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(71) Applicant: **ABB Oy**
00380 Helsinki (FI)

(72) Inventors:
- **Ostrow, Niko**
  00980 HELSINKI (FI)
- **Hemmilä, Pauli**
  00980 HELSINKI (FI)
- **Kukkonen, Vladimir**
  00980 HELSINKI (FI)

(54) **Ship control arrangement and method**

(57) A control arrangement of a ship, comprising a first azimuthing propulsion unit and first lever (202) for controlling the first azimuthing unit, and a second azimuthing propulsion unit and a second lever (204) for controlling the second azimuthing propulsion unit, wherein the control arrangement comprises a synchronous operation mode in which one of the first lever and second lever is a master lever, whose control gestures are followed by other lever being a slave lever. The synchronous mode is activated by effecting a control gesture on one of the first lever or the second lever, which thereby becomes the master lever.

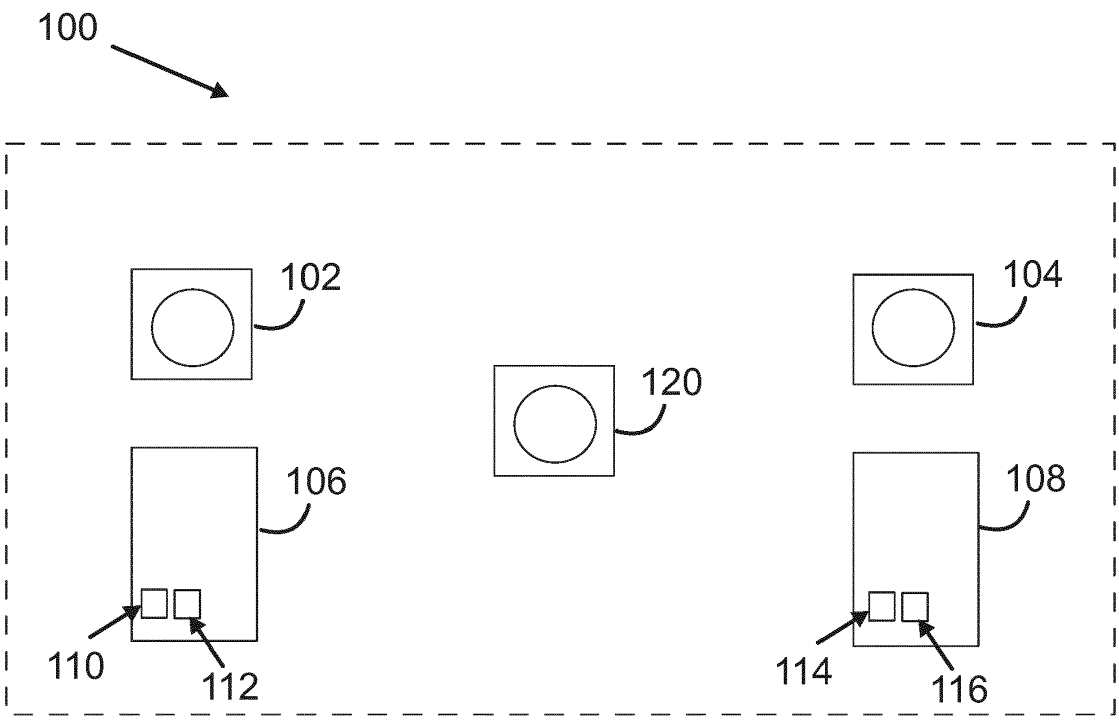

Fig. 1

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Description

FIELD

[0001] The present invention relates to controlling of a ship.

BACKGROUND

[0002] An azimuthing propulsion unit is a configuration of marine propellers that can be rotated horizontally to any angle. This gives the ship better maneuverability than a fixed propeller and rudder system.

[0003] Typically a ship has two azimuthing propulsion units adjacent to each other. Each azimuthing propulsion unit may have a manual controller such as a lever for controlling the orientation and propulsion power of the propulsion unit.

[0004] In addition to a separated mode where both propulsion units are operated separately by their respective levers, there has also been provided a synchronous mode where the levers are operatively connected so that a control operation/gesture performed on one of the levers (master lever) causes a similar control operation on the other lever (slave lever).

[0005] Figure 1 shows one example of a prior art bridge center 100 where all the control devices are arranged. The shown view is very much simplified such that only the relevant features have been shown.

[0006] There has been a port lever 102 for controlling the port azimuthing propulsion unit, and a starboard lever 104 for controlling the starboard propulsion unit. There are separate respective control panels 106, 108 for each lever. In the control panel there are typically provided push buttons for activating and deactivating the synchronous mode. The control panel 106 has an activation button 110 for activating the synchronous mode such that the lever 102 becomes the master lever and the lever 104 is the slave lever. The panel 108 has a similar button 114 for activating the synchronous mode such that the lever 104 becomes the master lever. The buttons 112 and 116 are provided for deactivating the synchronous mode whereby the system returns to a separated azimuthing propulsion mode where both propulsion units can be separately controlled by their respective levers 102, 104.

[0007] Figure 1 shows also a miniwheel 120 for providing an alternative for controlling the ship in the synchronous mode. Both panels 106 and 108 may have one or more buttons for activation and deactivation of such a control mode.

[0008] The selection mechanisms associated with the synchronous mode and separated mode have been complicated and may cause danger situations if the user in emergency situation cannot easily find the lever that is in command.

SUMMARY

[0009] An object of the present invention is to provide an apparatus and a method which are defined in the independent claims. Some embodiments are disclosed in the dependent claims.

DRAWINGS

[0010] In the following, the invention will be described in greater detail by means of some embodiments with reference to the accompanying drawing, in which

Figure 1 shows an example of an already explained prior art control bridge of a ship;
Figure 2 shows an embodiment according to the invention of a control board of a ship;
Figure 3 shows an embodiment of a state model of a control arrangement; and
Figure 4 shows an embodiment of a method.

DETAILED DESCRIPTION

[0011] The embodiments relate to a ship, and especially to a control arrangement for controlling the ship. The ship according to the embodiments comprises at least two azimuthing propulsion units. The azimuthing propulsion unit is arranged to a bottom of the ship and can be horizontally rotated as desired. There may be arranged a space to the bottom of the ship such that the azimuthing propulsion units fit within the outer dimensions of the ship even when rotated to any position. The azimuthing propulsion units may be arranged symmetrically adjacent to each other behind the skeg of the ship.

[0012] The azimuthing propulsion unit comprises a pod, which is fixedly arranged to a strut. The strut is arranged rotationally by a bearing/swivel unit to the bottom of the ship. The pod houses an electric propulsion motor for rotating a propeller fixed to a hub at the end of the pod. A shaft rotated by the electric motor is the same shaft that rotates the propeller or at least coaxial to it.

[0013] The control devices of the ship are typically arranged to one or more bridge centers. There may be, for instance, three such centers adjacent to each other, one in the middle and two on both sides the ship. The ship can be controlled from any of the bridge centers. The bridge centers can be mutually similar or there may be some differences between those. The main center in the middle may, for instance, be provided with all or at least most functionality whereas the bridge centers on the edges may be provided with more limited functionality.

[0014] Figure 2 shows an embodiment of a bridge center 200 according to the invention to be compared to the prior art bridge center 100 of Figure 1. To the bridge centre 200 belong a port azimuthing lever 202 and a starboard azimuthing lever 204.

[0015] Each lever is adapted for controlling both the orientation and the propulsion power of the azimuthing propulsion unit. From the initial orientation, the lever can typically be rotated 180 degrees, for instance, either clockwise or counter-clockwise. On top of the lever there may be slide controller for controlling the propulsion power (propeller revolution rate) of the propulsion unit. The slide controller can be set between 0 and 10 in the forward and backward directions, for instance.

[0016] Figure 2 shows also respective control panels 206 and 208 similarly as in Figure 1. However, the control panels are free from activation/deactivation buttons of the synchronous mode shown in Figure 1.

[0017] In the embodiments of the present invention, the activation and deactivation of the synchronous mode are carried out differently. On a coarse level, in the embodiments, the user may enter the synch mode by grabbing any of the two levers, which automatically becomes the master lever and the other lever starts following the master lever. The synch mode can be deactivated by grabbing both levers and turning them to different reference points.

[0018] Figure 3 illustrates one embodiment of a state model of the port and starboard levers. There are basically four operation states. In the "idle"-state it is undefined which lever is in control. In the "sync-port"-state the port lever is the master lever and in the "sync-stbd" the stardboard lever is the master lever. In "separate cntl"-state the levers are operated separately and there is no master-slave relationship between the two.

[0019] The "idle"-mode is the default mode in which the system is, for instance, at start when no operation has yet been carried out. In the state transition 340, the user performs a control gesture on the port lever, whereby the system enters automatically into a synchronous mode where the port lever is the master lever and the other lever the slave lever. The state transition 344 is similar but in the opposite way, that is the user first performs a control gesture on the starboard lever whereby it becomes the master lever. In the third option 354, the user grabs both levers simultaneously or within a predetermined time window whereby the system enters the separated mode where both levers control their respective propulsion units.

[0020] When the system is in the synchronous mode "sync-port" where the port lever is the master, there are two ways to exit this state.

[0021] In the first option 342, the system can return to the idle mode. This can be carried out for instance when a predetermined time has elapsed during which no control gestures have been carried out on the port lever. At shortest, the period can be some seconds.

[0022] For instance, when a gesture has been performed on the master lever, the slave lever may follow with a delay of a couple of seconds. When the delay has lapsed and the slave lever had time to complete the task that was previously performed on the master lever, the system will return to the idle state in which any lever can become master lever again.

[0023] In the second option, the system can perform a state transition 450 from the "sync-port" state to "separate cntl" by grabbing the starboard lever and turning it a different reference point than the port lever. The different reference points means here that the levers are rotated sufficiently, e.g. a predetermined angle to different orientations. This is an indication to the system to exit the synchronous mode and enter the separated mode.

[0024] From the separated mode back to synchronous mode can be entered via the idle mode. At first the levers can be rotated to same positions and the powers can be set to the same. When a predetermined time such as a few seconds has elapsed, the system returns to the idle mode where any of the levers can become the master lever again.

[0025] The state transitions 346 and 352 correspond to the respective state transitions 342 and 350.

[0026] In an embodiment, if the ship includes several control boards, the active control board may be selected by performing a control gesture on one of the control levers of the azimuthing propulsion unit. In such an embodiment, the control gesture may perform two tasks, that is, select the active control board, and activate a synch mode between the levers of the propulsion units.

[0027] Figure 4 shows one embodiment of a method. The method is applicable in controlling a ship having at least two azimuthing propulsion units each having a lever for controlling one or more control parameters of the propulsion unit. There are provided at least two operating states. In a synch mode, the propulsion units are operated such that at least one of their operating parameters is the same. The operating parameter can include an orientation angle and/or a revolution speed of a propeller of the propulsion unit.

[0028] In 400, the synch mode is activated by performing a control gesture on one of the control levers while leaving the other lever intact. The operated lever becomes automatically the master lever which is followed by the other lever. Steps 402 and 404 show an embodiment how the master lever can be changed. In 402, it is assumed that a control gesture, such as modification of the orientation angle and/or the revolution speed, has been performed on the master lever and the slave lever follows the control gesture. There may be a slight delay in how the slave lever follows the master lever. When the slave lever has completed the gesture previously performed on the master lever, the system enters into a state where any of the two levers can again be selected as a master lever. In 404, the other lever than the lever in step 400 is operated, whereby that lever becomes the master lever.

[0029] Step 406 highlights how the separated mode can be entered from the synch mode. In contrast to step 400, where the user has performed the control gestures on one of the levers only, the user now performs the control gestures on both levers. There may be a predefined threshold, such as an angle difference, which triggers the state transfer from the synch mode to the separated mode. The threshold value may be any value, such as 30 degrees, or 90 degrees, for instance. In the separated mode both propulsion units may be controlled independently from each other with their own respective levers.

[0030] It will be obvious to a person skilled in the art that, as the technology advances, the inventive concept can be implemented in various ways. The invention and its embodiments are not limited to the examples described above but may vary within the scope of the claims.

Claims

1. A control arrangement of a ship, comprising a first azimuthing propulsion unit and first lever (202) for controlling the first azimuthing unit, and a second azimuthing propulsion unit and a second lever (204) for controlling the second azimuthing propulsion unit, wherein the control arrangement comprises a synchronous operation mode in which one of the first lever and second lever is a master lever, whose control gestures are followed by other lever being a slave lever, **characterized in that** the synchronous mode is activated by effecting a control gesture on one of the first lever or the second lever, which thereby becomes the master lever.

2. A control arrangement according to claim 1, **characterized in that** each of the first lever (202) and the second lever (204) control as operating parameters at least one of the propulsion power and the orientation of the respective azimuthing propulsion unit.

3. A control arrangement according to any preceding claim, **characterized in that** the synchronous mode is entered from a state where both levers have similar operating parameters.

4. A control arrangement according to any preceding claim, **characterized in that** the control arrangement comprises a separated operation mode in which the first lever (202) controls only the first azimuthing propulsion unit and the second lever (204) controls only the second azimuthing propulsion unit.

5. A control arrangement according to any preceding claim, **characterized in that** the separated operation mode is activated by controlling both levers simultaneously.

6. A control arrangement according to any preceding claim, **characterized in that** the separated operation mode is entered from the synchronous operation mode by turning the levers (202, 204) to different operation points.

7. A control arrangement according to any preceding claim, **characterized in that** when the system is in the synchronous operation mode, the slave lever follows the master lever with a delay.

8. A control arrangement according to claim 7, **characterized in that** when the delay has lapsed, the lever being the master lever can changed as that lever on which a control gesture is given first, becomes the master lever.

9. A control arrangement according to any preceding claim, **characterized in that** the arrangement comprises at least two bridge control boards, wherein each bridge control board comprises a first lever (202) for controlling the first azimuthing propulsion unit and second lever (204) for controlling the second azimuthing unit.

10. A control arrangement according to claim 9, **characterized in that** an active bridge control board is selected from the at least two bridge control boards by providing a control gesture on the first lever and/or the second lever of the bridge control board to be activated.

11. A method of controlling two azimuthing propulsion units of a ship, wherein there is provided a control lever for controlling each respective azimuthing propulsion unit, wherein the azimuthing propulsion units can be operated in a synchronous operation mode where both azimuthing propulsion units can be controlled concurrently with a single control lever being one of the control levers for controlling one of the azimuthing propulsion units, or in a separated mode where the azimuthing propulsion units can be controlled independently from each other with their respective control levers, **characterized in that** the synchronous mode is activated (400) by effecting a control gesture on one of the control levers, which thereby becomes a master lever being in control for both azimuthing propulsion units.

12. A method according to claim 11, **characterized in that** the state transfer from the synchronous mode to the separated mode is performed by carrying out (406) control gestures on both levers simultaneously, which control gestures fulfil a predetermined condition.

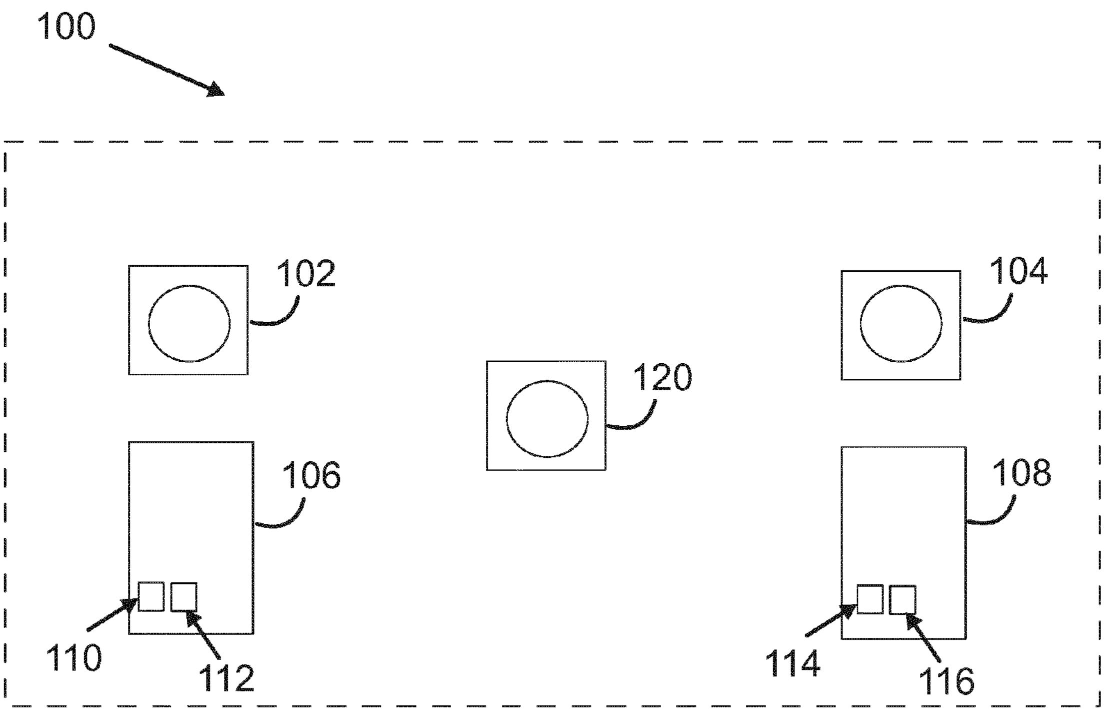


Fig. 1

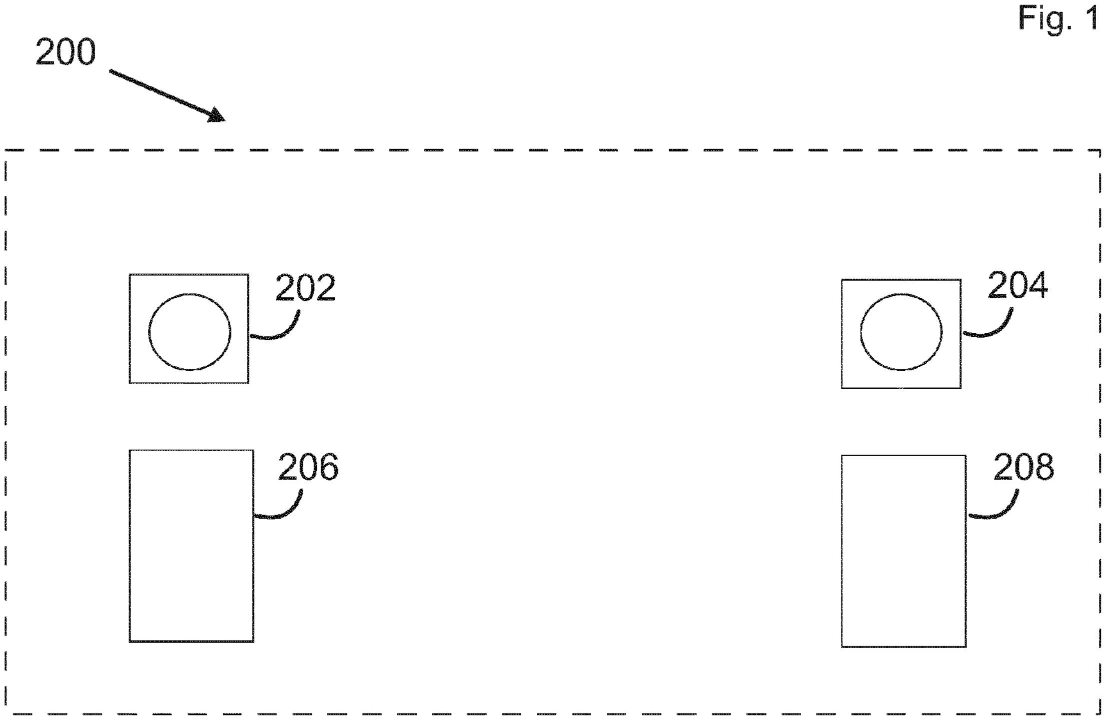
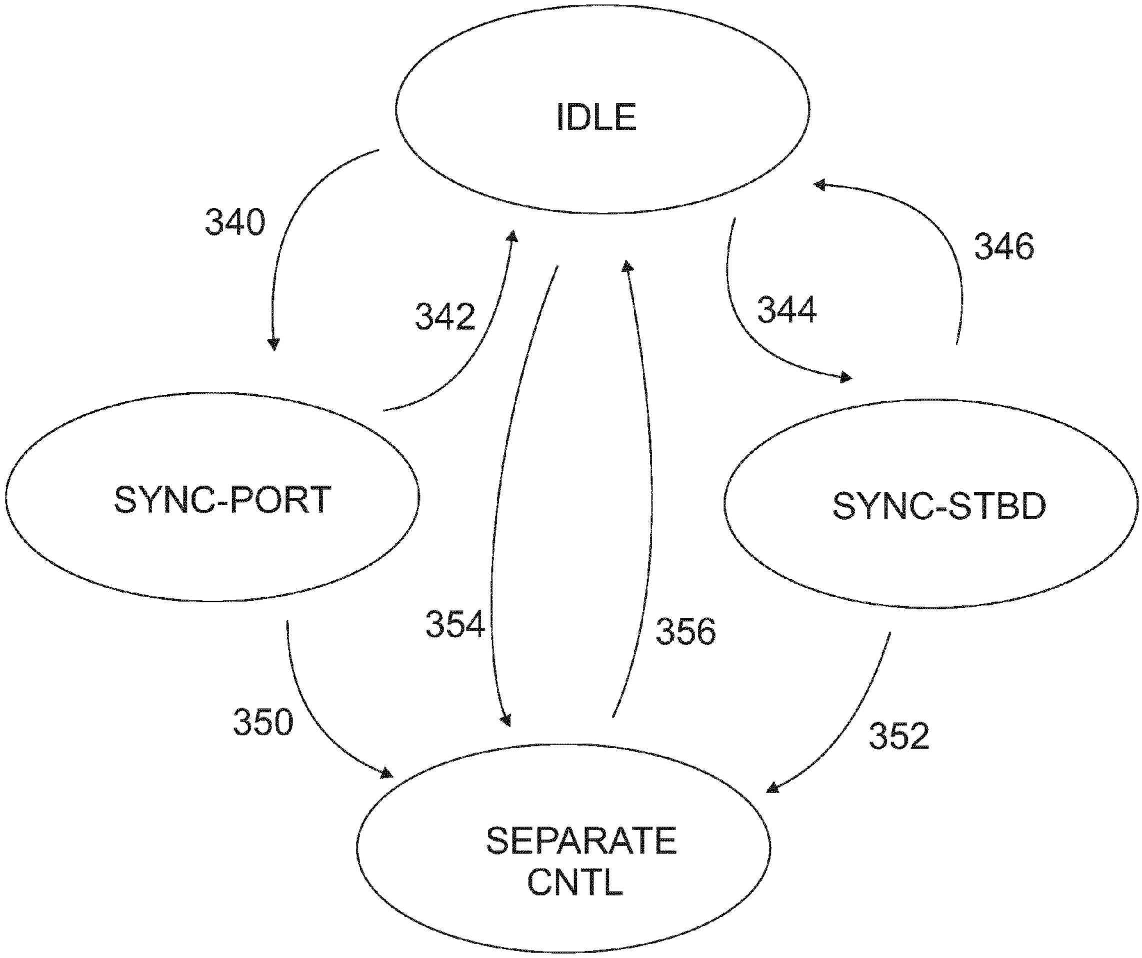


Fig. 2


IDLE
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342
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Fig. 3

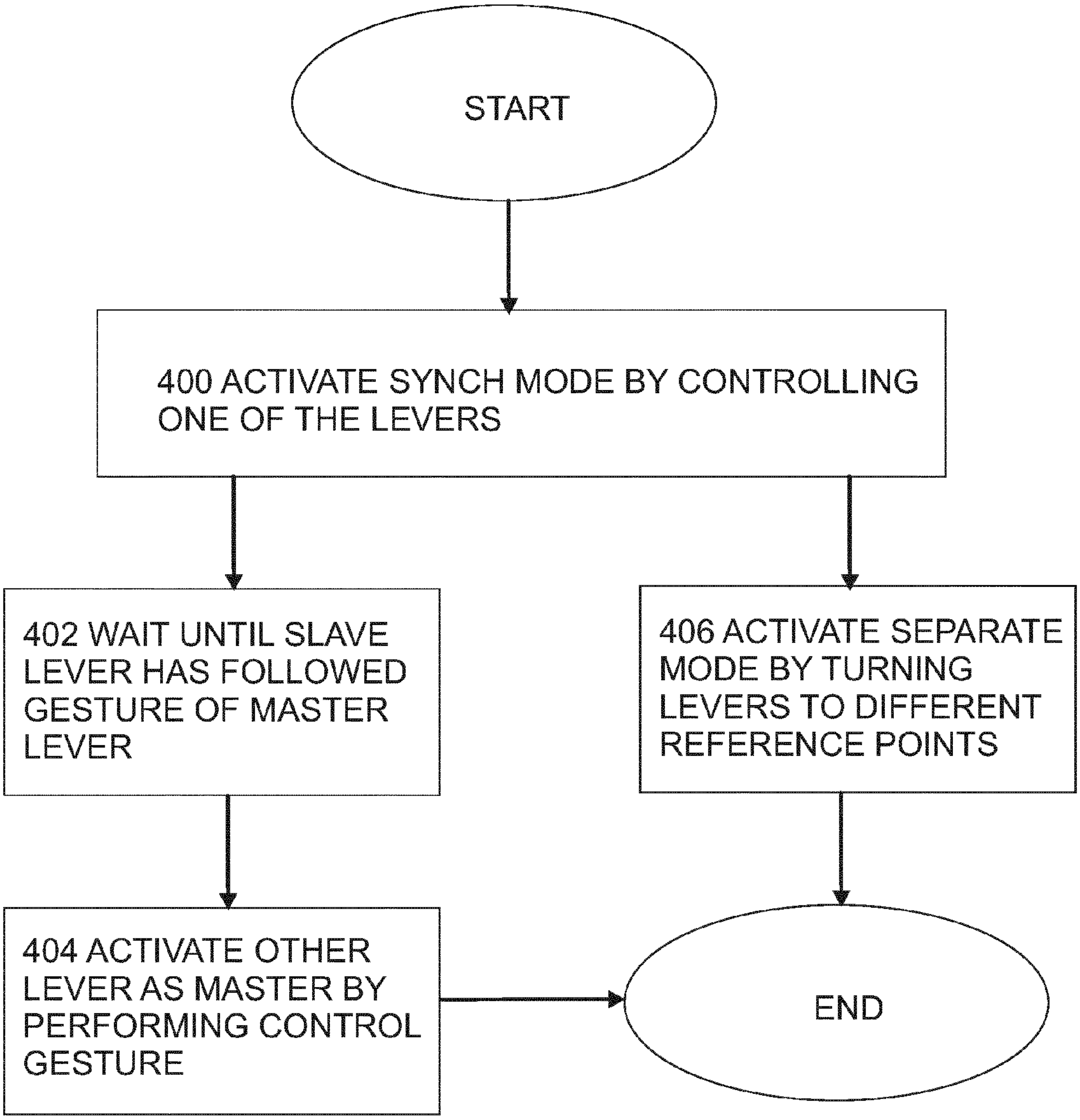
START
400 ACTIVATE SYNCH MODE BY CONTROLLING ONE OF THE LEVERS
402 WAIT UNTIL SLAVE LEVER HAS FOLLOWED GESTURE OF MASTER LEVER
406 ACTIVATE SEPARATE MODE BY TURNING LEVERS TO DIFFERENT REFERENCE POINTS
404 ACTIVATE OTHER LEVER AS MASTER BY PERFORMING CONTROL GESTURE
END

Fig. 4

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EUROPEAN SEARCH REPORT

Application Number
EP 15 15 2545

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 Y A	WO 2007/105995 A1 (CPAC SYSTEMS AB [SE]; TORRAANGS PETER [SE]; LINDEBORG MATHIAS [SE]) 20 September 2007 (2007-09-20) * page 2, line 9 - page 3, line 5 * * page 3, line 7 - line 10 * * page 7, line 4 - line 5 * * page 7, line 10 - line 17 * -----	1,3-5,7, 9-12 2 6,8	INV. B63H5/125 B63H21/21 B63H25/02
X Y	EP 2 163 473 A2 (VOLVO PENTA AB [SE]) 17 March 2010 (2010-03-17) * paragraphs [0008], [0012], [0014], [0017], [0019] * -----	1,11 2	
A	WO 01/00485 A1 (SIEMENS AG [DE]; RZADKI WOLFGANG [DE]; GEIL GUENTER [DE]; HOES STEFAN) 4 January 2001 (2001-01-04) * page 42, line 27 - page 43, line 19 * * page 50, paragraph 1 * -----	1-12	
A	"AUSTRIAN RIVER ICEBREAKER WITH AZIPOD PROPULSION", SHIP AND BOAT INTERNATIONAL, ROYAL INSTITUTION OF NAVAL ARCHITECTS, LONDON, GB, vol. 48, no. 5, 1 June 1995 (1995-06-01), page 5,07,09, XP000517047, ISSN: 0037-3834 * the whole document * -----	1-12	TECHNICAL FIELDS SEARCHED (IPC) B63H
A	US 2008/171479 A1 (HALLENSTVEDT ODDBJORN [SE] ET AL) 17 July 2008 (2008-07-17) * paragraphs [0029], [0042], [0061], [0071], [0077] * -----	1	
A	US 2009/197486 A1 (SZILAGYI EDMUND ALEXANDER [US] ET AL) 6 August 2009 (2009-08-06) * paragraphs [0057], [0058], [0074] * -----	1	

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The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	13 July 2015	Barré, Vincent

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 15 15 2545

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13-07-2015

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
WO 2007105995 A1	20-09-2007	EP 1999011 A1	10-12-2008
		US 2008318482 A1	25-12-2008
		WO 2007105995 A1	20-09-2007
EP 2163473 A2	17-03-2010	EP 2163473 A2	17-03-2010
		US 2010068950 A1	18-03-2010
WO 0100485 A1	04-01-2001	AT 264216 T	15-04-2004
		CA 2377511 A1	04-01-2001
		DE 50006082 D1	19-05-2004
		DK 1187760 T3	09-08-2004
		EP 1187760 A1	20-03-2002
		ES 2219364 T3	01-12-2004
		JP 4623897 B2	02-02-2011
		JP 2003517394 A	27-05-2003
		PT 1187760 E	30-09-2004
		US 6592412 B1	15-07-2003
		WO 0100485 A1	04-01-2001
US 2008171479 A1	17-07-2008	NONE	
US 2009197486 A1	06-08-2009	NONE	

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