



(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
07.05.2014 Bulletin 2014/19

(51) Int Cl.:
B63H 5/125 (2006.01)

(21) Application number: **13190232.2**

(22) Date of filing: **25.10.2013**

(84) Designated Contracting States:
AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR
Designated Extension States:
BA ME

(72) Inventor: **Bava, Giuseppe**
Milano (IT)

(74) Representative: **Corradini, Corrado et al**
Ing. C. Corradini & C. S.r.l.
Via Dante Alighieri 4
IT-42121 Reggio Emilia (IT)

(30) Priority: **30.10.2012 IT RE20120075**

(71) Applicant: **Lombardini S.r.l.**
42124 Reggio Emilia (IT)

Remarks:

The application is published incomplete as filed (Rule 68(1) EPC).

(54) **A Device for Propelling Marine Vessels**

(57) A device (100) for propelling marine vessels comprising at least a propulsion group (105) provided with a marine propeller (115) and a motor (120) suitable for rotating the propeller (115), first movement means (170, 195, 200, 220, 225) suitable for moving the propulsion group (105) along a translation direction which is perpendicular to an axis of rotation (X) of the propeller (115), and second movement means (210, 280, 285, 310) suitable for moving the propulsion group (105) about an axis (Y) that is parallel to the translation direction.

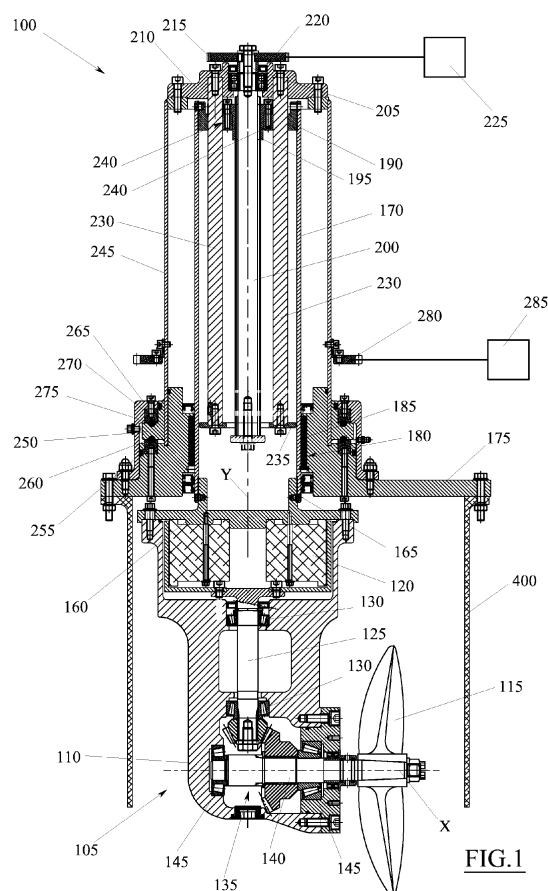


FIG.1

Description

[0001] The invention relates to a device for propelling marine vessels, in particular for the auxiliary propulsion of sailboats.

[0002] As is known, sailboats are generally provided with at least a motorised propulsion group, which is used for navigation when climatic conditions do not permit sailing, and also for manoeuvring within ports.

[0003] This propulsion group essentially comprises a motor, for example an internal combustion engine or an electric motor, and a marine propeller, which is connected to the motor by a suitable transmission system, such that the propeller can be driven to rotate about the axis thereof.

[0004] Some propulsion groups comprise a motor body, which is mounted outboard in the stern area of the vessel, and upon which motor, propeller and relative transmission system are mounted.

[0005] A drawback of this solution is that the outboard propulsion group and the relative controls take up a significant amount of space in the stern area of the vessel, where the tiller and other control organs of the vessel are usually located. Further, outboard propulsion groups also have the drawback of always being in sight, thus compromising the external appearance of the sailboat. To obviate these drawbacks, other propulsion groups are known, the motor of which is mounted inboard and is suitable for powering a propeller supported by a vertical support, commonly known as the tail, which is attached in the stern area, below the keel of the sailboat.

[0006] A drawback of this second solution is that the tail bearing the propeller is generally fixed, thus constituting a friction element which slows the sailboat when navigating under sail, while being unable to steer the vessel when manoeuvring, which operations can therefore only be performed using the tiller, with the result that some manoeuvres can become highly complicated and laborious, especially when they have to be performed in port areas.

[0007] An aim of the present invention is to obviate the above-mentioned drawbacks in the prior art, with a simple, rational and relatively inexpensive solution. These and other aims are attained thanks to the characteristics of the invention of independent claim 1. The dependent claims delineate preferred and/or particularly advantageous aspects of the invention.

[0008] In particular, an embodiment of this invention discloses a propulsion device for marine vessels comprising at least a propulsion group provided with a marine propeller and with a motor able to rotate the propeller, first movement means able to move the propulsion group in a translation direction which is perpendicular to the propeller's axis of rotation, and second movement means which are able to move the propulsion group about an axis which is parallel to the translation direction.

[0009] Thanks to this solution, the propulsion group can be advantageously shifted between a raised position,

in which the propulsion group can be received inside the vessel's keel, and a lowered position, in which the propulsion group is immersed in the water to enable the vessel to advance.

[0010] In particular, the propulsion group can be lowered only when it is necessary to generate auxiliary propulsion for navigation or manoeuvring, the propulsion group being maintained in a raised position in all other cases, for example, when navigating under sail.

[0011] When the propulsion group is in a lowered position, the proposed solution further enables orientating the propulsion group with respect to an axis of rotation which is parallel to the translation direction.

[0012] In this way, the propulsion group can advantageously be used to steer the vessel, thus facilitating manoeuvring.

[0013] In an aspect of the invention, the motor of the propulsion group can be an electric motor.

[0014] This aspect has the advantage of reducing the space occupied by the motor and eliminating pollutant emissions linked to operation of the propulsion group.

[0015] In another aspect of the invention, the propeller can be keyed directly to the motor drive shaft.

[0016] This advantageously simplifies the mechanical architecture of the propulsion group.

[0017] Alternatively, the propeller can be keyed to a support shaft, which is perpendicular to the drive shaft and is kinematically connected to the drive shaft by a transmission group.

[0018] In this way, the motor can be advantageously positioned at a higher level than the propeller, thus improving motor cooling and facilitating any necessary maintenance work.

[0019] In a further aspect of the invention, the first movement means of the propulsion group can comprise a threaded shaft exhibiting an axis of rotation which is parallel to the direction of translation, a locknut which is screwed on the threaded shaft and solidly connected to the propulsion group, guide means coupled to the locknut such that the locknut is prevented from rotating about the threaded shaft, and movement means which can set the threaded shaft in rotation.

[0020] This solution has the advantage of being rather simple and of conferring a quite gradual translation motion to the propulsion group.

[0021] In particular, the locknut can be connected to the propulsion group by a hollow cylinder which is coaxial with the threaded shaft, exhibiting an end constrained to the locknut and an opposite end fixed to the propulsion group. The guide means of the locknut can comprise one or more rods arranged parallel by a flank of the threaded shaft, each of which is housed in a gap between the threaded shaft and the hollow cylinder and is slidably inserted in a respective through-hole afforded in the body of the locknut.

[0022] With this solution, the hollow connecting cylinder between the locknut and the propulsion group exhibits a rather large diameter and is therefore able to present

a rather high resistance to the thrust the water exerts on the propulsion group in the lowered position. The disclosed solution is therefore advantageous as it provides a more rigid and stable support for the propulsion group, while remaining a very compact and modestly dimensioned structure.

[0023] At the same time, this mechanical architecture enables hermetically isolating all the device with respect to the possible infiltrations of water, with a relatively simple and economical system of seals.

[0024] In an aspect of the invention, the activating means of the threaded shaft can comprise an electric motor which is connected to the threaded shaft by a suitable transmission system.

[0025] In particular, the activating means of the threaded shaft can be located externally of a protective casing which closes the locknut, the relative guide means and at least a portion of the threaded shaft, which can naturally partially project externally for connection with the activating means.

[0026] In this way, the motor and/o the other means for activating the lowering and the raising of the propulsion group can be located relatively distant from the water, in a position in which they are more protected and therefore more subject to damage. In case of failure, these activating organs can also be more easily replaced. For example, the motor might be provisionally replaced with other manual activating organs, for example with a crank or the like, which in an emergency enable lowering and raising of the propulsion group.

[0027] In a further aspect of the invention, the second movement means are capable of rotating the guide means of the locknut about the axis of the threaded shaft.

[0028] For example, the second movement means can generally comprise a connecting element which is constrained to the guide means and is rotatably associated to the threaded shaft about an axis of rotation coinciding with the axis of the threaded shaft, and activating means able to make the connecting element rotate with respect to the threaded shaft.

[0029] In this way, the locknut is forced to rotate together with the relative guide means, thus also drawing the propulsion group in rotation.

[0030] The activating means of the connecting element can comprise a further electric motor, which is connected to the connecting element by a suitable transmission system.

[0031] In this case too, in an aspect of the invention the activating means of the connecting element can be located externally of a protective casing that closes the locknut, the relative guide means and at least a portion of the threaded shaft.

[0032] In this way, the motor and/or the other means for activating the rotation of the propulsion group might also be located relatively far from the water, in a position in which they are protected and therefore less subject to damage.

[0033] In cases of malfunctioning, these activating or-

gans can further be easily replaced. For example, the motor might be provisionally replaced with other manually activated organs, for example with a crank or the like, which in an emergency enable rotation of the propulsion group.

[0034] In an aspect of the invention, the connecting element can be fixed to the top of a hollow cylinder which coaxially surrounds the threaded shaft and can rotate about the threaded shaft together with the connecting element.

[0035] In this way it is advantageously possible to connect the activating means (for example the motor) directly to the hollow cylinder, which also functions as a protective element, thus improving the layout of the device.

[0036] Alternatively, the connecting element can be rotatably coupled to the top of a hollow cylinder, which coaxially surrounds the threaded shaft but can remain stationary with respect to the rotation of the connecting element.

[0037] In this way, the hollow cylinder can advantageously act as a protective element which substantially encloses all the moving parts of the device.

[0038] In a further aspect of the invention, the threaded shaft can be internally hollow and the propulsion group can comprise one or more electrical cables for supplying the motor, which cables pass along the internal cavity of the threaded shaft.

[0039] This aspect of the invention provides a valid solution for enabling supply of the motor of the propulsion group, which does not require complicated technical specifications for guaranteeing the hermetic seal of the whole system. A further important advantage of this solution consists in the fact that when the motor propulsion group rotates about the axis of the threaded shaft (it can rotate by 360 degrees) or vertically translates, the electric cables, being coaxially arranged, are subjected to the minimal movements and therefore also equally small amounts of stress.

[0040] In another aspect of the invention, the motor of the propulsion group can be a reversible electrical machine, which is mechanically connected to the propeller and which can function both as an electric motor and as a generator.

[0041] In this way, it is advantageously possible to use the propulsion group to transform part of the mechanical energy produced by the motion of the vessel into electrical energy, for example when the vessel is navigating under sail.

[0042] To obtain this effect, the device can comprise suitable control means which are configured to use the electric machine alternatively as a motor to rotate the propeller in the water, and as a generator, to convert the mechanical energy of the propeller into electrical energy.

[0043] The control means can preferably be configured to use the electrical apparatus as a generator, after having commanded the first movement means to move the propulsion group into a lowered position and the second movement means to rotate the propulsion group (for ex-

ample by 180°) such as to orientate the propeller in a direction which is substantially opposite to the vessel's advancement direction.

[0044] In this way, the propeller is rotated more efficiently by the water in which it is immersed, thus increasing the obtainable electrical energy.

[0045] Consistently with the foregoing, the device can further comprise an electrical storage system, typically one or more batteries, configured such as to accumulate the electrical energy produced by the electric machine when the electric machine is in use as a generator.

[0046] In particular, the electrical storage system can be configured such as to power the electric machine when in use as a motor.

[0047] A further embodiment of the invention discloses a vessel comprising the above-delineated propulsion device.

[0048] Further characteristics and advantages of the invention will emerge from the following description, which is provided by way of a non-limiting example, with the aid of the appended drawings.

Figure 1 is a section view of a propulsion device for marine vessels in a first embodiment of the invention.

Figure 2 is a section view of a propulsion device for marine vessels in a second embodiment of the invention

Figure 3 is a section view of a propulsion device for marine vessels in a third embodiment of the invention.

[0049] All the appended figures show a propulsion device 100, which is destined to be installed on board a marine vessel, preferably on board a sailboat and preferably in the stern area.

[0050] Firstly, the propulsion device 100 comprises a motorised propulsion group 105, which is capable of generating mechanical power to enable a vessel to move. The motorised propulsion group 105 generally comprises an internally hollow support body 110, commonly known as the "tail", a marine propeller 115 which is rotatably coupled to the outside of the support body 110, which marine propeller 115 can rotate about a central axis X thereof, and a motor 120 housed internally of the support body 110 and mechanically linked to the propeller 115, such that the propeller can be made to rotate by the motor 120.

[0051] The motor 120 can be an electric motor, for example a motor with permanent magnets. The power of the motor 120 depends in general on the type of vessel to which the propulsion device 100 is destined. For medium-sized sail-boats, the motor 120 can indicatively deliver between 7kW and 25kW of power with a supply tension of 410 volts.

[0052] In the example illustrated in figure 1, the motor 120 is positioned in the upper part of the support body 110, at a higher level than the propeller 115. The motor 120 comprises a rotor which can rotate about an axis of

rotation that is perpendicular to the axis of rotation X of the propeller 115. A drive shaft 125 is coaxially constrained to the rotor, the drive shaft 125 being rotatably supported internally of the support body 110 by a pair of bearings 130. The drive shaft 125 is connected by a bevel gear 135 to a transmission shaft 140 which is perpendicular to the drive shaft 125, the transmission shaft 140 being rotatably supported internally of the support body 110 by a further pair of bearings 145. The propeller 115 is keyed to an end of the transmission shaft 140, which end projects externally from the support body 110.

[0053] In the example of figure 2, the motor 120 is located in the lower part of the support body 110 and comprises a rotor which can rotate about an axis coinciding with the axis of rotation X of the propeller 115. A drive shaft 150 is coaxially keyed to the rotor, the drive shaft 150 being rotatably supported inside the support body 110 by a pair of bearings 155. The propeller 115 is keyed directly to an end of the drive shaft 150, which end projects externally from the support body 110.

[0054] This second embodiment of the motorised propulsion group 105 has the advantage of simplifying the transmission system between the motor 120 and the propeller 115. Instead the first embodiment, which is shown in figure 1, has the advantage of facilitating maintenance of the motor 120 and improving cooling of the motor 120 during operation.

[0055] In both embodiments, the motorised propulsion group 105 comprises a flange 160, which is fixed to the upper part of the support body 110. The flange 160 centrally exhibits a cylindrical tubular shank 165, the axis of which is oriented perpendicularly to the axis of rotation of the propeller 115. The lower end of a cylindrical tube 170 is inserted in the tubular shank 165 and is axially and rotatably constrained to the tubular shank 165.

[0056] The cylindrical tube 170 is slidably coupled with a support 175, the support 175 being positioned above the motorised propulsion group 105 and destined to be attached to the vessel. In more detail, the cylindrical tube 170 is coaxially inserted in a through hole 180 afforded in the support 175, such that the cylindrical tube 170 can slide with respect to the support 175 in a vertical direction which is defined by a central axis Y. A guide bushing 185 and a group of seals can be coaxially interposed between the cylindrical tube 170 and the through hole 180.

[0057] With these simple seals between the support 175 and the cylindrical tube 180, a complete hermetic separation is advantageously obtained between the aquatic ambient in which the motorized propulsion means 105 is immersed and the inside of the device 100 and therefore the vessel to which it is applied.

[0058] The upper end of the cylindrical tube 170 is closed by a ring nut 190, which is axially and rotatably constrained to the cylindrical tube 170. The ring nut 190 provides an internally threaded central bushing 195, which is arranged coaxially with the cylindrical tube 170. A threaded shaft 200 is screwed into the threaded bushing 195, giving rise overall to a screw-locknut mechanical

couple with an axis of rotation coinciding with a central axis Y.

[0059] The threaded shaft 200 is superiorly provided with a coaxial cylindrical shank 205, which is rotatably coupled with, and axially constrained to a connecting element 210 which is positioned above the cylindrical tube 170. In more detail, the cylindrical shank 205 is inserted in a through-hole of the connecting element 210, it is supported by a bearing 215, an inner ring of which is axially blocked on the cylindrical shank 205, while the outer ring is axially blocked in the hole of the connecting element 210.

[0060] The cylindrical shank 205 exhibits a portion projecting above the connecting element 210, to which portion a cogwheel 220 is coaxially keyed. Using suitable transmission means, the cogwheel 220 can be mechanically connected to a motor 225 such as to rotate the threaded shaft 200. The motor 225 and the transmission means are of a known type and are therefore shown only schematically. In general, the motor 225 can be an electric motor, for example a direct current electric motor delivering power supplied at a tension of 12 or 24 Volts and delivering power at about 150 watts.

[0061] The device 100 further comprises a group of guide rods 230 which are orientated parallel to the threaded shaft 200 and arranged circumferentially about the threaded shaft 200. The guide rods 230 are received in the gap between the threaded shaft 200 and the cylindrical tube 170, and are superiorly constrained to the connecting element 210.

[0062] More in detail, the upper ends of the guide rods 230 are singly constrained to the connecting element 210 by a respective screw, while their lower ends are screwed to a single bottom ring 235, the outer diameter of which is substantially the same, preferably with a little play (for example around 1 mm), as the inner diameter of the cylindrical tube 170 in which the ring 235 is coaxially inserted.

[0063] Each guide rod 230 is slidably inserted in a respective through hole 240 of the ring nut 190. In this way, the ring nut 190 and the relative threaded bushing 195 are free to slide along a direction defined by the axis of the threaded shaft 200, but are rotatably constrained to the connecting element 210.

[0064] In the examples shown in figures 1 and 2, the connecting element 210 substantially exhibits the shape of a disc-like plate, which is constrained to the top of a further cylindrical tube 245. The further cylindrical tube 245 is arranged coaxially with the threaded shaft 200, externally surrounds the cylindrical tube 170, and is coupled with the support 175, such that the cylindrical tube 170 can rotate about its own axis.

[0065] In this way, the cylindrical tube 245 also functions as a protective casing for the other elements contained therein.

[0066] In the illustrated example, the coupling is achieved using a coaxial flange 250, which is welded to the lower end of the cylindrical tube 245. The flange 250

projects radially and externally, resting on the support 175 by means of the interposing of a first axial thrust bearing. The first axial thrust bearing is defined by a lower ring 255 fixed to the support 175, and by a crown bearing 260 directly interposed between the lower ring 255 and the flange 250. A ring nut 265 is further constrained to the support 175, the ring nut 265 being coaxially inserted in the cylindrical tube 245 and exhibiting an annular abutment which surmounts the flange 250. A second axial thrust bearing is interposed between the abutment and the flange 250, defined by an upper ring 270 constrained to the ring nut 265, and a crown bearing 275 which is directly interposed between the upper ring 270 and the flange 250.

[0067] A crown gear 280 is externally constrained coaxially to the cylindrical tube 245. By means of suitable transmission means, the crown gear 280 can be mechanically connected to a motor 285 in order to rotate the cylindrical tube 245 and consequently the connecting element 210. The motor 285 and the transmission means are of known type and are therefore only schematically illustrated. In general, the motor 285 can be an electric motor, for example a direct current electric motor delivering power of around 150 watts and supplied at a tension of 12 or 24 volts.

[0068] Note that thanks to this solution, the motors 225 and 185 (with the relative gearings 220 and 280) are both external of the cylindrical protection tube 245, so that they are relatively distant from the water, in a position in which they are more protected and therefore less subject to damage. In case of malfunctioning, the motors 225 and 285 can further be more easily replaced or provisionally replaced by other manual actuation organs, for example with a crank or the like, which in an emergency further enable moving the motorized propulsion group 105.

[0069] The embodiment illustrated in figure 3 differs from the previously-described embodiments in that the support 175 comprises a cylindrical portion 290 which is arranged coaxially with, and surrounds the cylindrical tube 170, so as to function as a protection casing. The top of the cylindrical portion 290 is closed by a cover 295. The connecting element 210 which bears the guide rods 230 is rotatably coupled with and axially constrained to both the shank 205 of the threaded shaft 200 and the cover 259, such that the connecting element 210 can rotate with respect to both the shank 205 and the cover 295, about the axis Y of the threaded shaft 200.

[0070] In particular, the connecting element 210 is shaped as a substantially cylindrical bushing, which is coaxially inserted on the shank 205 and internally of a through-hole which is afforded centrally in the cover 295, where it is supported by a bearing 300, the inner ring of which is axially blocked on the connecting element 210, while the outer ring is axially blocked in the hole of the cover 295. The connecting element 210 exhibits a lower end, to which an annular flange 305, destined to bear the guide rods 230, is constrained, and an upper end, which

projects above the cover 295. A cogwheel 310 is coaxially keyed to the upper end, which cogwheel 310 is interposed between the cover 295 and the cogwheel 220 of the threaded shaft 200, and in any case is external of the protection casing. By means of suitable transmission means, the cogwheel 310 can be mechanically connected to the motor 285 in order to set the connecting element 210 directly in rotation. In this case too, the motors 225 and 285 (with the relative gearings 220 and 310) are both external of the protection cylinder 290, so that they are relatively far from the water, in a position in which they are more protected and therefore less subject to damage and more easily replaceable.

[0071] With respect to the embodiment shown in figures 1 and 2, this second solution has the advantage of protecting the cylindrical tube 170 internally of the cylindrical portion 290 of the support 175. On the other hand, the embodiment shown in figures 1 and 2 has the advantage of enabling the space to be better utilised.

[0072] In the embodiment of figure 3 (but the same concept might also be applied to the other embodiments), the threaded shaft 200 is internally hollow, so as to define a central conduit 500 open at both ends that, passing internally of the cylindrical tube 170, places the motorized propulsion group 105 in communication with the outside of the device 100. The electric cables 505 for supplying the engine 120 of the motorized propulsion group 105 can be housed internally of the central conduit 500, so as to be able to connect it with an external supply source in a very simple way and without interfering either with the movement or with the hermetic seal of the system.

[0073] In particular, during the rotations of the motorized propulsion group 105 about the central axis Y, as well as during the raising and lowering thereof, the electric cables 505, being substantially coaxial to the rotation/translation axis Y, are subjected to limited movements and therefore equally limited amounts of stress.

[0074] Note that although the embodiment shown in figure 3 comprises the motorised propulsion group 105 which is shown in figure 1, the motorised propulsion group 105 could also be replaced by the group shown in figure 2.

[0075] In all the shown embodiments, the motor 120 of the motorised propulsion group 105 can be powered by an electrical generator (not shown) installed on board the vessel. The motors 225 and 285 can be powered by a pack of batteries (not shown), for example a pack of Lithium batteries, which are also installed on board the vessel. The batteries can be recharged by an electrical generator, or by systems exploiting renewable forms of energy, such as solar panels or wind turbines. The batteries can also be recharged via an electric socket which can be connected to the electricity grid, generally available on quays in ports.

[0076] The motors 120, 225 and 285 can be connected to an electronic control and management unit (not shown), for example an electronic control panel, which is also connected to the generator and the various battery

recharging organs and can manage both the operations of the motors, and battery recharging.

[0077] The control unit is generally also connected to a plurality of encoders, each of which is associated to a respective motor 120, 225 and 285, thus making it possible to know at all times the position of the organs which are controlled by the control unit.

[0078] As mentioned in the preamble, the propulsion device 100 is destined to be installed on a marine vessel, preferably in the stern area. In more detail, the propulsion device 100 is fixed on board the vessel by means of the support 175. The support 175 is positioned such that the axis Y of the cylindrical tube 170 is substantially vertical and the axis X of the propeller 115 is substantially horizontal.

[0079] The functioning of the propulsion device 100 can be described with reference to the configuration shown in all the appended drawings, in which the motorised propulsion group 105 is in a raised position and exhibits a preset neutral orientation. In the raised position, the motorised propulsion group 105 is out of the water, for example accommodated in the vessel's keel and/or inside a protective guard 400 which can be attached below the support 175.

[0080] Starting from this configuration, when it becomes necessary to propel the vessel, the control unit can activate the motor 225, leaving the motor 285 inactive. In this way, the threaded shaft 200 rotates about its own axis, while the connecting element 210 and the guide rods 230 of the ring nut 190 remain stationary. The rotation of the threaded shaft 200 is thus transformed into a downward translation of the ring nut 190, along a direction which is defined by the axis Y of the threaded shaft 200. The translation of the ring nut 190 also causes the simultaneous downward translation of the cylindrical tube 170 and consequently of the motorised propulsion group 105.

[0081] This descending stage is halted when the motorised propulsion group 105 reaches a predetermined lowered position, in which the motorised propulsion group 105 has exited from the keel of the vessel and/or the protective casing 400, and the propeller is therefore immersed in the water. The downward travel of the motorised propulsion group 105 can be halted mechanically, when the ring nut 190 comes into contact with the ring 235 which is fixed at the lower end of the guide rods 230, or electronically, on the basis of signals coming from the encoder associated to the motor 225. By way of example, the downward travel of the motorised propulsion group 105 from the raised position to the lowered position can measure around 350-400mm.

[0082] When the motorised propulsion group 105 reaches the lowered position, it still exhibits a neutral orientation. In the neutral orientation, the propeller 115 is preferably facing towards the stern of the vessel, and is thus capable of providing the propulsion which is necessary for advancement.

[0083] To vary the orientation of the propeller 115, for example to impart a direction to the vessel and/or to fa-

facilitate manoeuvring in port, the control unit can activate the motor 285, while maintaining the motor 225 inactive. In this way, the threaded shaft 200 is forced to remain stationary, while the connecting element 210 and the guide rods 230 rotate about the axis of the threaded shaft 200, also drawing the ring nut 190 in rotation. Rotation of the ring nut 190 also causes the simultaneous rotation of the cylindrical tube 170 and consequently of the motorised propulsion group 105.

[0084] The motor 285 can rotate the motorised propulsion group 105, starting from the neutral orientation, up to a maximum of 180 degrees in a clockwise direction and 180 degrees in an anti-clockwise direction, such that the motorised propulsion group 105 can assume any desired orientation within the 360 degrees of rotation about the axis Y of the threaded shaft 200. The signals from the encoder associated to the motor 285 enable the controlled desired orientation to be reached.

[0085] When propulsion is no longer necessary, the control unit re-activates the motor 285, in order to rotate the motorised propulsion group 105 until the neutral orientation is re-attained. Once this orientation has been reached, the control unit can halt the motor 285 and activate the motor 225 so as to rotate the threaded shaft 200 in order to raise the motorised propulsion group 105 from the lowered position newly towards the raised position.

[0086] During functioning of the device 100, the control system can also implement a series of safety procedures which make use of the encoders associated to the motors 120, 225 and 285. A procedure can for example include preventing the rotation of the propeller 115 about its own X when the motorised propulsion group 105 is in the raised position. Another procedure includes allowing the motorised propulsion group 105 to be raised only when in the neutral orientation, and with the propeller 115 stationary.

[0087] The encoders which are associated to the motors can also be used as temperature sensors and the control unit can use the encoders to halt or prevent operation of the motors if overheating is detected.

[0088] Other safety procedures can be implemented with the aid of suitable moisture sensors which can be positioned in the portions of the device 100 which cannot be reached by water. For example, a moisture sensor could be positioned in the support body 110 of the motorised propulsion group 105, internally of the space destined to house the motor 120, such that the electronic unit could halt operation of the group should the motor 120 be reached by any seepage of water.

[0089] In a variant which can be applied to each of the above-described embodiments, the motor 120 can be a reversible electrical machine, for example with permanent magnets, which device can function both as an electric motor, rotating the propeller 115 (as previously described), and as an electric generator, transforming the rotation of the propeller 115 into electrical energy.

[0090] The electrical machine 12 can be connected to

a pack of batteries, for example a pack of Lithium batteries, which are also installed on board the vessel and which can also be capable of powering the motors 225 and 285.

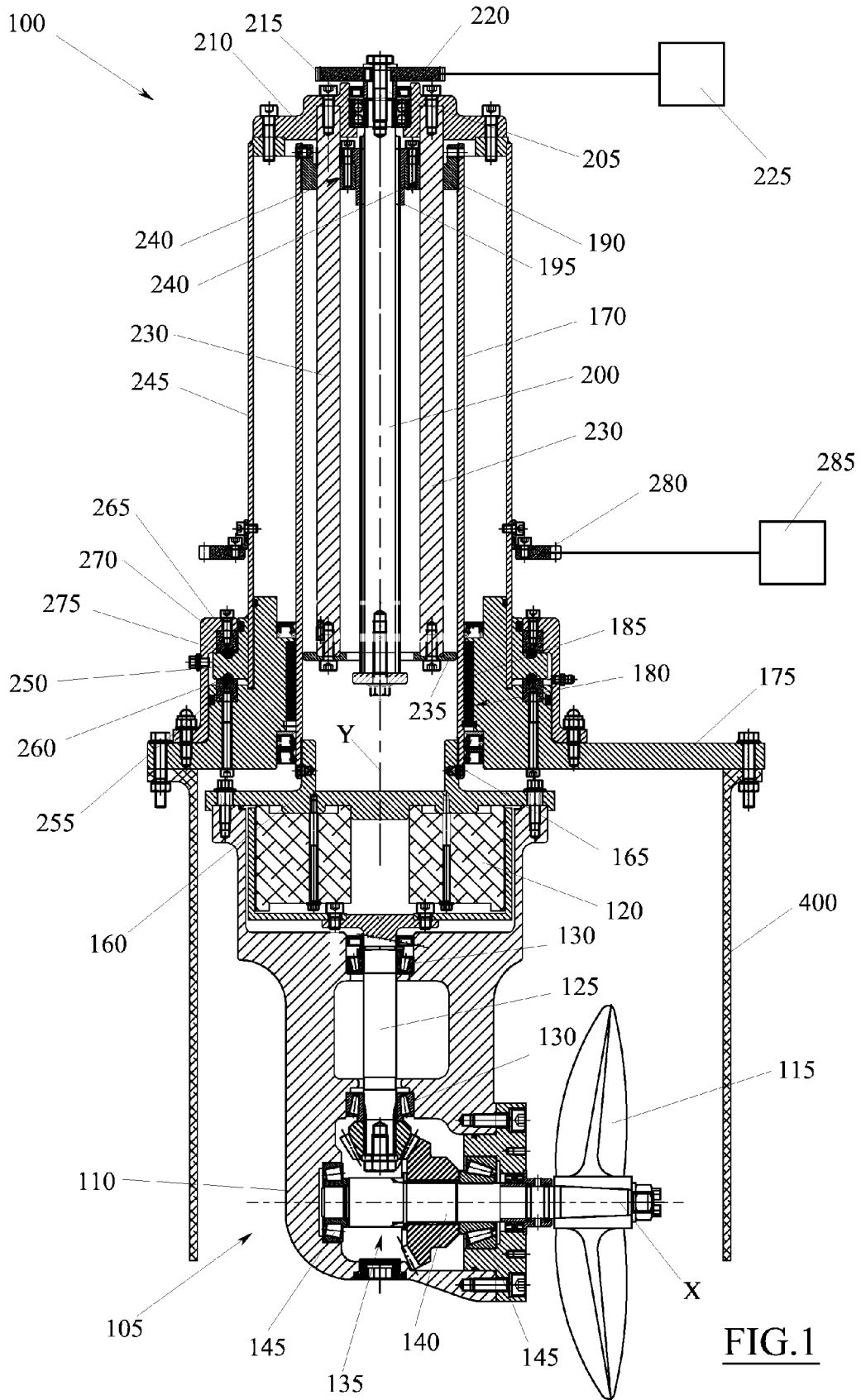
[0091] Thanks to this solution, when the vessel is navigating under sail, the control unit can maintain the motorised propulsion group 105 in, or return the motorised propulsion group 105 to the lowered position and activate the motor 285, in order to cause the motorised propulsion group 105 to rotate about the axis Y by 180 degrees with respect to the neutral orientation (either clockwise or anti-clockwise), until the opposite orientation is reached. With this orientation, the propeller 115 of the motorised propulsion group 105 is substantially facing in the opposite direction to the direction of advancement of the vessel. In this way, the propeller 115 is invested by a current of water caused by the vessel's motion and makes the propeller 115 rotate about its axis X. During this stage, the control unit can make the electrical apparatus 120 function as a generator, thus transforming the mechanical energy due to the rotation of the propeller 115 into electrical energy. The electrical energy which is produced during this generation stage can be used for any purpose, in particular to recharge the battery pack, which can then be used to power the motors 225 and 285, and also the electric machine 120 when functioning as a motor. Obviously a person skilled in the art can introduce numerous practical and applicational modifications can be introduced to the device propulsion without thereby forsaking the scope of the invention as claimed herein below.

Claims

1. A device (100) for propelling marine vessels comprising at least a propulsion group (105) provided with a marine propeller (115) and a motor (120) suitable for rotating the propeller (115), **characterised in that** it further comprises first movement means (170, 195, 200, 220, 225) suitable for moving the propulsion group (105) along a translation direction which is perpendicular to an axis of rotation (X) of the propeller (115), and second movement means (210, 280, 285, 310) which are suitable for moving the propulsion group (105) about an axis (Y) that is parallel to the translation direction.
2. The device (100) of claim 1, **characterised in that** the motor (120) is an electric motor.
3. The device (100) of claim 1 or 2, **characterised in that** the propeller (115) is keyed directly on a shaft (150) of the motor (120).
4. The device (100) of claim 1 or 2, **characterised in that** the propeller (115) is keyed to a support shaft (140), which is perpendicular to a shaft (125) of the motor (120) and is kinematically connected to the

motor (120) via a transmission group (135).

5. The device (100) of any one of the preceding claims, **characterised in that** the first movement means comprise at least a threaded shaft (200) exhibiting an axis of rotation (Y) which is parallel to the translation direction, a locknut (195) which is screwed on the threaded shaft (200) and solidly connected to the propulsion group (105), guide means (230) which are coupled with the locknut (195) such as to prevent the locknut (195) from rotating around the threaded shaft (200), and activating means (220, 225) which can set the threaded shaft (200) in rotation.
6. The device (100) of claim 5, **characterised in that** the locknut (195) is connected to the propulsion group (105) by means of a hollow cylinder (170) which is coaxial with the threaded shaft (200), which hollow cylinder (170) exhibits an end which is attached to the locknut (195) and an opposite end which is attached to the propulsion group (105).
7. The device (100) of claim 6, **characterised in that** guide means of the locknut (195) comprise one or more rods (230) which are arranged parallel beside the threaded shaft (200), each of which rods (230) is housed in a gap between the threaded shaft (200) and the hollow cylinder (170) and is inserted in a respective through-hole afforded in the body of the locknut (195).
8. The device (100) of any one of claims from 5 to 7, **characterised in that** the activating means of the threaded shaft (200) comprise an electric motor (225).
9. The device (100) of any one of claims from 5 to 8, **characterised in that** the activating means (220, 225) of the threaded shaft (200) are located externally of a protection casing (345, 290) which encloses the locknut (195), the guide means (230) and at least a portion of the threaded shaft (200).
10. The device (100) of any one of claims from 5 to 9, **characterised in that** the second movement means (210, 280, 285, 310) are able to rotate the guide means (230) of the locknut (195) about the axis of the threaded shaft (200).
11. The device (100) of claim 10, **characterised in that** the second movement means comprise a connecting element (210), which is constrained to the guide means (230) and is rotatably associated to the threaded shaft (200) on an axis of rotation coinciding with the axis of the threaded shaft (200), and activating means (280, 285, 310) which are able to set the connecting element (210) in rotation with respect to the threaded shaft (200).
12. The device (100) of claim 11, **characterised in that** the activating means of the connecting element (210) comprise an electric motor (285).
13. The device (100) of claim 11 or 12, **characterised in that** the activating means (280, 285, 310) of the connecting element (210) are located externally of a protection casing (245, 290) which encloses the locknut (195), the relative guide means (230) and at least a portion of the threaded shaft (200).
14. The device (100) of any one of claims from 11 to 13, **characterised in that** the connecting element (210) is constrained to a top end of a hollow cylinder (245), which coaxially surrounds the threaded shaft (200) and is able to rotate about the threaded shaft (200) solidly with the connecting element (210).
15. The device (100) of any one of claims from 11 to 13, **characterised in that** the connecting element (210) is rotatably coupled with a top end of a hollow cylinder (290), which hollow cylinder (290) coaxially surrounds the threaded shaft (200) and will remain stationary with respect to the rotation of the connecting element (210).
16. The device (100) of any one of claims from 5 to 15, **characterised in that** the threaded shaft (200) is internally hollow, and **in that** the propulsion group (105) comprises one or more electric cables (505) for supplying the motor (120) which pass along the internal cavity (500) of the threaded shaft (200).
17. The device (100) of any one of the preceding claims, **characterised in that** the motor (120) is a reversible electrical machine which is mechanically connected to the propeller (115).
18. A vessel **characterised in that** it comprises a propulsion device of any of the preceding claims.



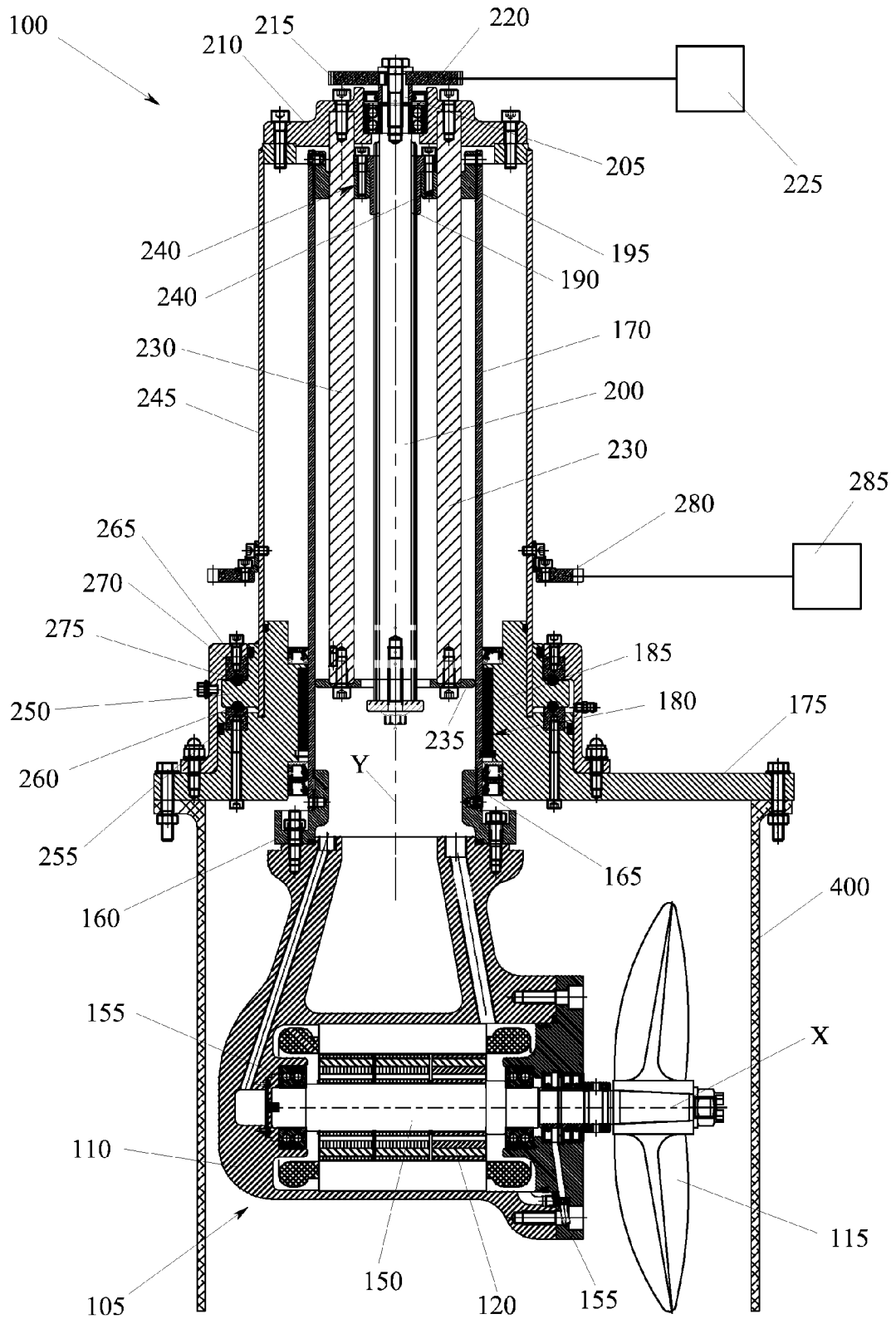
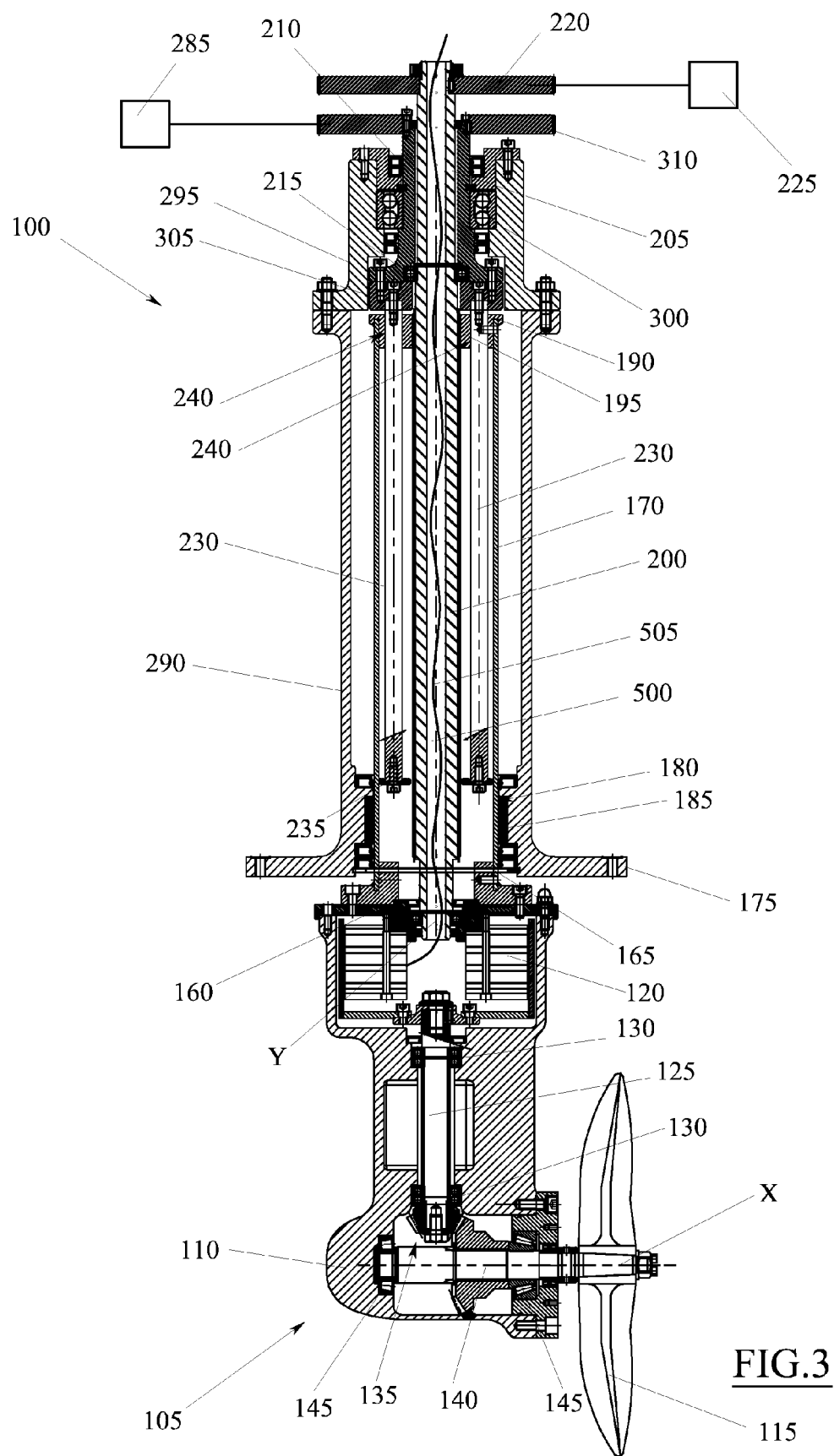


FIG.2





EUROPEAN SEARCH REPORT

Application Number
EP 13 19 0232

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	EP 2 463 195 A1 (HOWALDTSWERKE DEUTSCHE WERFT [DE]) 13 June 2012 (2012-06-13)	1,2,5-18	INV. B63H5/125
Y	* paragraph [0023]; claim 1; figures 10,11 *	3	
X	DE 201 00 671 U1 (BIESCHEWSKI LOTHAR [DE]) 19 April 2001 (2001-04-19) * the whole document *	1,2,5-18	
X	EP 2 210 809 A2 (KLINGENBURG GMBH [DE]) 28 July 2010 (2010-07-28) * the whole document *	1,2,5-18	
X	US 3 483 843 A (HAWTHORNE JAMES M) 16 December 1969 (1969-12-16) * column 4, line 24 - line 73; figures 1-5 *	1,2,4,5	
Y	DE 43 27 559 C1 (GLASER HORST [DE]) 9 February 1995 (1995-02-09) * figure 2 *	3	
A	US 3 807 347 A (BALDWIN W) 30 April 1974 (1974-04-30) * the whole document *	1-18	TECHNICAL FIELDS SEARCHED (IPC) B63H
The present search report has been drawn up for all claims			
Place of search The Hague		Date of completion of the search 30 January 2014	Examiner De Sena Hernandorena
<p>CATEGORY OF CITED DOCUMENTS</p> <p>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</p> <p>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</p>			

1
EPO FORM 1503 03.82 (P04C01)

**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

EP 13 19 0232

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
The members are as contained in the European Patent Office EDP file on
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

30-01-2014

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
EP 2463195 A1	13-06-2012	DE 102010054124 A1	14-06-2012
		EP 2463195 A1	13-06-2012
		ES 2408807 T3	21-06-2013
		KR 20120065259 A	20-06-2012
		PT 2463195 E	24-05-2013

DE 20100671 U1	19-04-2001	DE 10002655 A1	26-07-2001
		DE 20100671 U1	19-04-2001

EP 2210809 A2	28-07-2010	DE 202009000687 U1	10-06-2010
		EP 2210809 A2	28-07-2010

US 3483843 A	16-12-1969	NONE	

DE 4327559 C1	09-02-1995	NONE	

US 3807347 A	30-04-1974	NONE	
