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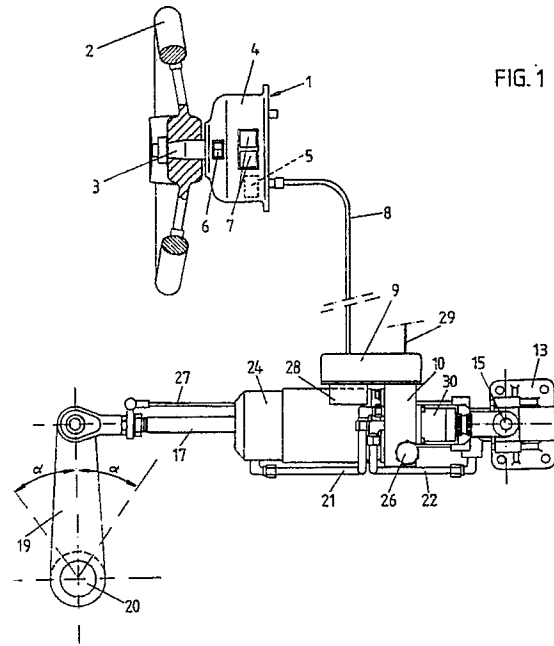
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(54) **Device for steering a vessel.**

(57) Device for steering a vessel in which the rudder shaft (20) is carrying a rudder arm (19) which can be pivoted by operating means comprising a steering wheel (2) the shaft (3) of which is coupled with a potentiometer (5) being electrically connected to a control unit (9) such that during rotation of the steering wheel (2) a signal is delivered to the control unit (9) to energize an electric motor (24) driving a hydraulic pump (23) for supplying hydraulic medium to one end of a hydraulic cylinder (11) connected between the vessel construction (14) and said rudder arm (19), a control rod (27) being provided moving together with the piston rod (17) and cooperating with a potentiometer (28) providing that in the position of the rudder which is adjusted by means of the steering wheel (2) no further signal is delivered by said control unit (9) for holding of putting said hydraulic pump (23) into operation.



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**DEVICE FOR STEERING A VESSEL.**

The invention relates to a device for steering a vessel in which the rotatable supported shaft, connected to the rudder, is carrying a rudder arm running substantially square to the axis of rotation, which rudder arm can be pivoted by operating means being coupled with a rotatable supported steering wheel.

In particular in case of smaller vessels the operating means is shaped by cables extending from both sides of the rudder arm in a horizontal plane, and running to the steering wheel via guiding rolls and being connected to the shaft of rotation of the steering wheel in one way or another.

In case of bigger vessels use is also made of a hydraulic cylinder for pivoting the rudder arm. In this case then the steering wheel cooperates with a means for supplying hydraulic medium to the cylinder.

In both cases the means required for connecting the steering wheel with the rudder arm are cumbersome and are occupying relatively much room. By this also the mounting of such a steering device will take much time.

Now the invention aims to remove this objection and to that end it is provided that the steering wheel shaft is coupled with a potentiometer being electrically connected to a control unit such that during rotation of the steering wheel by means of said potentiometer a signal is delivered to the control unit to energize an electric motor driving a hydraulic pump for supplying hydraulic medium to one end of a hydraulic cylinder the housing of which is connected to the vessel construction and the piston rod to said rudder arm, a control rod being provided running parallel to said piston rod and moving together with this and cooperating with a potentiometer being fixedly mounted in respect of the housing of said hydraulic cylinder, said potentiometer providing that in the position of the rudder which is adjusted by means of the steering wheel, no further signal is delivered by said control unit for holding or putting said hydraulic pump into operation.

In this way it is attained that only an electric cable is needed running from the steering wheel to the control unit, which will be positioned near the hydraulic cylinder.

In particular it will be provided that the control unit, the assembly of driving motor and hydraulic pump together with an oil tank and the hydraulic piping between the various parts, are mounted on said hydraulic cylinder.

In this way a compact unit is obtained and the hydraulic pipes can be kept very short while only an electric cable needs to run from the steering

wheel unit to the control unit, being positioned directly on said hydraulic cylinder.

In this way it is also possible to connect more than one steering wheel unit to the control unit so that the vessel can be steered from various positions. Such a steering wheel unit can also be easily displaceable and in view of this may offer more possibilities.

To put a steering wheel unit into operation an operation switch can be mounted on it and also a pilot lamp, so that it can quickly be ascertained whether the steering wheel unit is in operation.

Further a short-circuit valve will be present between the two pipes connected to the hydraulic cylinder, said short-circuit valve opening when the supply of electric current to the device is cut off.

By this it is obtained that in case of a power break down the rudder can be manually controlled because the hydraulic medium may flow from one end of the hydraulic cylinder towards the other end via the short-circuit valve.

Preferably two manually controlled switches will be present for directly activating said control unit by means of which the electric motor driving the hydraulic pump is energized, such that pressurized medium can be supplied to one end of the hydraulic cylinder or to the other end.

The switches can be used in case of a failure in the electric control unit or in the steering wheel unit when this does not lead to an interruption of the current supply to the electric motor of the hydraulic pump.

The possibility exists, that the steering wheel unit is formed by an automatic pilot which can be connected to the electric control unit. By this it can be provided that the vessel will follow a given course, while it is not necessary that the steering wheel is continuously attended by a person.

To prevent that already in case of a small rotational movement of the steering wheel the vessel will change its course considerably, the steering wheel unit will be executed such that the steering wheel can be rotated in total over an angle of 280° to 320°, during which an angle of rotation of the rudder will occur between 60° and 90° in total, the ratio between both angles of rotation being considerably smaller near the end positions of steering wheel and rudder than the ratio in case of small rotations starting from the middle position. By this it is obtained that during travelling straight on small corrections in the course can be acquired by means of the steering wheel while nevertheless the steering wheel has to be rotated over an observable angle. When, however, it has to be strongly manoeuvred, as e.g. during mooring a vessel, at

the end of the rotational movement of the steering wheel a smaller rotation of said steering wheel will be sufficient for a given rotational movement of the rudder, so that the vessel will faster react to a rotation of the steering wheel. The ratio between the angle of rotation of the steering wheel and rudder near the middle position of the steering wheel can lie between 5 and 8 and near the end of the angle of rotation of the steering wheel between 1.5 and 3.

Now the invention is described by means of an embodiment shown in the drawing, in which:

Fig. 1 schematically shows a top view of a steering device according to the invention; and

Fig. 2 shows a side view of the device of Fig. 1 omitting the steering wheel unit.

The device shown in the drawing comprises the steering wheel unit 1 consisting of the steering wheel 2, connected to the shaft 3 which is rotatable supported in the housing 4 in which the potentiometer 5 is present, being only schematically indicated. Abutments, not shown, are provided in the housing which are taking care for it that the angle of rotation of the steering wheel cannot be greater than  $280^{\circ}$ - $320^{\circ}$ .

The housing 4 further is provided with the operation switch 6 and the pilot lamp 7. The pilot lamp 7 e.g. can be executed double so that on the one hand it can be signalized whether voltage is applied to the device and on the other hand whether the steering wheel unit is activated.

A cable 8 is running from the steering wheel unit 1 to the control unit 9 mounted on the frame 10 which in a not further indicated way is fixed to the hydraulic cylinder 11.

The housing 12 of the hydraulic cylinder 11 is connected to the support 13 fixed to the vessel construction 14, which is not shown further. The connection between the housing 12 and the support 13 is executed such that the housing is pivotable in respect of the shafts 15 and 16. This support construction is not described in detail.

The piston rod 17 extending from the hydraulic cylinder 12 is connected to the rudder arm 19 by means of a ball joint 18, said rudder arm 19 being provided on the shaft 20 carrying the not shown rudder.

By the described way of connection of the hydraulic cylinder 11 with the vessel construction 14 on the one hand and with the rudder arm 19 on the other end, the change in position of the hydraulic cylinder can be absorbed. This change in position will occur as well as during movement of the piston rod 17 in the one and the other direction as being caused by loads being exerted on the rudder and on the vessel construction.

Movement of the piston rod 17 of the hydraulic cylinder 11 and by this pivoting of the rudder arm

19 takes place by supplying pressurized medium to one of the ends of the hydraulic cylinder via the pipe 21 either 22. The pipes 21 and 22 are connected to a hydraulic pump 23 driven by means of the electric motor 24. This electric motor 24 can be rotated in both directions so that the pump 23 can supply pressurized medium to the pipe 21 either to the pipe 22.

The hydraulic pump 23 and the motor 24 for driving this are mounted to the frame 10, in which frame the various pipes for pressurized medium can be present. A tank 25 for hydraulic medium is also mounted in the frame 10 and is provided with the filler cap 26.

The direction in which the piston rod 17 is moved is determined by the direction of rotation of the motor 24. This direction of rotation is controlled by means of the control unit 9 to which signals are supplied from the steering wheel unit 1.

To obtain that the rudder arm 19 will come in the desired position the piston rod 17 is connected to a control rod 27 which in a not further indicated way cooperates with a potentiometer 28, the signals of which are also supplied to the control unit 9.

When from the signals delivered by the potentiometers 5 and 28 appears that the rudder arm 19 has reached the position corresponding with a given position of the steering wheel 2, the electric motor 24 will be switched off so that the rudder arm 19 will remain in the desired position. As soon as the steering wheel is rotated in the one or the other direction, the motor 24 will be energized again to move the piston rod 17 of the hydraulic cylinder 11 in the one or in the other direction, so that the rudder arm 19 will be brought into the desired position. The latter is controlled by means of the control rod 27 and the potentiometer 28 cooperating with it.

The electric current necessary to drive the electric motor 24 and for operating the electric control unit 9 can be supplied to the latter by means of a cable 29 being connected to a not shown battery to which in the known way current can be supplied by means of a generator driven by the marine engine.

An electrically activated short-circuit valve 30 further is provided on the frame 10. As long as no voltage is applied to the device this valve 30 takes care for a connection between the pipes 21 and 22 so that the rudder arm 19 can be manually pivoted because the hydraulic medium can flow freely from the one end of the hydraulic cylinder 11 to the other end. As soon as voltage is applied to the control unit 9 the valve 30 will be closed and the device will be in running order.

As already remarked above two electric switches can be provided which directly may activate the control unit 9 and which e.g. can be used when the

steering wheel unit 1 should be out of use by one or other cause.

In fig. 1 further the angle  $\alpha$  is indicated over which the rudder arm 19, starting from the middle position, can be maximum pivoted. This angle, generally speaking, will not be much more than  $45^\circ$  while the steering wheel can make a substantially larger rotation to both sides.

The ratio between the rotation of the steering wheel 2 and of the rudder arm 19 can be ascertained by means of the control unit 9.

Obviously only a possible embodiment of the device according to the invention is shown in the drawing and described above and many modifications can be applied without leaving the inventive concept.

### Claims

1. Device for steering a vessel in which the rotatable supported shaft (20), connected to the rudder, is carrying a rudder arm (19) running substantially square to the axis of rotation, which rudder arm can be pivoted by operating means being coupled with a rotatable supported steering wheel (2), characterized in

that the steering wheel shaft (3) is coupled with a potentiometer (5) being electrically connected to a control unit (9) such that during rotation of the steering wheel (2) by means of said potentiometer (5) a signal is delivered to the control unit (9) to energize an electric motor (24) driving a hydraulic pump (23) for supplying hydraulic medium to one end of a hydraulic cylinder (11) the housing (12) of which is connected to the vessel construction (14) and the piston rod (17) to said rudder arm (19), a control rod (27) being provided running parallel to said piston rod (17) and moving together with the piston rod (17) and cooperates with a potentiometer (28) being fixedly mounted in respect of the housing (12) of said hydraulic cylinder (11), said potentiometer (28) providing that in the position of the rudder which is adjusted by means of the steering wheel (2), no further signal is delivered by said control unit (9) for holding or putting said hydraulic pump (23) into operation.

2. Device according to claim 1, characterized in

that the control unit (9), the assembly of driving motor (24) and hydraulic pump (23) together with an oil tank (25) and the hydraulic piping between the various parts, are mounted on said hydraulic cylinder (11).

3. Device according to claims 1 or 2, characterized in

that more than one steering wheel unit (1) can be connected to the control unit (9).

4. Device according to one of the preceding claims, characterized in that said steering wheel unit (1) is provided with an operation switch (6) and a pilot lamp (7).

5. Device according to one of the preceding claims, characterized in

that a short-circuit valve (30) is present between the two pipes (21,22) connected to the hydraulic cylinder (11), said short-circuit valve (30) opening when the supply of electric current to the device is cut off.

6. Device according to one of the preceding claims, characterized in

that two manually controlled switches are present for directly activating said control unit (9) by means of which the electric motor (24) driving the hydraulic pump (23) is energized, such that pressurized medium can be supplied to one end of the hydraulic cylinder (11) or to the other end.

7. Device according to one of the preceding claims, characterized in

that the steering wheel unit (1) is formed by an automatic pilot which can be connected to the electric control unit (9).

8. Device according to one of the preceding claims, characterized in

that the steering wheel unit (1) is executed such that the steering wheel (2) can be rotated in total over an angle of  $280^\circ$  to  $320^\circ$ , during which an angle of rotation of the rudder will occur between  $60^\circ$  en  $90^\circ$  in total, the ratio between both angles of rotation being considerably smaller near the end positions of steering wheel (2) and rudder then the ratio in case of small rotations starting from the middle position.

9. Device according to claim 8, characterized in

that the ratio between the angle of rotation of the steering wheel (2) and the rudder starting from the middle position is lying between 5 and 8 and near the maximum angle of rotation between 1.5 and 3, said values gradually changing into each other.

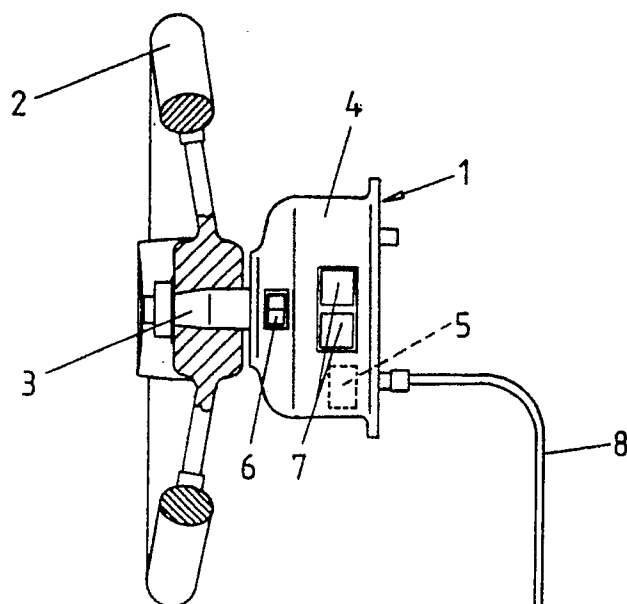


FIG. 1

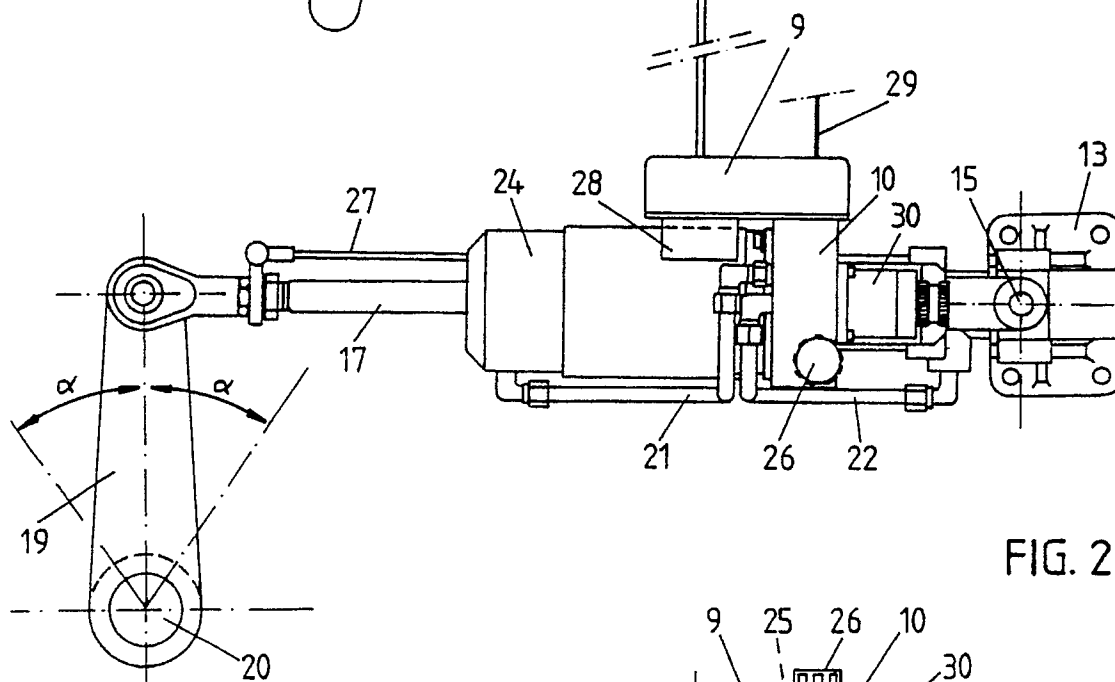
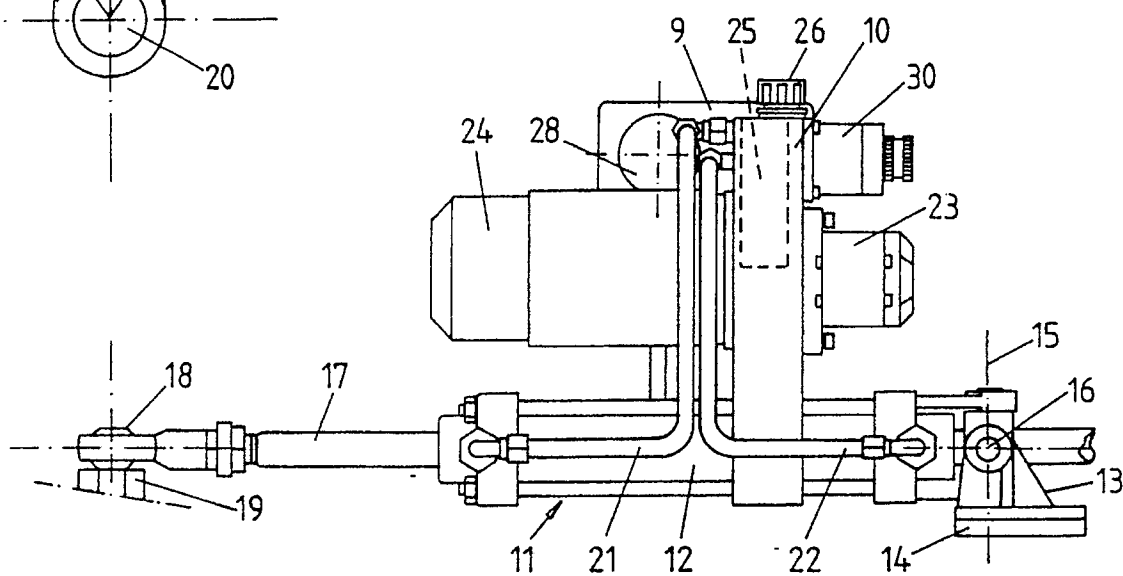


FIG. 2





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## EUROPEAN SEARCH REPORT

Application Number

EP 89 20 2317

| 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.5) |
| X                                                                                | FR-A-1 478 455 (MERCIER)<br>* Whole document *                                                     | 1-4,6,7                          | B 63 H 25/34                                  |
| Y                                                                                | ---                                                                                                | 5,8,9                            |                                               |
| Y                                                                                | GB-A- 751 608 (ETABLISSEMENTS PAUL DUCLOS)<br>* Page 2, line 69 - page 3, line 7;<br>Figures 1-5 * | 5                                |                                               |
| Y                                                                                | FR-A-2 367 657 (SPERRY RAND CORP.)<br>* Page 5, line 30 - page 7, line 27;<br>figures 1-4 *        | 8,9                              |                                               |
| A                                                                                | ---                                                                                                | 1                                |                                               |
| X                                                                                | US-A-3 739 738 (CAVIL)<br>* Abstract; column 2, line 51 - column 4, line 52; figure 1 *            | 1                                |                                               |
| A                                                                                | ---                                                                                                | 4,6                              |                                               |
| X                                                                                | WO-A-8 000 506 (ANSCHÜTZ)<br>* Page 4, paragraph 3 - page 8, paragraph 1; figure *                 | 1                                |                                               |
| A                                                                                | ---                                                                                                | 4,6                              |                                               |
| A                                                                                | US-A-3 390 614 (TATUM)<br>-----                                                                    |                                  |                                               |
| The present search report has been drawn up for all claims                       |                                                                                                    |                                  | TECHNICAL FIELDS SEARCHED (Int. Cl.5)         |
|                                                                                  |                                                                                                    |                                  | B 63 H                                        |
| Place of search                                                                  |                                                                                                    | Date of completion of the search | Examiner                                      |
| THE HAGUE                                                                        |                                                                                                    | 09-11-1989                       | DE SENA Y HERNANDORENA A                      |
| CATEGORY OF CITED DOCUMENTS                                                      |                                                                                                    |                                  |                                               |
| X : particularly relevant if taken alone                                         |                                                                                                    |                                  |                                               |
| Y : particularly relevant if combined with another document of the same category |                                                                                                    |                                  |                                               |
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| P : intermediate document                                                        |                                                                                                    |                                  |                                               |
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