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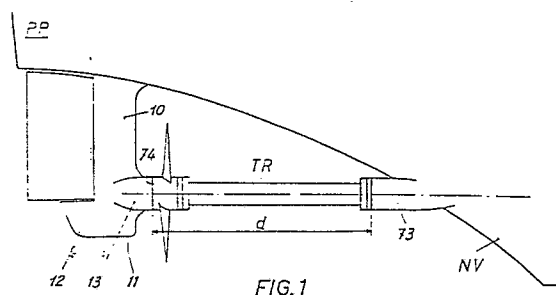
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54 **Stern mounting structure for rudder, screw propeller, and shafting suitable for ships of any kind and use.**

57 Stern mounting structure for rudder, screw propeller, and shafting, suitable for ships of any kind and use arranged abaft the screw propeller that substantially comprises an integral to the hull, foil shaped post which sustains the rudderstock and an integral to the post boss which sustains the rudder heel and houses the last shafting bearing. Where a controllable pitch propeller (CPP) is used, the post houses the most of the pitch control hydraulic devices in order to provide an apparatus wherein there are no rotating members under hydraulic pressure.



Description

Stern mounting structure for rudder, screw propeller, and shafting, suitable for ships of any kind and use.

The subject matter of this invention is a stern mounting structure for rudder, screw propeller, and shafting, suitable for ship of any kind and use. This structure is arranged abaft the screw propeller and substantially comprises an integral to the hull, foil-shaped post which sustains the rudderstock and an integral to the post boss which sustains the rudder heel and houses the last shafting bearing. Where a controllable pitch propeller (CPP) is used, the post houses the most of the pitch control hydraulic devices in order to provide an apparatus wherein there are no rotating members under hydraulic pressure.

The preliminary search results show that six patents could be considered in the discussion of the present application. Comments showing the differences between them and the present application can be made as following: Pat. n. US-A-2317196 is applicable only to very small boats for the presence of a pivoted bearing at the rear end of the shaft, and does not consider the possibility of disassembling the screw propeller without moving all the shaft-line. Furthermore it does not consider controllable pitch propellers.

Pat. n. GB-A-446838 has the feature of varying the length of the cross section of the stationary rudder member in order to approach the contour of the after edges of the propeller blades; it does not take into account the disassembling of the screw propeller and the possible installation of a controllable pitch propeller.

Pat. n. US-A-2931443 has a completely different structure of the rudder, it has under pressure rotating members and does not consider the disassembling of the screw propeller.

Pat. n. FR-A-2044651 does not support the shaft with a bearing in its rear end, it has under pressure rotating members, the rudder has a completely different hydraulic motor, it does not consider the screw propeller disassembling.

Pat. n. WO-A-80/01373 has under pressure rotating members, it does not consider a bearing at the rear end of the shaft, it does not consider the screw propeller disassembling.

Pat. n. FR-A-844151 has the main purpose to allow the rear bearing maintenance and control from the inside of the hull and thus is not comparable with the present patent application.

As it is well known to the naval architects, a great care must be taken in the propulsive system design to the problem of the screw propeller-ship hull interaction in order to match the screw characteristics to the hull form, particularly the stern body.

As regard as this problem, and in order to avoid large changes in the hydrodynamic angle of attack on the blades sections, it is of paramount importance to achieve a flow uniformity as high as possible in the propeller disk region. The flow uniformity problem, and therefore the problem of achieving the higher propulsive system efficiency, related thereto which is already present in the twin screw ships is of

bigger importance in the mono screw ships. This is due to the fact that the flow uniformity mainly depends upon the presence of appendages protruding from the hull before the propeller disk, and that the twin screw ships can be fitted either with simple strut, or strut and brackets, etc., and generally they do not have the hull skeg before the propellers. By using the traditional stern structures it is impossible to eliminate the flow disuniformity due to the appendages, consequently, the main object of the invention is to provide a new stern structure which allows to optimize the propeller disk in-flow.

It is another object of the invention to provide such a structure which houses a CPP pitch control device wherein no rotating members are under hydraulic pressure.

Furthermore, it is another object of the invention to provide such a structure which allows to reduce in size or eliminate the skeg, and thus obtaining a bigger net volume in the aftbody.

These objects can be achieved by using this invention which:

- carries the screw propeller, therefore eliminating any shaft overhang;
- sustains the rudderstock bending stress;
- houses the devices and members of the CPP pitch control system, which accordingly is simpler and more reliable.

Furthermore this invention is particularly suitable to reduce the cavitation phenomena related to the flow disuniformity.

The applicant has also studied a non-symmetrical shaped post suitable for those special cases wherein the cavitation phenomenon can occur over the post.

The invention will now be more particularly described with an embodiment thereof with an exclusively exemplifying and not limiting aim. This embodiment is suitable for a mono screw ship fitted with an hydraulic CPP plant.

In the drawings:

Fig.1 shows a partial lateral view of a stern mounting structure according to the invention.

Fig.2 is a section fragmentary showing in a larger scale, the stern mounting structure of fig.1 with the rudderstock, last shaft bearing, and a fixed pitch propeller (FPP) arrangement.

Fig.3 is a cutaway section on line III-III of fig.2.

Fig.4 shows perspective view of an alternative embodiment of the post which is suitable to eliminate the cavitation phenomenon over it.

Fig.5 is a front view of the post of fig.4.

Fig.6 is a detailed section showing the invention when applied to an hydraulically operated CPP propulsive plant.

Fig.7 is a perspective view showing the blade position control plate of fig.6.

Fig.8 is a fragmentary section along line VIII-VIII of fig.6.

Fig.9 is a schematic view showing various positions of the blade eccentric-holder slide.

Fig.10 is a sketch of the blade control equipment; which in this case is of the hydraulic type .

Looking now at figures 1-3 they show the stern mounting structure comprising : a foil shaped post 10, which is integral to the stern PP of the ship NV. This post has a sickle-shaped outline to house the rudder blade and presents a boss 11 having an overhanged aftbody 12 and an ogive-shaped fore body 13.

As it is clearly shown post 10 supports the rudderstock 14, the rudder heel 16 of which is pivoted in the overhanged aft body 12 ; rudderstock 14 is partially housed in the vertical groove 18 of post 10 .

The forebody 13 of boss 11 houses the last bearing 19 of the shafting 20. The boss forebody 13 and the screw propeller hub 22 are sized and shaped in such a way to avoid flow separation or vortices ; the same concept is valid for rudder 15 and post 10 .

Figures 4 and 5 show a variant stern mounting structure of the invention thus it is suitable to eliminate cavitation phenomenon over the post. This structure also allows mono screw ships to keep the course, eliminating the need of steering, thus giving a further advantage to the overall efficiency of the ship.

In this second embodiment the side surfaces of the post, indicated by reference 10A , are not symmetrically layed with respect to the ship symmetry plane, since they have both a curved surface while boss 11A and the rudderstock maintain their central position and rectilinear shape, respectively .

It can be useful to note that the arrangement shown is suitable for a counter clockwise screw propeller .

Figures 6-10 show the invention as applied to a CPP plant for a monoscrew ship .

At present the hydraulic oil pipes for the CPP are housed inside the shaft line and reach the hub from the main gear box. This arrangement makes it necessary to perform very costly fine workings of the shaft line and involves the use of heavy and complicated members under pressure which are in rotation.

This invention eliminates all the above mentioned draw backs as it allows to control the blade position making use of devices which are all housed either in the propeller hub or boss . The oil pipes , in the case of an hydraulic operated plant, arrive to the screw boss through the post of the invention .

As it is shown, the pitch control device comprises substantially three sections :

- a first section housed in the ship hull ; comprising the auxiliaries ;
- the second section, which is partially fitted inside post 110 and boss 111 and partially fitted inside the hub ; this section comprising non-rotating members ;
- the third section, which is totally fitted inside hub 25 and comprises rotating members .

The first section comprises :

- a high pressure oil pump 30,
- a high pressure oil storage chamber 31 ,
- a hydraulic circuit including a distributing valve 32

- and remote controlled valves 33,
- an oil pressure regulating valve 34 ,
- a low pressure hydraulic circuit 37 .

The non-rotating section comprises :

- 5 - a double-acting hydraulic unit consisting of a cylinder 40 and a piston 41 ,
- a first operating disk 42 , that is fixed ,
- a second movable-operating disk 43 ,
- 10 - a low pressure hydraulic actuator, including a first chamber 44, which is internal to the piston 41, and a second chamber 45 which houses the forebody 46 of movable-operating disk 43 .

Finally the rotating section comprises :

- 15 - a slidable plate 60 (fig.8),
- eccentric-holder slides 61 ,
- rotating disk 62 .

Furthermore, two grooves 64 are machined on the opposite sides of slidable plate 60, which engage the slide-guides 75 machined on the hub .

- 20 From the foregoing it is easy to understand that all the pitch control system of screw blades 70 does not rotate with the exception of slidable plate 60 , which is positioned between the fixed operating disk 42 and movable operating disk 43. Between slidable plate 60 and disks 42 and 43 , antifriction plain bearings 65 and 66 are interposed .

- 25 Making use of the described arrangement it will happen that the position of piston 41 inside cylinder 40 will set the axial position of the slidable plate 60 trough fixed disk 42 and movable disk 43 .

- 30 Furthermore an axial passage 47 is machined in piston 41 .This passage allows chamber 45 , at the end 48 of piston 41, to communicate the oil pressure to chamber 44 . That is located between the end of drilled stem 49 and the housing thereof which is in the head 50 of the axial hole 47 .

- 35 Drilled stem 49 is integral to the bottom 53 of cylinder 40. With such arrangement end chamber 45 communicates with chamber 44 trough passage 47 and then with low pressure circuit 37 trough axial passage 54 of stem 49 .

- 40 Operation of the blades rotation is made in the following way :

- 45 the high pressure circuit, through distributing valve 32 and valves 33, controls the position of piston 41 by means of oil chambers 55 and 56, located on the sides of head 50. The fixed-operating disk 42, which is integral to the piston 41, sets up the position of slidable plate 60. This plate, through eccentric-holder slides 61 and eccentrics 67, which are integral to the rotating disk 62 ,ultimately controls the blade pitch, being disk 62 bolted to the root 68 of screw blade 70 .(See figures 7,8,9) .The position of fixed operating disk 42 is directly related to the position of piston 41 ; the position of movable-operating disk 43, that can slide axially to piston 41 ,is set up by the low pressure circuit action . This circuit comprises :
- 50 - oil storage chamber 35 ,
- pipe 37 ,
- 55 - passage 54 ,
- chamber 44 ,
- passage 47 ,
- and chamber 45 .

- 60 With this arrangement disk 43 engages the plate 60 owing to the pressure in end chamber 45 .

The aims of the capability of sliding disk 43 are :
 - to take up automatically the slack due to the wear of antifriction bearings 65 and 66 ,
 - to maintain a low pressure engagement between antifriction bearing 66 and the slidable plate 60. Bearings 77 and 78 are provided for guiding and supporting piston 41 . Stop ring 80 , which slides in groove 81 , is mounted, at the end 79 of cylinder 40 , for preventing piston 41 to rotate.

The embodiment shown and illustrated is designed for a four-bladed propeller having the capability of the three positions :

- ahead ,
 - astern ,
 - feathering
- and the intermediates ones of course .

In fig.9 are schematically shown the positions of one eccentric-holder slide 61 and its eccentric 67 .

The positions are represented:

- ahead, with solid lines
- astern , with dashed lines
- feathering , with chain lines .

The shafting disassembly will be made by taking down the sections of the shaft line from the stern , being the length TR of the shaft sections less than the clearance between stern boss 73 and end 74 of the forebody 13 of boss 11 .

It has been shown how the invention provides a stern mounting structure which , by using a new concept , allows the designer to achieve the target of increased efficiency , lower cavitation , simpler and cheaper construction .

It is intended that it is possible to modify and change in some way what has been herein illustrated and described without altering the concepts and scope of the invention .

Instead of the hydraulic type which has been thoroughly described , for example , it will be possible to install inside port 110 and boss 111 either a pneumatic or a mechanic device to control the blades position .

Claims

1. A stern mounting structure located abaft the screw propeller ,for ship of any kind and use ,characterized in that it comprises an integral to the hull foil-shaped post and a boss ,integral to the post , which houses the last shafting bearing ,thus eliminating any shaft overhang .

2. The stern mounting structure , of claim 1 , wherein said post houses the rudderstock and supports the rudder heel.

3. The stern mounting structure of claim 2 , wherein said post has curved lateral surfaces , while boss and rudderstock maintain their central position and rectilinear shape, respectively.

4. The stern mounting structure ,of claim 1, particularly adapted to controllable pitch propeller ships , wherein said post and boss house the devices and members of the blades position

control system, so that said devices and members have not to be housed inside the shafting .

5.The stern mounting structure ,of claim 4, wherein the control system comprises :a first section housed in the ship hull; a second non rotating section partially housed in said propeller boss and partially in said hub, and a third rotating section which is totally housed in said propeller hub .

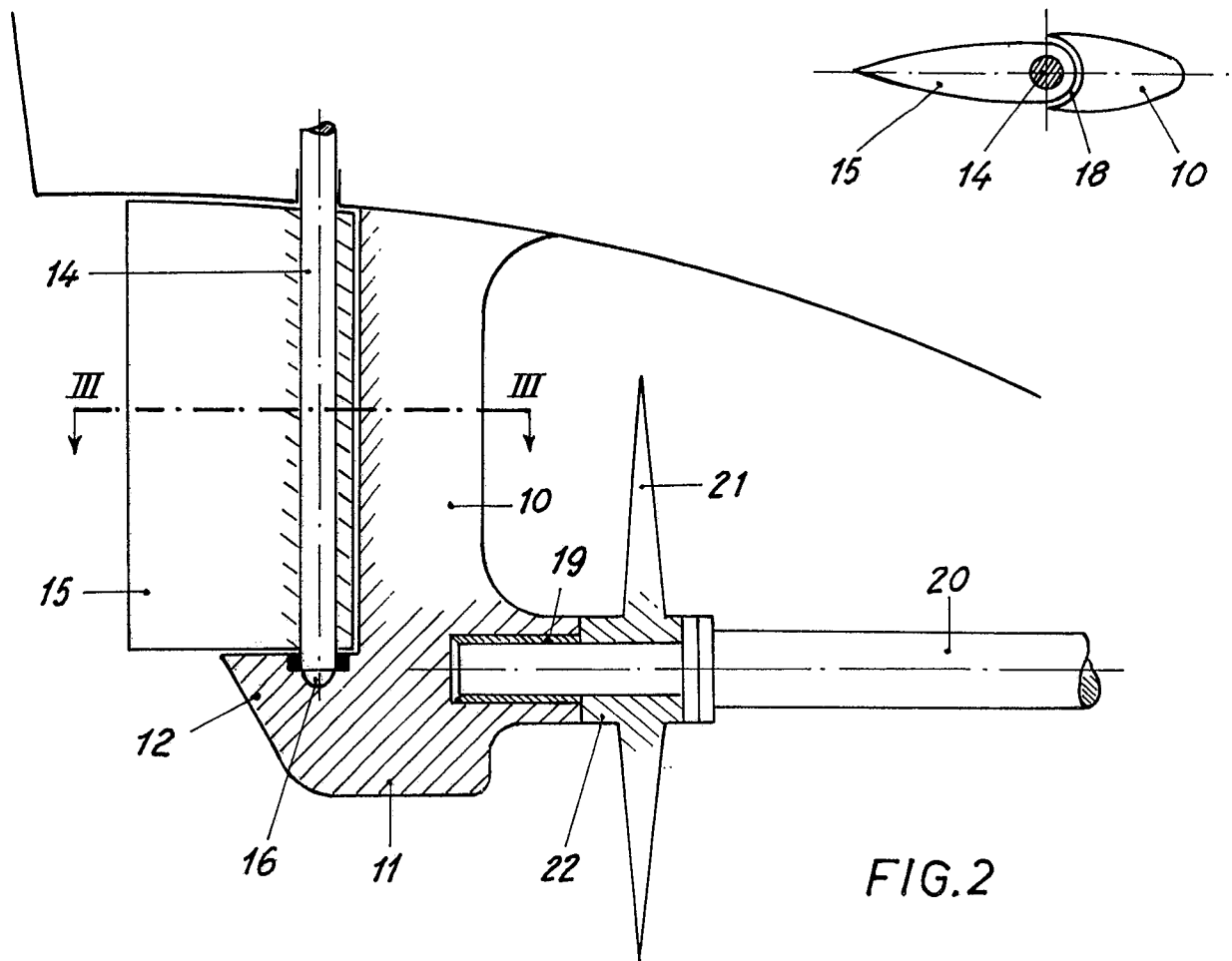
6.The stern mounting structure , of claim 5,wherein control system is hydraulically operated and wherein said first section comprises : a high pressure oil pump , a high pressure oil storage chamber,a hydraulic circuit including a distributing valve and remote-controlled valves, an oil pressure regulating valve ,an oil tank, a low pressure oil storage chamber, a low pressure hydraulic circuit ;said second non rotating section includes : a double acting hydraulic cylinder and piston unit ;a fixed-operating disk and a movable-operating disk, a low pressure hydraulic actuator which includes a first and a second chamber , said first chamber being internal to said piston, and said second chamber being external thereto, and housing the end of said movable-operating disk ; said third rotating section comprises :

a squared sliding plate which rotates with the shaft and is positioned between said operating disks ; more eccentric-holder slides,and pivotally mounted disks ,one for each blade ,each mounting eccentric pin ;and wherein each of said pivotally mounted disks is suitably connected to the respective blade root that is compelled to rotate therewith.

7.The stern mounting structure , of claim 6 , wherein said fixed-operating disk is integral to the piston , and said sliding-operating disk is allowed to slide axially when operated by said low pressure oil circuit , so that the slack due to the wear of the antifriction bearings is continuously taken up.

8.The stern mounting structure ,of claim 1 , wherein said sliding plate presents a pair of grooves machined therein which cooperate with slide-guides machined in said hub ,in order to easily move axially thereto.

FIG. 3



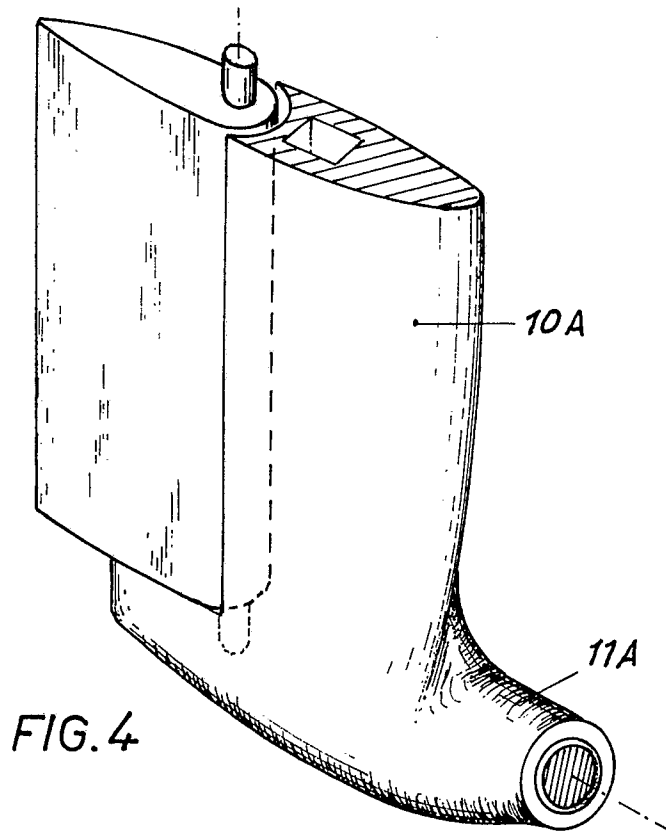


FIG. 5

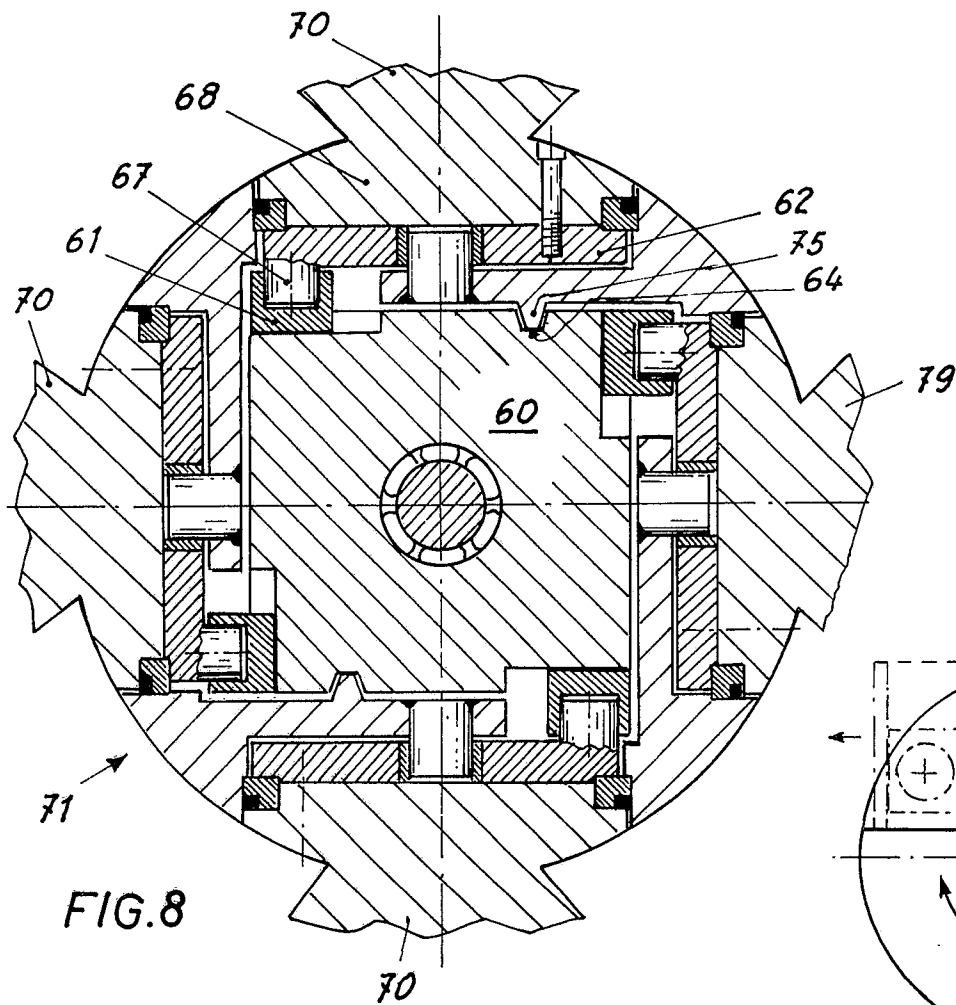
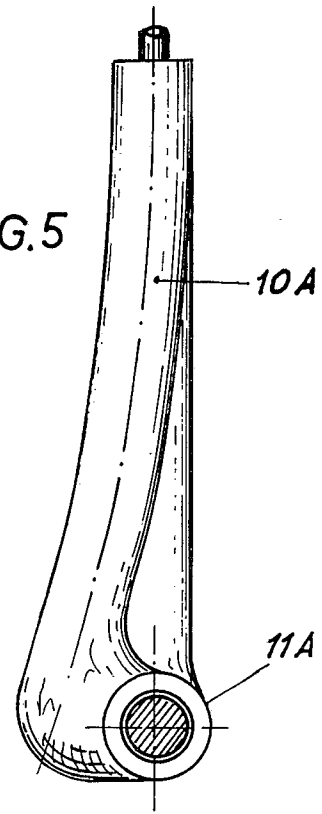
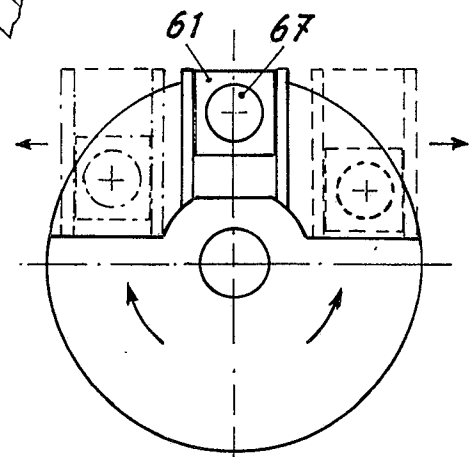
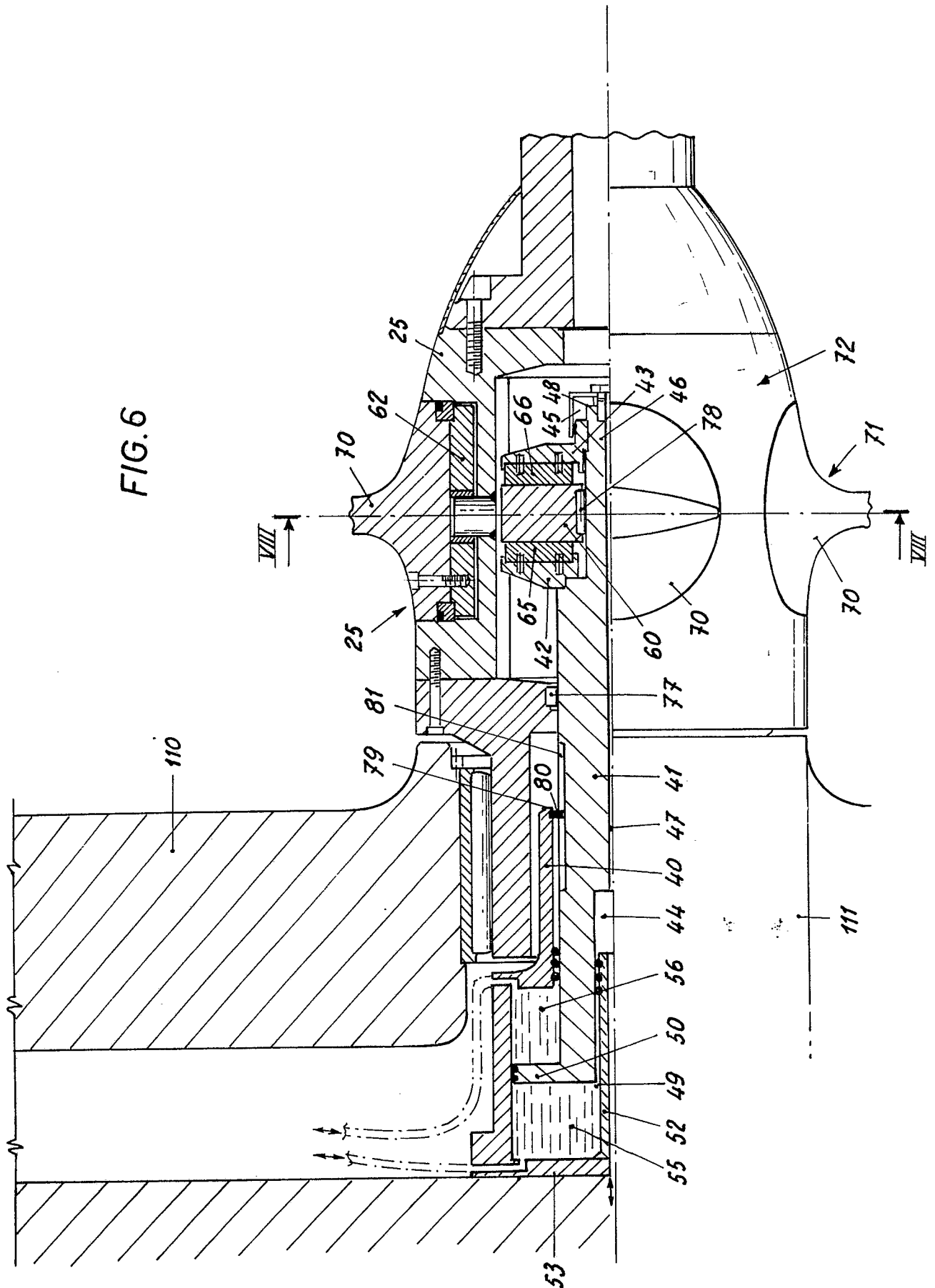
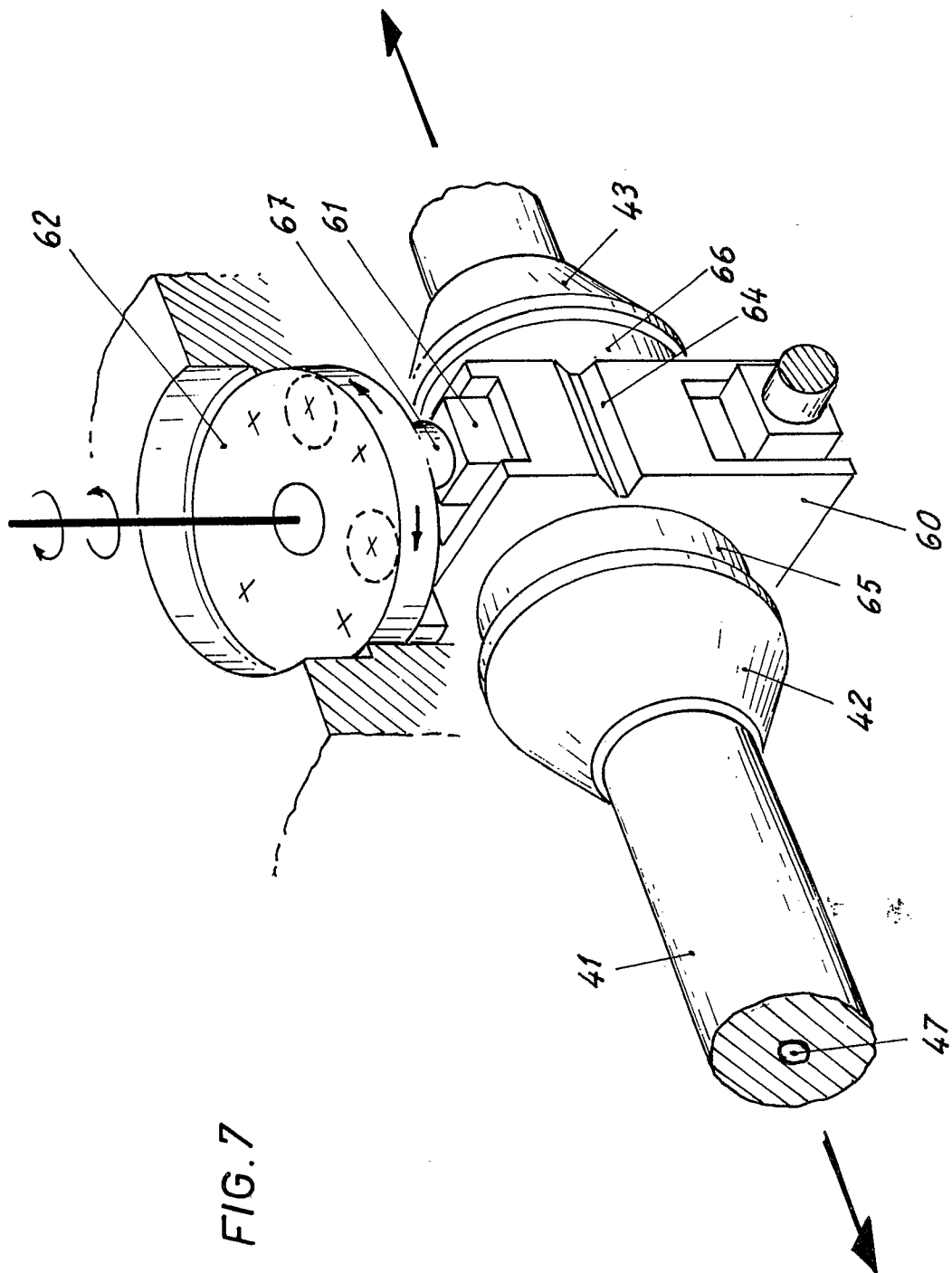


FIG. 9







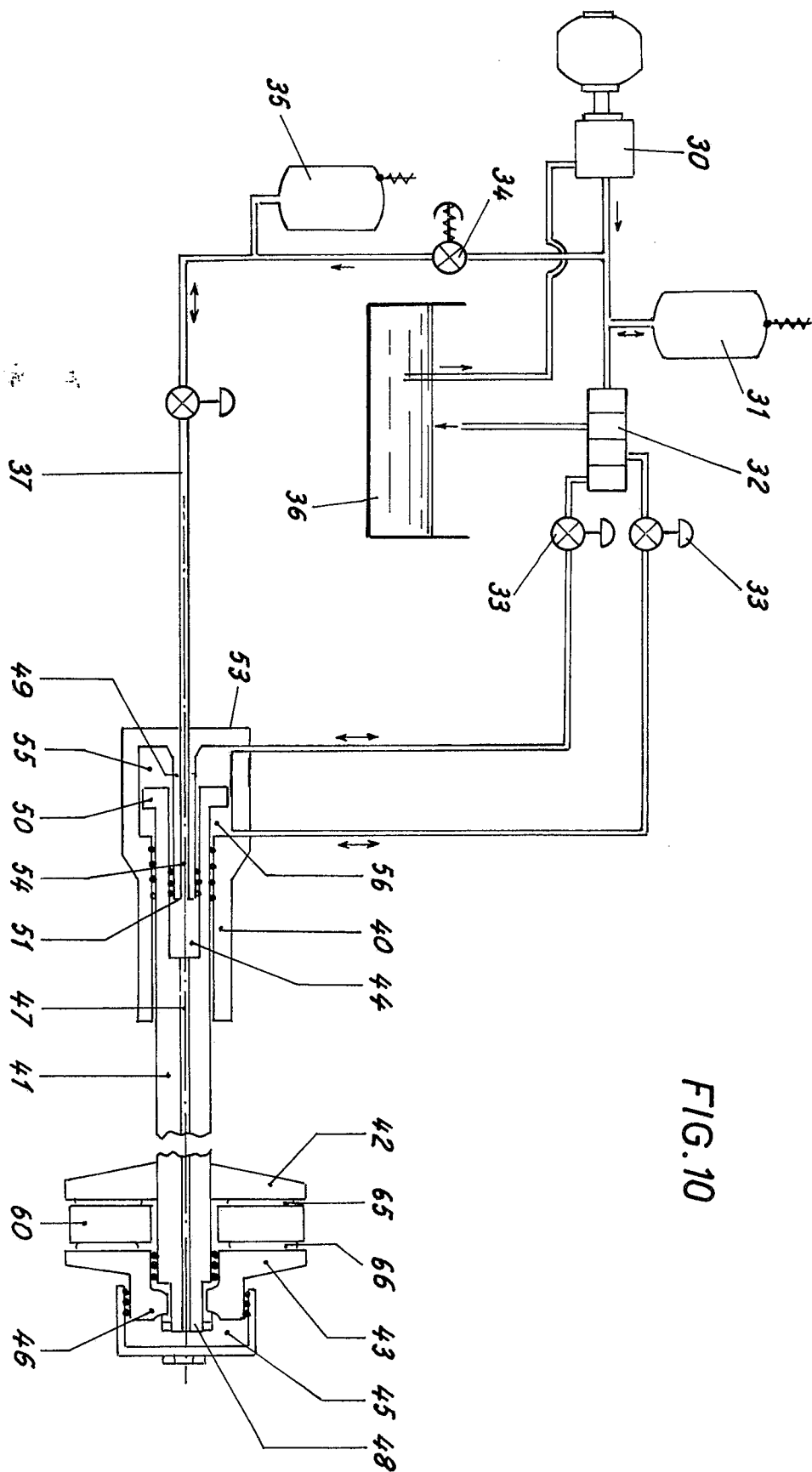


FIG. 10



European Patent
Office

EUROPEAN SEARCH REPORT

Application Number

EP 88 83 0294

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)
X,D	US-A-2 317 196 (HUSTED) * Whole document * ---	1,2	B 63 H 3/08 B 63 B 3/40
X,D	GB-A- 446 838 (MAYO) * Whole document * ---	1,2	
X,D	US-A-2 931 443 (PEHRSSON) * Whole document * ---	1,4,5,6	
A,D	FR-A-2 044 651 (WIECZOREK) ---		
A,D	WO-A-8 001 373 (GLÖTZER) ---		
A,D	FR-A- 844 151 (SELDEN) -----		
			TECHNICAL FIELDS SEARCHED (Int. Cl.4)
			B 63 B B 63 H
The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 22-09-1988	Examiner DE SCHEPPER H.P.H.
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			