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(54) Abstract Title
Cycloid propeller/turbine

(57) The blades 1 are cyclically adjustable about their respective axes, as the rotor rotates about a central axis, by means of a joystick acting through kinematic mechanism 12,13,14 and toothed members 2,3. The tooth profiles of the members 2,3 are non-circular to ensure intersection of normals to the blade chords at a control point N.

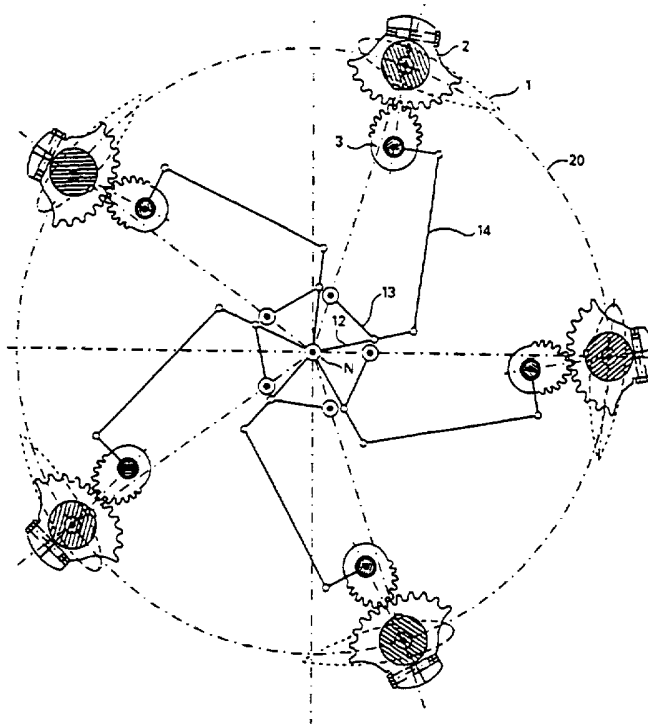


Fig. 1

At least one drawing originally filed was informal and the print reproduced here is taken from a later filed formal copy.

This print takes account of replacement documents submitted after the date of filing to enable the application to comply with the formal requirements of the Patents Rules 1995

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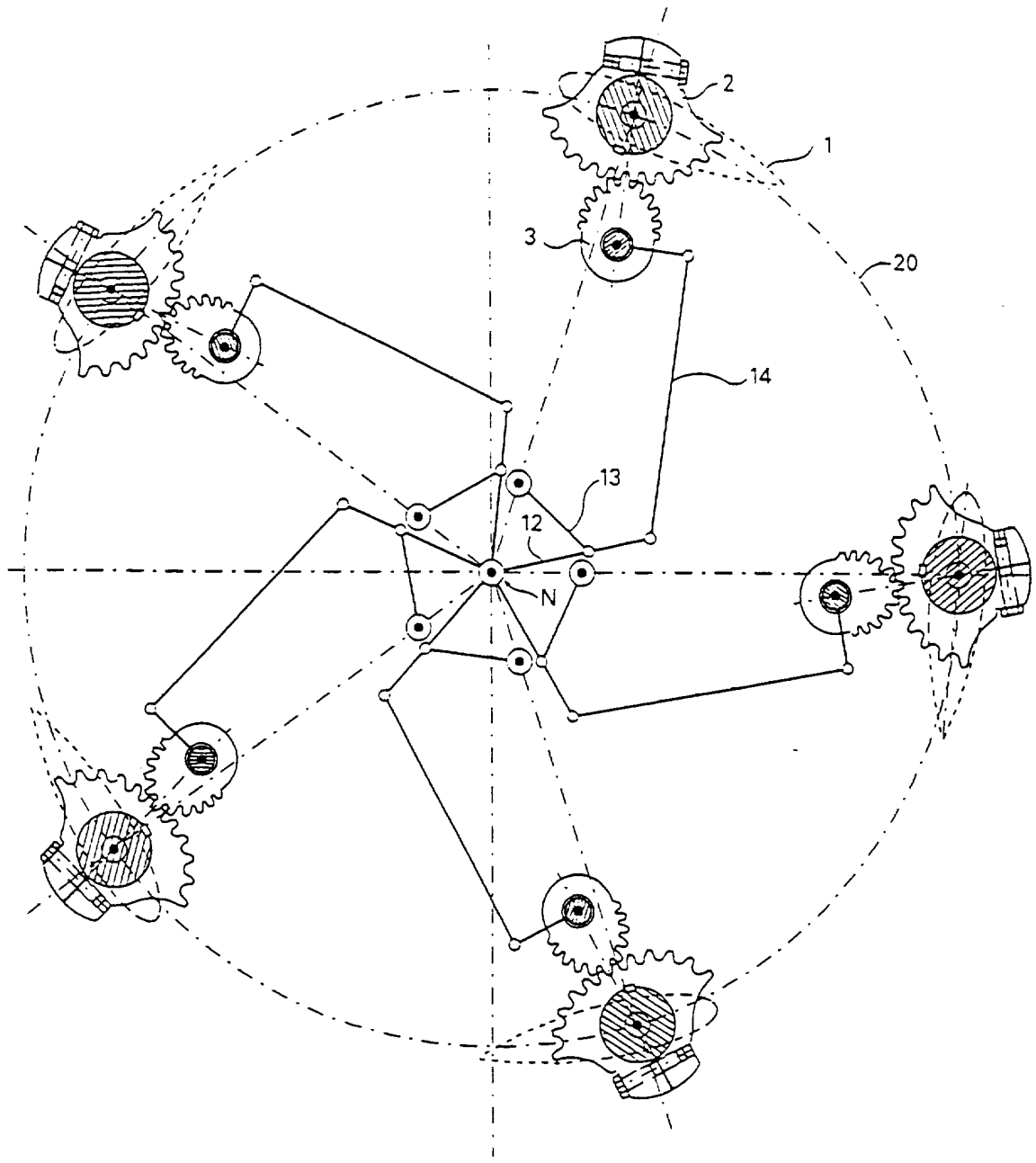


Fig. 1

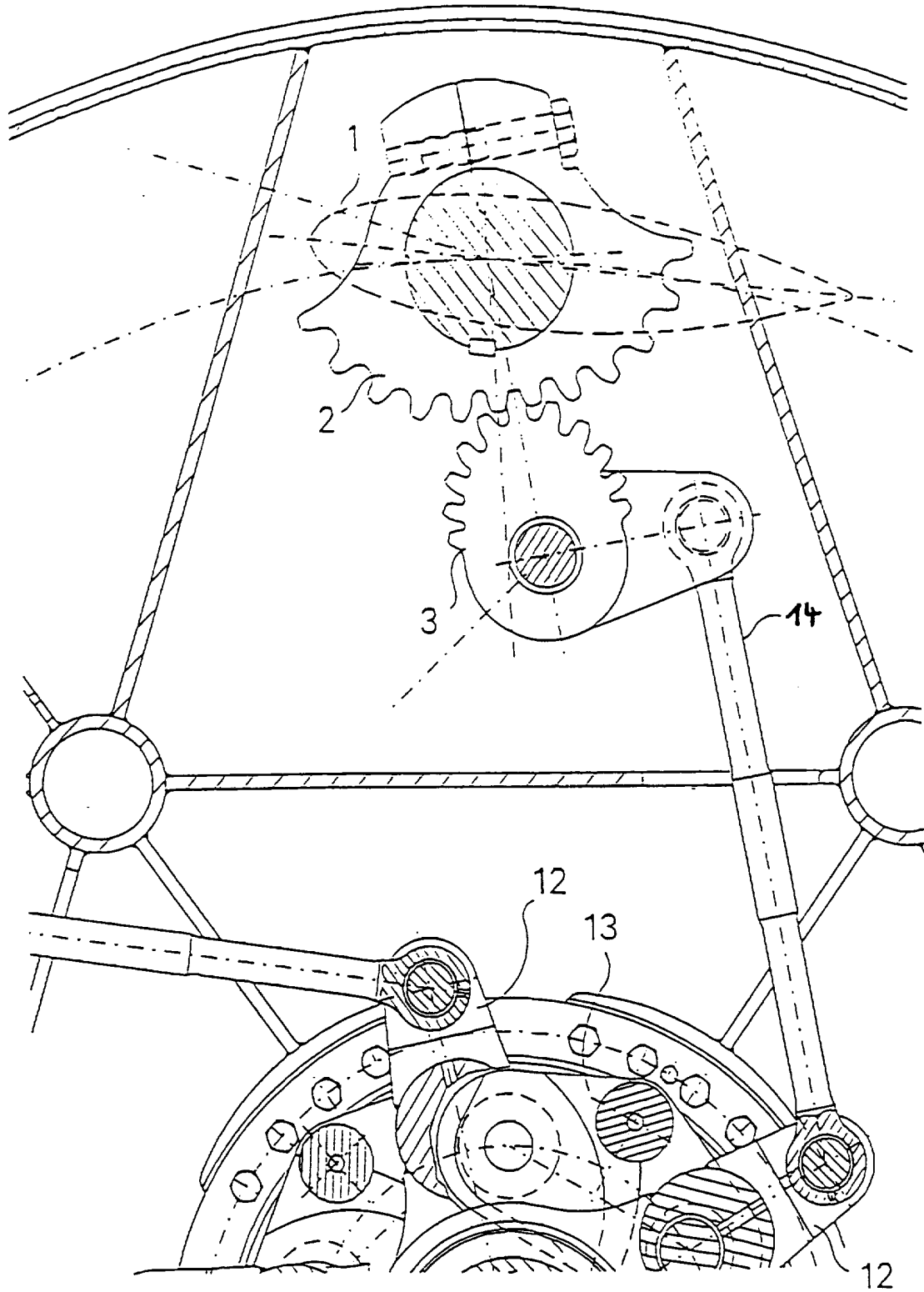


Fig. 2

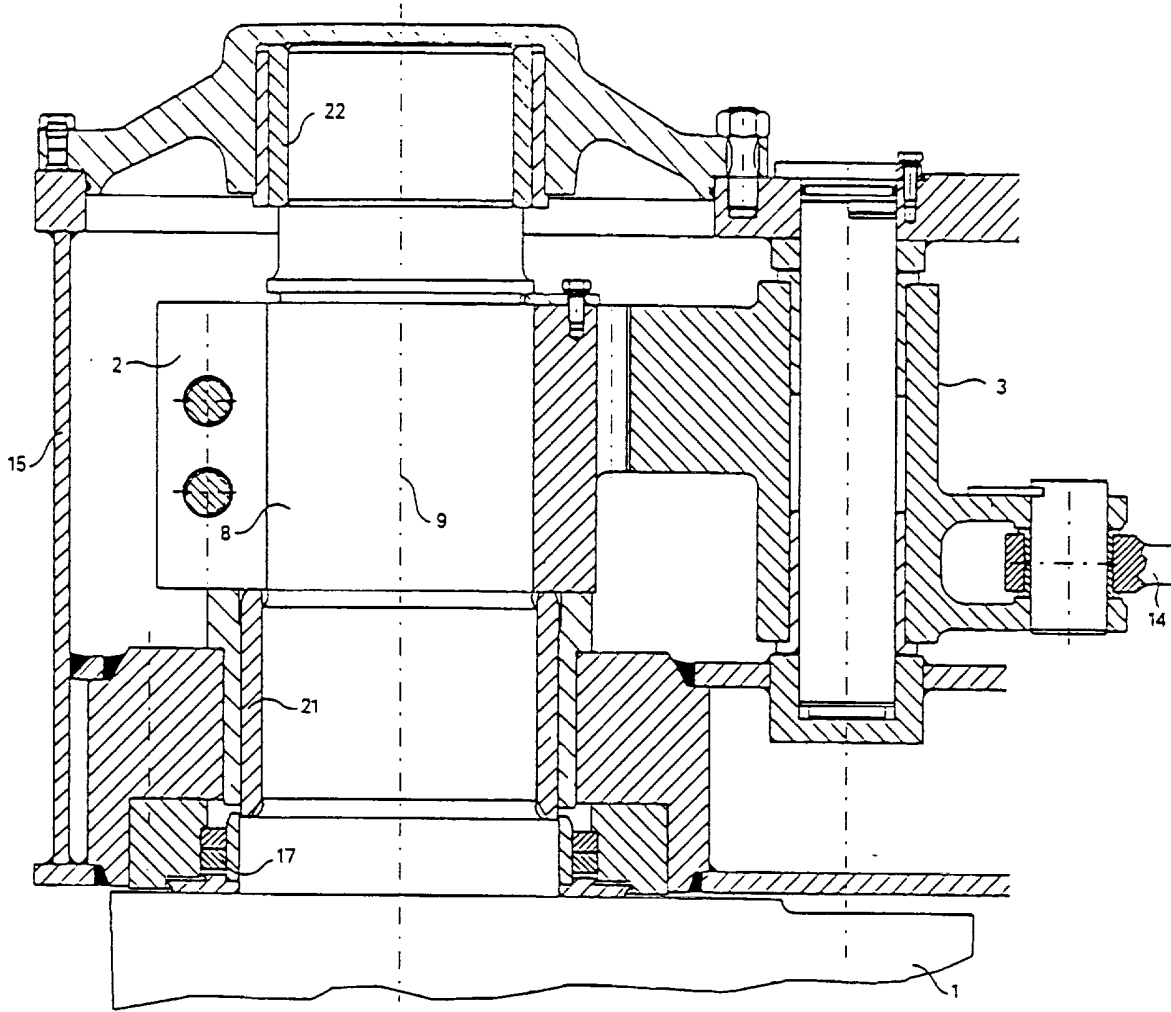


Fig. 3

Ship's propulsion constructed as a cycloid propeller

The invention relates to a cycloid propeller according to the precharacterising clause of Claim 1, as described in German Patent 196 02 043 C2.

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The structural elements and theoretical fundamental principles of the ship's propulsion constructed as a cycloid propeller have been represented in many different ways in the literature, e.g. in Voith-Druck 9.94 2000 and also in Voith Sonderdruck 1803, which represents an extract from "Voith Forschung und Konstruktion" [Voith Research and
10 Construction] No. 18, Article 3, May 1967. Here many details can also be found on the kinematics of the blades, which serve to bring about the cyclical adjustment of the blades during a rotation on the circular path (see Figures 6 to 9). Statements on the theoretical fundamental principles of the cyclical blade adjustment are found in the first-mentioned document.

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DE 196 02 043 C1 describes a cycloid propeller with blades which are mounted on a rotor. In this case too the swivel axes of the blades run parallel to the axis of rotation of the rotor. On the shaft of the individual blade a drive unit engages with a set of gears which can be driven by the rod assembly of the blade propulsion kinematics.

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The inventor has now recognised that with the conventional kinematics of the blade adjustment the theoretical fundamental principles for it cannot be exactly satisfied, i.e. that the "normal law" to be observed for the blade adjustment is not complied with, i.e. that the normals on the blade chords have to join exactly in the respective control point.

25 This is where the invention now intervenes.

The object of the invention is to construct the Voith-Schneider propeller in such a manner the "normal law" mentioned above can be largely complied with, i.e. that in every driving state the normals on the blade chords meet exactly in the so-called control point. This object is achieved in accordance with the invention by the features of Claim 1.

By means of this described achievement it can also be ensured that the acceleration of the individual blades that occurs can be reduced so that the blade stresses can be crucially reduced. In connection with the object just mentioned, this admittedly represents a certain compromise, which results in an optimal object when designing the respective ship's propulsion, since the very varying marginal conditions have to be taken into consideration for each individual propeller design.

It is known that a pair of gears can be formed by non-circular toothed wheels, in which connection details and other corresponding references can be gathered from Konstruktion 48 (1996) pages 256 to 262.

A preferred embodiment of the invention is described below by means of the attached drawings, in which

Figure 1 shows a basic top view of the circular motion of the blades,
Figure 2 shows constructive details for this view and representation and
Figure 3 shows a longitudinal section through the mounting of the single blade and the toothed wheels.

From the representation in Figure 1 one can see in principle the slider-crank kinematics with the connecting rod 12, the rocker 13 and the coupling rod 14, which basically form the slider-crank kinematics. This propulsive kinematics is the construction to be encountered today in the Voith cycloid propeller.

In the German Patent Specification mentioned at the beginning, this so-called slider-crank kinematics is brought into relationship with a gear pair, by which finally the individual blade is swivelled. Here the two gearwheels are designated by 2 and 3, with the driving wheel 3 being securely connected to the coupling rod 14 and the driven wheel 2 being securely connected via the blade shaft 8 to the individual blade 1 (see Figure 3). The individual blades now revolve on the blade circle of rotation 20 with their generally vertically aligned blade axes or also shaft axes 9 and the associated control point for the kinematics is indicated by N in Figure 1.

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From Figure 3 can also be seen the mounting of the blade shaft in an upper bearing 22 and a lower bearing 21 and also corresponding seals 17, which seal the interior of the rotor housing 15 against water.

20 With the construction of the toothed wheels as non-circular toothed wheels it is now possible to design the shape of the blade angle curve as desired and in particular to ensure that the normals on the chords of the blade sections join exactly at the control point, in which case the position of the control point N changes in accordance with the journey conditions, according to the required angular adjustment of the individual
25 blades.

The maximum adjustment of a blade is normally roughly 110 to 120 , so that here the non-circular toothed wheels are not completely meshed, but practically formed by toothed quadrants. It can be seen that the reference diameter of the toothed wheels
5 continually changes, in which case of course the sum of the individual reference diameters of the toothed driving wheel and toothed driven wheel is a constant value (= centre distance). The maximum change in the transmission ratios of the pairs of toothed wheels is to be fixed for example at roughly 15 to 20 % of the minimum transmission.

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It may be very advantageous to reduce the acceleration of the blades and consequently the forces that accordingly occur in an extreme region or towards the extreme region of the blade setting angle by a reference diameter of the driven toothed wheel that increases in each case, i.e. of that toothed wheel which is coupled with the
15 blade shaft in each case.

The invention can be applied not only in a ship's propulsion, but also in a turbine or another centrifugal machine. Water, air or other media are possible as the medium here.

Claims

1. A cycloid propeller with blades that can swivel cyclically by means of a joystick
5 and blade kinematics, the swivel axes of which are disposed parallel to one
another and to the axis of rotation of the rotor mounted in the stator, wherein
in each case blades are coupled with the blade kinematics by means of a pair
of toothed wheels, one of which is attached to the blade shaft in each case, the
non-circular toothed wheels in each case forming the pairs of toothed wheels.
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2. A cycloid propeller according to Claim 1, in which the reference diameter of the
driving wheel in the extreme range or towards the extreme range of the blade
adjustment angle is smaller than the mean range thereof and is accordingly
larger in the driven toothed wheel.
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3. A cycloid propeller according to Claim 1 or 2, in which the maximum difference
in the reference diameter on the respective toothed wheel is 15 % of the
minimum value.
- 20 4. A cycloid propeller substantially as described herein with reference to the
accompanying drawings.



INVESTOR IN PEOPLE

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Claims searched: 1-4

Examiner: C.B. VOSPER
Date of search: 18 April 2000

Patents Act 1977
Search Report under Section 17

Databases searched:

UK Patent Office collections, including GB, EP, WO & US patent specifications, in:
UK Cl (Ed.R): B7G; F1V(VDA)
Int Cl (Ed.7): B63H 1/08,1/10; B64C 11/32,11/34,11/36,11/38,11/40,11/42,11/46;
F03D 7/06; F03B 3/14,15/00
Other: ONLINE:EPODOC,JAPIO,WPI

Documents considered to be relevant:

Category	Identity of document and relevant passage	Relevant to claims
X	EP 0785129 A1 VOITH (fig. 2; components 2 and 3 appear non-circular)(Equivalent = DE19602043)	1
A	EP 0829422 A1 VOITH (fig. 1)	1

X	Document indicating lack of novelty or inventive step	A	Document indicating technological background and/or state of the art.
Y	Document indicating lack of inventive step if combined with one or more other documents of same category.	P	Document published on or after the declared priority date but before the filing date of this invention.
&	Member of the same patent family	E	Patent document published on or after, but with priority date earlier than, the filing date of this application.