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(54) Ship with at least two propelling screws.

(57) Two or more propelling screws 1,15 of a ship are rotatably mounted on a bearing bush 4 solidly joined to the stern post 5. The drive shaft 6 projects through the bearing bush and the end of the drive shaft is joined by a coupling piece 11 to the hub 2 of the sternmost screw 1. Between the hubs 2, 16 of the screws 1,15 a transmission system 17 is provided which links the hubs in a drive mode to each other

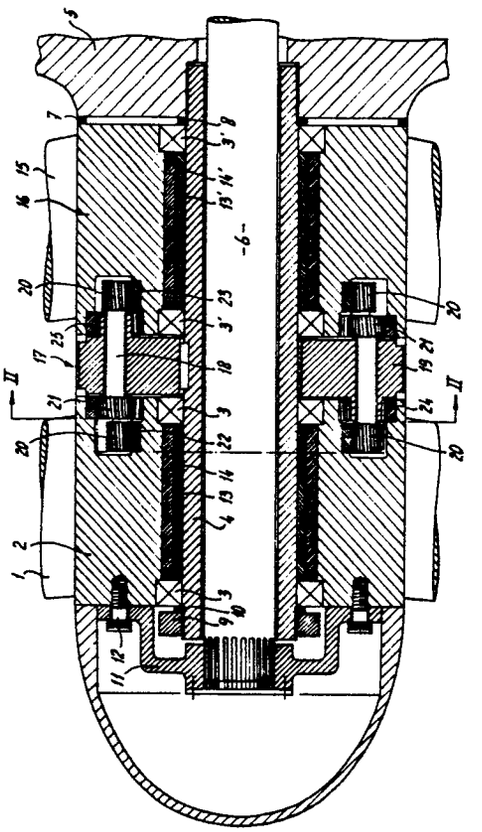


fig-1

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Ship with at least two propelling screws

The invention relates to a ship, the drive shaft of which projects through a bearing bush solidly joined to the stern post, on which bush a propelling screw is mounted, the end of the drive shaft being joined by a coupling piece to the hub of the said propelling screw, all this in a manner such that the thrust is transmitted to the stern post via the bearing bush.

Such a ship is known from the US patent no. 3,422,905 and the British patent no. 1,158,594. Because the thrust is transmitted to the stern post of the ship via the bearing bush, the thrust block near the motor or the gear box may be omitted and axial vibrations are not transmitted to the interior of the ship via the drive shaft. The rotary shaft will not be loaded by the thrust during rotation of the propeller and can be of lighter construction in view of the fact that it is not subjected to bending loads by the overhanging propellor.

It can be shown theoretically that the use of two or more propelling screws can yield an improvement of the efficiency compared with a drive by means of a single screw, in particular if the screws rotate in opposite directions and/or at different speed. Hitherto it has not been possible to provide a satisfactory embodiment on this principle. A construction in which one screw is provided on an outside shaft and the other screw on an inside shaft mounted concentrically therein is known from the British patent no. 538,731 and the European patent application 132,220. Said construction has the disadvantages that a gear box, which is necessary to convert the torque delivered by the motor into two dissimilar rotary motions, is complicated, while the mounting and sealing of rotating shafts projecting into each other is associated with considerable problems. The mounting problem is a consequence of the fact that no film of lubricant can build up.

The object of the invention is to eliminate the problems outlined in the case of different screws which have to be able to rotate in opposite directions and/or at different speeds.

According to the invention the ship specified in the introduction is characterized for this purpose in that two or more separate screws are mounted on the bearing bush solidly joined to the stern post and a transmission system is provided between the hubs of the screws which links the hubs in a drive mode to each other. Lubrication and bearing can take place easily in a conventional way. The use of two or more separate screws has the advantage that the mutual blade position can be chosen in a manner such that vibrations due to propellor surges are limited to a minimum and beat phenomena are eliminated.

Preferably the transmission consists of a planetary gear box.

On each of the hubs, at the sides thereof facing each other, two gear rings may be provided: an innermost ring, the teeth of which face outwards, and an outermost ring the teeth of which face inwards. Between the hubs a series of shafts may be placed with a pinion at both ends, the one pinion of each shaft engaging in the innermost gear ring of the one hub and the other pinion in the outermost gearing of the other hub and, seen in the circumferential direction of each of the gear rings, a pinion engaging in the innermost tooth system always alternates with a pinion engaging in the outermost tooth system, consecutive pinions being staggered in the axial direction.

The bearings of the hub or hubs will have to be able to absorb not only radial load but also large axial load. Preferably use is therefore made of so-called Michell blocks consisting of a ring of small pressure blocks which are able to tilt slightly and can adjust themselves automatically if the axial pressure alters (Michell blocks are described, inter alia, in "Machineonderdelen" (Machine components) by Ir G. Hofstede, Ir H.J. Meeuwis and Ir P.G. Ridderhaus, 1953, pages 114 and 201).

The transmission may also consist of a hydraulic clutch.

The transmission can be given an embediment such that the screws will rotate in opposite directions. In such the case of another possibility the screws may rotate in the same direction at unequal speed. The screws may also have an unequal pitch.

The invention will now be explained in more detail on the basis of the figures in which an exemplary embodiment is shown.

Figure 1 shows a longitudinal section.

Figure 2 shows a cross-section along the line II-II in Figure 1.

The propelling screw 1 with hub 2 is rotatably mounted on a bearing bush 4 via bearings 3 which absorb axial load and bearings 13, 14 which absorb radial load, which bearing bush 4 is joined to a part 5 of the stern post of the ship, for example a block load. A second propelling screw 15 with hub 16 is rotatably mounted on the same bearing bush 4 via bearings 3' which absorb axial load and bearings 13', 14' which absorb radial load.

Within the fixed bus 4 there extends the end of the drive shaft 6 which can be driven by a motor or a gear box linked thereto. Moreover, a seal 7 and a

washer 8 are provided between the hub 16 and the part 5.

The hubs 2 and 16 are secured by a nut 9 screwed onto the bearing bush 4, a pressure ring 10 being placed between the nut and the hub 2.

A coupling piece 11 is mounted on the end of the shaft 6, which end is provided with axial grooves, bolts 12 serving to bring about a link between said coupling piece 11 and the hub 2.

The bearings 3, 3' which absorb axial load each form a so-called Michell block, that is to say that they comprise a series of small pressure blocks arranged in a circle which can adjust themselves automatically because they can tip or tilt if the axial pressure changes. Because the small blocks can rotate slightly over the pressure face a complete lubrication is produced, which would not be possible between parallel sliding surfaces. The radial bearings are sliding bearings and comprise a bearing bush 13 or 13' respectively mounted on the bearing bush 4 and a bearing bush 14 or 14' respectively which can be rotated about it and is attached to the hub 2. The fixed part of the bearings 3, 3' and the bearing bush 13, 13' are trapped between the stern post part 5 and the ring 8 on the one hand, and the nut 9 and the ring 10 on the other hand.

A transmission system 17 to be described in more detail is placed between the two hubs 2 and 16.

It will be clear that when the shaft 6 is made to rotate, the hubs 2, 16 of the screws 1, 15 will rotate at the same time, and that the thrust produced is transmitted to the part 5 of the stern post. A separate thrust block is no longer necessary near the motor or gear box. The shaft 6 is not subject to axial load and axial vibrations are not transmitted or scarcely transmitted by the shafts 6 to the interior of the ship. Because, moreover, the shaft 6 is no longer subjected to load by an overhanging screw, no bending load is exerted and the shaft can be of relatively light construction.

The transmission system 17 is a planetary gear box provided with a series of shafts 18 of the same length which are arranged as a cylinder and which are mounted in the block 19 which is trapped on the bearing bush 4.

A relatively small pinion 20 is provided at the one end of each shaft and a somewhat larger pinion 21 is provided at the other end. Seen in the circumferential direction of a series of pinions, pinions 20 and 21 alternate with each other. Each of the smaller pinions 20 engages in one of the innermost gear rings 22, 23 which are provided in a recess of the hubs 2 or 16 respectively with the teeth facing outwards. Each of the larger pinions 21 engages in one of the outermost gear rings 24, 25 which are provided in one of the said recesses in the hubs 2 or 16 respectively with the teeth facing inwards.

If the hub 2 of the screw 1 is rotated by the shaft 6 and the coupling piece 11 in a certain direction, the hub 16 of the screw 15 is rotated in the opposite direction, the power from the hub 2 being transmitted in a well distributed manner to the nut 10. Because of the relatively large number of pinions the transmission system 17 has a compact construction.

By using counter-rotating screws a higher efficiency is possible, it being possible for the diameter of the screws 1, 15 to be smaller than the diameter of a single screw which yields the same propulsive power.

The vibration generated by propellor pulses can be limited to a minimum with a permanently chosen mutual blade position of the screw. In the case of two separately driven screws beat phenomena may occur through lack of synchronism; with the a priori synchronous drive of the screws 1 and 15 according to the invention this possibility is ruled out.

Compared with any constructions having two screws, the shafts of which are concentric, the construction according to the invention has the advantage that the bearing, in particular the lubrication of the hubs, presents no problem. As has been shown, the planetary gear transmission system is also simpler in construction than a gear transmission system for two concentric shafts.

Incidentally, a planetary gear transmission system between the hubs 2 and 16 is not a necessity. Another possibility for the transmission system 17 is a hydraulic clutch which reverses the direction of rotation. Such a clutch, which is known per se, comprises, for example, a ring of blades attached to the hub 2 which, with the hub rotating, generates a liquid flow which sets in motion a second ring of blades which is attached to the hub 16. Some of the important advantages can also be obtained if the screws 1 and 15 rotate in the same direction. A difference in speed of revolutions and/or a difference in screw pitch of the two screws 1, 15 may also lead to improvements in efficiency. However, counter-rotation of the two screws is, in fact, preferable.

Of course, more than two screw hubs may also be mounted behind each other on a fixed bearing bush within which the drive shaft extends which drives the rearmost hub via a coupling piece, a planetary gear transmission system or a hydraulic clutch always being placed between successive hubs.

Within the scope of the invention more changes are incidentally possible.

Claims

1. Ship, the drive shaft of which projects through a bearing bush solidly joined to the stern post, on which bush a propelling screw is mounted, the end of the drive shaft being joined by a coupling piece to the hub of the said propelling screw, all this in a manner such that the thrust is transmitted to the stern post via the bearing bush, characterized in that two or more separate screws (1, 15) are mounted on the bearing bush solidly joined to the stern post and a transmission system (17) is provided between the hubs (2, 16) of the screws (1, 15) which links the hubs in a drive mode to each other.

2. Ship according to Claim 1, characterized in that the transmission system (17) consists of a planetary gear box.

3. Ship according to Claim 2, characterized in that on each side of the hubs (2, 16) at the sides thereof facing each other, two gear rings (22, 24; 23, 25) are provided: an innermost ring (22, 23), the teeth of which face outwards, and an outermost ring (24, 25), the teeth of which face inwards, and that between the hubs (2, 16) a series of shafts - (18) is placed with a pinion (20, 21) at both ends, the one pinion (20) of each shaft engaging in the innermost gear ring of the one hub and the other pinion (21) in the outermost gear ring of the other hub and, seen in the circumferential direction of each of the gear rings, a pinion (20) engaging in the innermost tooth system always alternates with a pinion (21) engaging in the outermost tooth system, consecutive pinions (20, 21) being staggered in the axial direction.

4. Ship according to Claim 1, characterized in that the transmission system (17) consists of a hydraulic clutch.

5. Ship according to one of the preceding claims, characterized in that the transmission 17 is constructed in a manner such that the screws (1, 15) will rotate in opposite directions.

6. Ship according to one of the Claims 1-4, characterized in that the transmission system (17) is constructed in a manner such that the screws (1, 15) will rotate in the same direction at unequal speed.

7. Ship according to one of the preceding claims, characterized in that the screws (1, 15) have an unequal pitch.

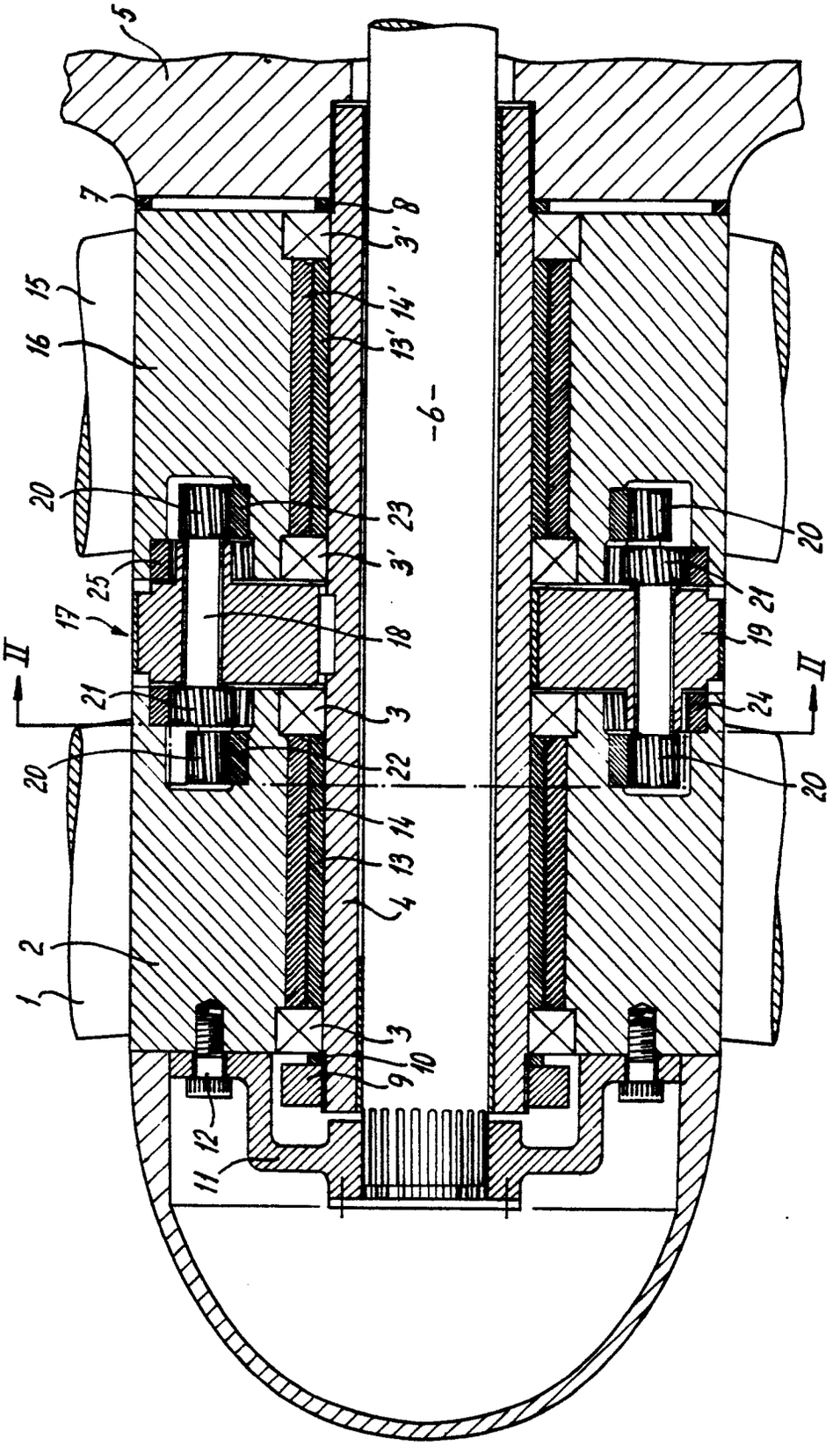
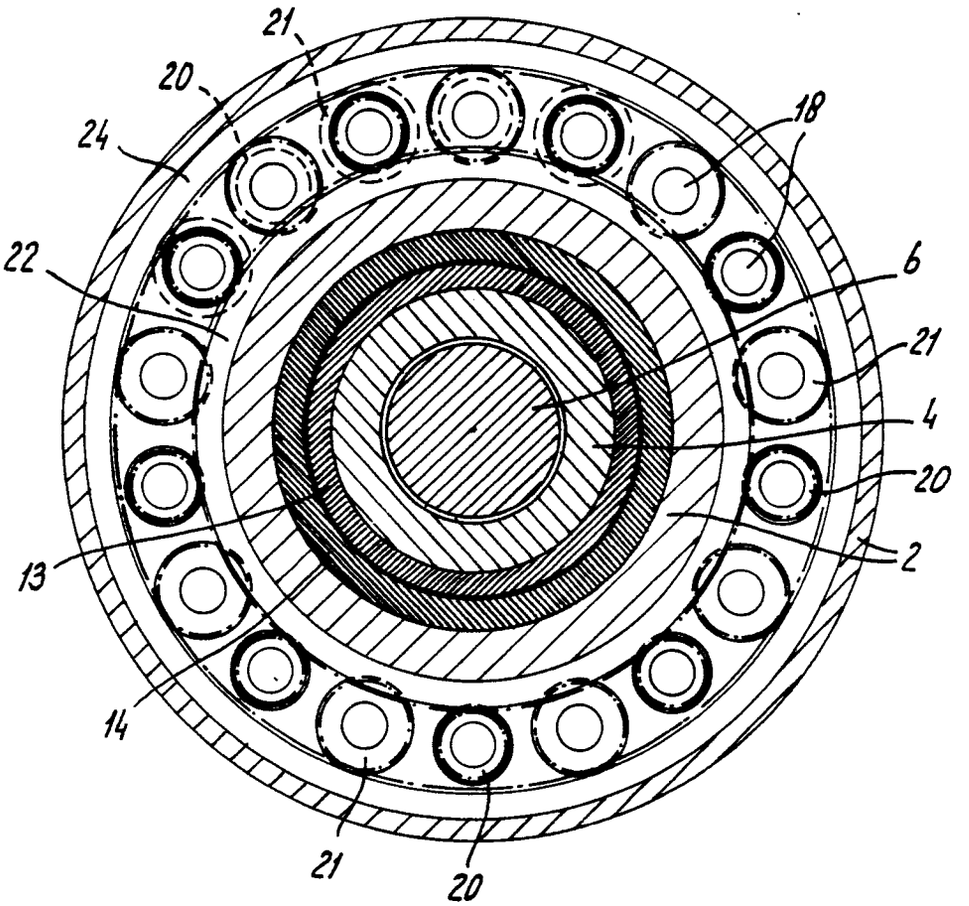

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fig-1

fig-2



European Patent Office

EUROPEAN SEARCH REPORT

Application number

EP 86 20 1448

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.4)
D,A	US-A-3 422 905 (MULLER) * The whole document *	1	B 63 H 5/10 B 63 H 23/34
D,A	GB-A-1 158 594 (STONE MANGANESE MARINE LTD.) * Page 2; figures 1,2 *	1	
A	GB-A-2 142 116 (BRANDT) * The whole document *	1,2,3, 5,7	
A	US-A-4 050 849 (SHEETS) * Columns 2-5; figures 1-8 *	1,4	
D,A	EP-A-0 132 220 (MITSUBISHI JUKOGYO) * The whole document *	1,3	TECHNICAL FIELDS SEARCHED (Int. Cl.4)
A	GB-A- 15 029 (CAKE)(1911) * The whole document *	2,6	B 63 H
D,A	GB-A- 538 731 (BROWN)		

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	11-12-1986	VOLLERING J.P.G.

CATEGORY OF CITED DOCUMENTS

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