyond the hub 2 by a threaded extension 6 on which a stop nut 7 is screwed.

Provided on the hub 2 is a bevel toothing 8 meshing with bevel pinions 9 provided at the base of respective blades 10, three in number for example, dis-
posed circumferentially and spaced apart from one another through 120°.

The blades 10 are held in place by a shell embracing the hub 2 and consisting of two shell halves or annular portions 11 and 12 which, when coupled to each other, define holes 13 for respectively receiving the short cylindrical shanks 14 of the blade pinions 9. In this way the blades 10 can rotate about their own axes within the shell holes 13, the bevel pinions 9 meshing with the bevel pinion 8 of the hub.

The two shell halves 11 and 12 are fastened to each other by axial screws 15. Secured to the front or outer shell half 11, still by means of axial screws 17, is an ogive-shaped end portion 16 upon interposition of a lock nut 18 between said shell half 11 and the stop nut 7 of the hub 2.

Secured to the rear or inner shell half 12 by a gear coupling 19 and axial securing screws 20 is an adjusting element 21 fitted to the hub 2. A flange 22 designed to axially lock the hub 2 is screwed to the inner end of the adjusting element 21.

The rotary motion of the hub 2 is transmitted to the inner shell 12 and therefore to the propeller blades 10 by a circular sector or tooth 23 projecting outwardly from the hub outline, as more clearly shown in Fig. 3, and engaging with a corresponding circular sector or tooth 24 projecting inwardly from the adjusting element 21 (Fig. 3).

In the position shown in Fig. 3 the two circular sectors 23 and 24 are in abutment against each other so that a clockwise rotation of the drive shaft 5 and therefore the hub 2 corresponding to the forward speed of the boat for example, produces a rotation in the same way of the adjusting element 21 and consequently of the shells 11, 12 and the propeller blades 10. The position of sector 23 shown in Fig. 3 corresponds to a given orientation of the blades 10, that is to the optimal propeller pitch for a forward speed.

When the drive shaft 5 rotates in the opposite way, that is carries out a counter-clockwise rotation with reference to Fig. 3, the bevel pinion 8 of the hub 2 will cause the blades 10 to rotate through a given angle, meshing with the corresponding bevel pinions 9 so that they will take the optimal orientation for a reverse speed at the time that sector 23 comes in abutment with sector 24 on the opposite side with respect to the one shown in Fig. 3, thereby dragging along in rotation the outer shell and consequently the propeller blades 10.

When there is no propulsion on propeller 1, that is when the drive shaft 5 idles and therefore rotates freely, for example when the boat is sail pushed, upon the action of a hydraulic thrust the blades 10 will take the position of minimum resistance rotating about their own axes and also causing the hub 2 to rotate by meshing of pinions 9 with the hub pinion.

The flattened position of the blades 10 approximately corresponds to the median position relative to the two limit positions for the forward and reserve speeds, determined by the angular position of sectors 23 and 24.

In order to vary the propeller pitch, that is the position of blades 10 in the conditions of forward and reverse speed, in accordance with the invention, it is sufficient to loosen the screws 20 that fasten the adjusting element 21 to the inner shell half 12, so that toothings 19 between said elements can be disengaged and element 21 can be rotated through the desired angle, which brings about the angular displacement of the circular sector 24 and therefore enables the position of end of stroke of sector 23 to be modified.

The rotation of the adjusting element 21 is permitted due to the fact that the securing screws 20 are housed in slots 25 of circular sector outline provided in the element 21. When the adjustment has been completed toothings 19 are brought into engagement again and screws 20 are tightened.

It is to be noted that the threaded portions of the screws 20 engaged with the inner shell half 12 have a longitudinal dimension greater than the longitudinal dimensions of the toothings 19. From what said above, it is possible to disengage the toothings 19 without requiring the complete removal of the screws 20 and of the adjusting element 21, but just by means of a partial loosening of the screws themselves.

From the foregoing it appears that the propeller of the invention enables the pitch to be easily modified without resorting to the dismantling thereof and therefore without being obliged to beach the boat, by means of very simple and quick operations carried out directly on the adjusting element 21.

Obviously the invention is not limited to the embodiment described and shown in the drawings and modifications and variations can be made without departing from the scope of the invention as defined in the appended claims.

Claims

1. A variable pitch-propeller having feathering blades, comprising:
   - a hub (2) fitted on a drive shaft (5) of a propulsive means;
   - a shell (11, 12) rotatably embracing the hub (2);
   - propeller blades (10) mounted rotatably about their own axes through respective holes (13) defined by the shell (11, 12);
   - a bevel toothing (8) provided on the hub (2) and meshing with bevel pinions (9) carried by each of said propeller blades (10);
   - an adjusting element (21) rotatably engaged on the hub (2);
   - a first circular sector (23) connected to and
projecting outwardly from the hub (2);
- a second circular sector (24) projecting inwardly from the adjusting element (21) and designed to engage the first circular sector (23) to transmit a rotatory motion from the hub (2) to the shell (11, 12);
- a gear coupling having mating toothing (19) carried respectively by a rear shell half (12) of the shell (11, 12) and the adjusting element (20) and meshing together to couple the shell (11, 12) and the adjusting element (21);
characterized in that it comprises:
- axial securing screws housed in slots (25) of circular sector outline formed in said adjusting element (21) and engaging said rear shell half (12) by threaded portions to lock axial movement of the adjusting element (21), said threaded portions of the screws (20) having a longitudinal dimension greater than the longitudinal dimension of said mating toothing, and said axial screws (20) being looseable to allow reciprocal disengagement of the mating toothing (19) and rotation of the adjusting element (21) with respect to the shell (11, 12).

2. The propeller as claimed in claim 1, characterized in that said shell is comprised of a front shell half (11) and a rear shell half (12) to be axially fixed to each other by means of screws (15).

3. The propeller as claimed in claim 2, characterized in that said annular shell halves (11, 12) are provided with semicircular opposite housings which on coupling will define holes (13) for receiving the respective shanks (14) of the blade bevel pinions (9).

4. The propeller as claimed in claim 2, characterized in that an ogive-shaped end portion is fastened to a front portion of the front shell half (11) by means of screws (17).

Patentansprüche

1. Drehflügelschraube mit umlegbaren Flügeln, umfassend:
- eine mit einer Antriebswelle (5) eines Antriebsmittels fest verbundenen Nabe (2);
- eine die Nabe (2) drehbar umgreifende Schale (11, 12);
- Schraubenflügel (10), die drehbar um die eigenen Achsen durch jeweilige durch die Schale (11, 12) festgelegte Bohrungen (13) angebracht sind;
- ein Kegelrad (8), das an der Nabe (2) vor- gesehen ist und mit von jedem der Schraubenflügel (10) getragenen Kegelräder (9) kämmt;
- ein drehbar mit der Nabe (2) in Eingriff stehendes Einstellelement (21);
- einen ersten Kreissektor (23), der mit der Nabe (2) verbunden ist und von dieser nach außen vorsteht;
- einen zweiten Kreissektor (24), der vom Einstelligglied (21) nach innen vorsteht und dazu bestimmt ist, den ersten Kreissektor (23) zur Übertragung einer Drehbewegung von der Nabe (2) an die Schale (11, 12) zu ergreifen;
- eine Zahnverbindung mit komplementären Verzahnungen (19), die jeweils von einer hintere Halbschale (12) der Schale (11, 12) und vom Einstelligglied (20) getragen werden und miteinander kämmt, um die Schale (11, 12) und das Einstelligglied (21) miteinander zu koppeln, dadurch gekennzeichnet, daß sie:
- axiale Befestigungsschrauben umfaßt, die in im Einstelligglied (21) mit Kreissektorprofil ausgebildeten Langlöchern (25) aufgenommen sind und die hintere Halbschale (12) mit Schraubteilen zur Feststellung der axialen Bewegung des Einstellelementes (21) ergreifen, wobei die Schraubteile der Schrauben (20) ein größeres Längsmäß gegenüber dem Längsmäß der komplementären Verzahnungen aufweist, und wobei die axialen Schrauben (20) entspannbar sind, um die gegenseitige Lösung der komplementären Verzahnungen (19) und die Verschwenkung des Einstelliglidades (21) gegenüber der Schale (11, 12) zu erlauben.

2. Schraube nach Anspruch 1, dadurch gekennzeichnet, daß die Schale eine Vorderhalbschale (11) und eine Hinterhalbschale (12) umfaßt, die dazu bestimmt sind, miteinander durch Schrauben (15) festgelegt zu werden.

3. Schraube nach Anspruch 2, dadurch gekennzeichnet, daß die ringförmigen Halbschalen (11, 12) mit gegenüberliegenden halbkreisförmigen Aufnahmen versehen sind, die nach der gegenseitigen Verbindung die Aufnahmeprofrungen (13) der jeweiligen Schäfte (14) der Kegelräder (9) der Flügel festlegen werden.

4. Schraube nach Anspruch 2, dadurch gekennzeichnet, daß ein Haubenendabschnitt am Stirn teil der Vorderhalbschale (11) mit Schrauben (17) befestigt ist.
Revendications

1. Hélice à pas variable pour pales pouvant être mise en drapeau, comprenant:
   - un moyeu (2) calé sur un arbre de commande (5) d'un moyen de propulsion;
   - une enveloppe (11, 12) entourant le moyeu (2) de manière tournante;
   - des pales (10) d'hélice, montées de manière tournante autour de leurs propres axes à travers des trous (13) respectifs définis par l'enveloppe (11, 12);
   - une denture conique (8) prévue sur le moyeu (2) et engrenant avec les pignons coniques (9) portés par chacune des dites pales (10) d'hélice;
   - un élément de réglage (21) engagé à rotation sur le moyeu (2);
   - un premier secteur circulaire (23) relié à, et faisant saillie du moyeu (2) vers l'extérieur;
   - un deuxième secteur circulaire (24) faisant saillie de l'élément de réglage (21) vers l'intérieur et destiné à engager le premier secteur circulaire (23) pour transmettre un mouvement rotatoire depuis le moyeu (2) vers l'enveloppe (11, 12);
   - un accouplement denté comportant des dentures (19) de forme conjuguée portées respectivement par une moitié arrière (12) de l'enveloppe (11, 12) et l'élément de réglage (21) et engrenant réciproquement en vue d'unir ensemble l'enveloppe (11, 12) et l'élément de réglage (21); caractérisée en ce qu'elle comporte:
   - des vis de fixation axiales logées dans des fentes (25), dont le profil est en forme de secteur circulaire, lesquelles sont formées dans ledit élément de réglage (21) et engageant ladite moitié arrière (12) d'enveloppe par des portions filetées, pour bloquer le mouvement axial de l'élément de réglage (21), lesdites portions filetées des vis (20) ayant une dimension longitudinale plus grande que la dimension longitudinale desdites dentures complémentaires, et lesdites vis axiales (20) pouvant être desserrées pour permettre le dégagement réciproque des dentures complémentaires (19) et la rotation de l'élément de réglage (21) par rapport à l'enveloppe (11, 12).

2. Hélice selon la revendication 1, caractérisée en ce que ladite enveloppe se compose d'une moitié avant (11) et d'une moitié arrière (12) lesquelles sont fixées axialement l'une à l'autre au moyen de vis (15).

3. Hélice selon la revendication 2, caractérisée en