(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) EP 0 723 910 A2

(12) EUROPEAN PATENT APPLICATION

(43) Date of publication:
31.07.1996 Bulletin 1996/31

(51) Int. Cl.[6]: **B63H 5/125**, B63H 5/20

(21) Application number: **96102868.5**

(22) Date of filing: **20.06.1991**

(84) Designated Contracting States:
DE DK ES FR GB NL SE

(30) Priority: **20.06.1990 NO 902737**

(62) Application number of the earlier application in accordance with Art. 76 EPC: **91911884.4**

(71) Applicant: **Lund-Andersen, Birger**
1614 Fredrikstad (NO)

(72) Inventor: **Lund-Andersen, Birger**
1614 Fredrikstad (NO)

(74) Representative: **Hammar, Ernst**
H. Albihns Patentbyra AB,
P.O. Box 3137
103 62 Stockholm (SE)

Remarks:
This application was filed on 27 - 02 - 1996 as a divisional application to the application mentioned under INID code 62.

(54) An arrangement in connection with a swingable turn-up inboard/outboard stern aggregate for a craft

(57) An arrangement in a swingable turn-up inboard/outboard stern aggregate (1) for craft with an inboard engine and outboard driving unit (2) comprising a screw (5), where an inboard driving shaft (3) of said stern aggregate (1) for connection with the engine is connected with a screw shaft (4), which is approximately horizontal in a position for use and is mounted in a lower end portion of a housing (7), via a transmission shaft (6) comprising first and second shaft sections (6a,6b) and being surrounded by the housing (7). The first section (6a) has one end mounted (8) in an upper end portion of the housing and being rotatably connected with the driving shaft (3) via a first universal joint (A), said first section (6a) being also rotatably connected with the upper end of the upwardly directed second shaft section (6b) via angular gear (B). The second section (6b) has its lower end rotatably connected with the screw shaft (4) at an angle (V) via a torque transmission means (C). Reversing means (D) is provided in powertrain between the engine and screw shaft (4). The torque transmission means between the transmission shaft (6) and screw shaft (4) comprises a double universal joint (C).

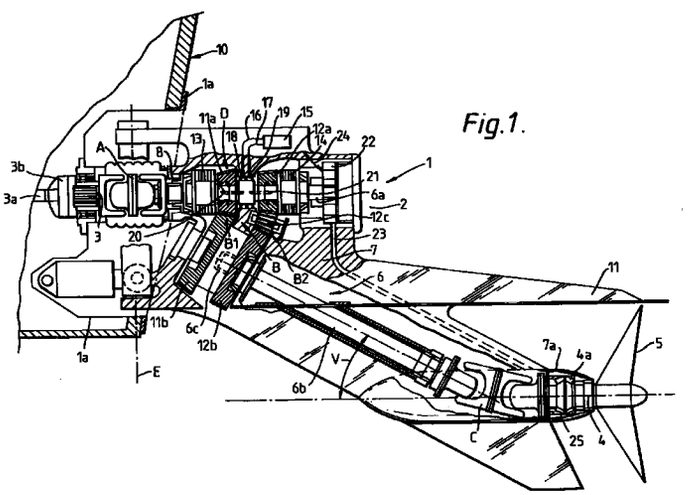

Fig.1.

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Description

The present invention relates to an arrangement in connection with a swingable turn-up inboard/outboard stern aggregate for craft with an inboard engine and an outboard drive unit comprising a screw, and of a kind as stated in the preamble of the following independent claim 1.

Such a stern aggregate is known from the applicant's previous NO-PS No. 158 335, the object of which was to reduce dimensions, especially the transversal dimension, of the lower portion of the housing surrounding the propeller shaft and screw shaft with bearings by using universal joints between the propeller shaft and the screw shaft.

In such a stern aggregate reversal of the direction of screw rotation may either be achieved by the aid of a gearbox in said inboard engine or, if desired, in the transmission from the latter to the stern aggregate.

The last mentioned concept will require space between the engine and the stern of the craft and it will also form an independent unit which has to be mounted, i.e. inserted between the stern aggregate and the engine.

One object of the present invention is to provide a stern aggregate arrangement rendering possible to transmit higher engine powers (i.e. torques or torsional moments) to a screw than would be feasible using conventional transmission means, e.g. gear means.

Another object of the present invention is to provide an arrangement wherein reversing means is part of the stern aggregate, so that such space as mentioned above is saved, and labour for mounting is saved, since only the stern aggregate is to be mounted on the craft and connected with the engine.

According to the present invention the above objects may be achieved by the features appearing from the following independent claim 1. The following dependent claims describe preferred embodiments.

An embodiment of the invention will be disclosed in more detail below with reference to the drawings, in which

Figure 1 is a side view and partly a sectional view of the stern aggregate, mounted on the stern of a craft;

Figure 2 is a diagrammatical top view of a stern aggregate with a pressure cylinder for lateral displacement of the stern aggregate for steering the craft and with pressure cylinders for turning the stern aggregate up and down into the water.

Figure 1 shows an inboard/outboard stern aggregate 1 the fastening means 1a of which is mounted on the stern of craft 10, and a driving unit 2 which is swingably fastened to fastening means 1a, via a horizontal transversal axis D (Figure 2) and an approximately vertical axis E, for lifting, and lowering, respectively, of driving unit 2 and for swinging driving unit 2 to steer craft 10 in motion. In fastening means 1a an inboard driving shaft 2 is mounted for connection with output shaft 3a, via a flange coupling 3b. Via a double universal joint A driving shaft 3 is connected with a transmission shaft 6 which is divided into two sections 6a, 6b. The first section 6a is mounted at the upper end of housing 7 and connected with said universal joint A, and its second end is connected with the second section 6b of transmission shaft 6, via angular gear B. The lower end of section 6b is, via a universal joint C, preferably a double universal joint, connected with a screw shaft 4, which is mounted in the lower rear end of housing 7, with a firm angle V between screw shaft 4 and lower section 6b of transmission shaft 6, which angle V is smaller than 45°, preferably 32°, with an approximately horizontal screw shaft 4. Universal joints A and C may, e.g. be of the ball-and-socket kind which may transmit high moments of torsion relative to its moderate external dimensions. When thin transmission and screw shafts 6, 4 are used at the same time, housing 7 and a lower portion of the same which forms the screw housing 7a, may be built with small transversal dimensions. The screw housing may, thus, be made narrow to reduce its resistance to water flow.

The drawing, however, shows that universal joints of the cardan type are used in the present case, and it is especially important to be able to use a double universal joint of the cardan type forming a transmission means C for torsional moment between lower section 6b of transmission shaft 6 and screw shaft 4 so to reduce the bending loads on the universal joint and, thus, to reduce any vibration and loss of transmitted torsional moment to screw 5.

Above screw 5 a stabilizing plate 11 is provided. It is fastened to and extends rearwards from housing 7 in an approximately horizontal plane and in the water-line when the craft is in motion.

By the aid of pressure cylinders 9, which are fastened to fastening means 1a and housing 7, below the horizontal transverse axis D, driving unit 2 may be turned up and down and the inclined position of driving unit 2 is adjustable in order to provide the most suitable angle of attack of screw 5 in the direction of motion. In order to swing driving unit 2 about vertical axis D to steer the craft, a pressure cylinder 12 is provided as shown in Figure 2.

The above mentioned reversing means for changing the direction of rotation of screw 5 as well as for cutting off the same is designated D and is arranged together with angular gear B connecting upper section 6a of transmission shaft 6 with its lower section 6b.

As shown in Figure 1 angular gear B comprises two sets B1 and B2 of conical gears 11a, 11b, and 12a, 12b, with driving gears 11a, 12a being mounted to be engageable and disengageable on first/upper section 6a of transmission shaft 6 and being engaged with the driven gearwheels 11b, 12b, which are provided in a mutually non-rotatable engagement with the second

section 6b. A conical intermediate gear 12c is arranged between the driving and the driven gear 12a, 12b to provide for opposite directions of rotation of section 6b when one or the other driving gear 11a, 12a is engaged, or disengaged, respectively.

In order to achieve said engagement and disengagement of the driving gears 11a, 12a of first section 6a clutches 13, 14 are provided in connection with respective gears 11a, 12a and are controlled from a manoeuvring central 15.

Clutches 13, 14 are preferably air-oil actuated, the compressed fluid being supplied, via conduits 16, 17 in housing 7 to annular chambers 18, 19 in section 6a and, via bores 20, 21 in section 6a to a motor (not shown) in each clutch 13, 14. The clutches may be sliding clutches with one set of disks being fastened to section 6a and the other set being fastened to driving gears 11a, 12a, which two sets of frictional disks are made to contact each other by the aid of said pressure motor in each of the clutches 13, 14 by the aid of manoeuvring central 15 which is controlled by suitable means from the driver's seat in craft 10.

In the embodiment as shown in Figure 1, annular chambers 18, 19 are provided between driving gears 11a, 12a and may either consist of annular flanges, which are provided on section 6a and cooperate with an annular surface provided in housing 7, and with conduits 16, 17 opening into a respective annular chamber. The annular chamber, obviously, may consist of annular flanges extending inwards from said annular surface and being in contact with a corresponding external bearing surface on section 6a. From each of said annular chambers 18, 19 bores 20, 21 extend in section 6a to a pressure motor in each clutch 13, 14.

The driven gears 11b, 12b on section B are connected with each other in a manner preventing relative rotation, if desired, via splines 6c, and said gears may also be connected with section 6b, via said splines 6c to be mutually non-rotating. This is so to permit movement/elongation of section 6b, among others in case of changes of temperature, without influencing the position of gears 11b, 12b relative to the driving gears 11a, 12a, and intermediate gear 12c.

A gear pump 22 is provided on section 6a, suitably at the outer end of the latter, and is, via piping 23, 24 connected with the lower portion of housing 7 comprising an oil sump 25 near propeller shaft 4 and bearing 4a, and with manoeuvring central 15. From the manoeuvring central piping 16, 17 extends to annular chambers 18, 19 and clutches 13, 14.

From manoeuvring central 15 a return conduit (not shown) extends to oil sump 25 for return of pressure fluid when the manoeuvring central is disengaged, or via pressure valves, respectively, when the manoeuvring central is engaged for forward or rearward motion of the craft, i.e. in one or the other direction of rotation of screw 5.

Due to the fact that reversing gear/manoeuvring central 15 has been moved from craft 10 adjacent to the engine or engine shaft, to the stern aggregate and is mounted with the driving means of the latter, the total dimensions are reduced, and an independent component and mounting of the same is avoided. With this arrangement of the reversing means D between the first section 6a of transmission shaft 6 and its second section 6b, a reduced torsional moment is achieved with high rpm of the first section of transmission shaft 6 and, consequently, of the first universal joint A between first section 6a of transmission shaft 6 and the driving shafts 3, because angular gears B1, B2 are designed to be reduction gears. Second section 6b of transmission shaft 6, thus, has lower rpm and a higher moment of torsion for transmission to screw 5. The first section 6a of transmission shaft 6 with associated components may, thus, be designed with smaller dimensions, whereas the second section 6b with associated components must be designed with larger/stronger components for transmission of said higher moment of torsion.

Claims

1. An arrangement in a swingable turn-up inboard/outboard stern aggregate (1) for craft with an inboard engine and outboard driving unit (2) comprising a screw (5), where an inboard driving shaft (3) of said stern aggregate (1) for connection with the engine is connected with a screw shaft (4), which is approximately horizontal in a position for use and is mounted in a lower end portion of a housing (7), via a transmission shaft (6) comprising first and second shaft sections (6a,6b) and being surrounded by the housing (7), said first section (6a) having one end mounted (8) in an upper end portion of the housing and being rotatably connected with the driving shaft (3) via a first universal joint (A), said first section (6a) being also rotatably connected with the upper end of the upwardly directed second shaft section (6b) via a transmission means, e.g. an angular gear (B) or a universal joint, the second section (6b) having its lower end rotatably connected with the screw shaft (4) at an angle (V) via a torque transmission means (C), and reversing means (D) being provided in powertrain between the engine and screw shaft (4), **characterized** in that said torque transmission means between the second transmission shaft section (6b) and screw shaft (4) comprises a double universal joint (C) of the gimbal joint type.

2. An arrangement according to claim 1, **characterized** in that the angles between the center axis of said double universal joint (C) and the second transmission shaft section (6b) and screw shaft (4), respectively, are equal.

3. An arrangement according to claim 1 or 2, **characterized** in that the opposed universal points of said double universal joint (C), are in phase.

4. An arrangement according to any of claims 1-3, **characterized** in that said reversing means (D), provided with first and second driving gears (11a,12a) on the reversing means (D) adapted to be, alternatively, connected with the first shaft section (6a) via a respective fluid actuated clutch (13,14) which is controlled by a manoeuvring central (15), being provided on said first shaft section (6a), this reversing means (D) through said gear (B) providing for reversal of the direction of rotation of said second shaft section (6b) and thereby of said screw (5), via an operative position of said reversing means (D) in which said first shaft section (6a) is disengaged from said second section (6b).

5. An arrangement according to any of claims 1-4, **characterized** in that the angular gear (B) comprises two sets (B1,B2) of conical gears (11a,11b, and 12a,12b), the driving gears (11a,12a) of which are mounted to be engageable and disengageable on said first shaft section (6a) and are engaged with said driven gears (11b,12b), which are provided in a mutually non-rotatable engagement with said second shaft section (6b), a conical intermediate gear (12c) being provided between one (12a) of said driven gears (11b,12b) for providing an opposite direction of rotation of said section (6b) when one or the other of said driving gears (11a,12a) is engaged on said first section (6a).

6. An arrangement according to claim 5, **characterized** in that said driven gears (11b,12b) are mutually connected and are connected with said second shaft section (6b) via splines (6c).

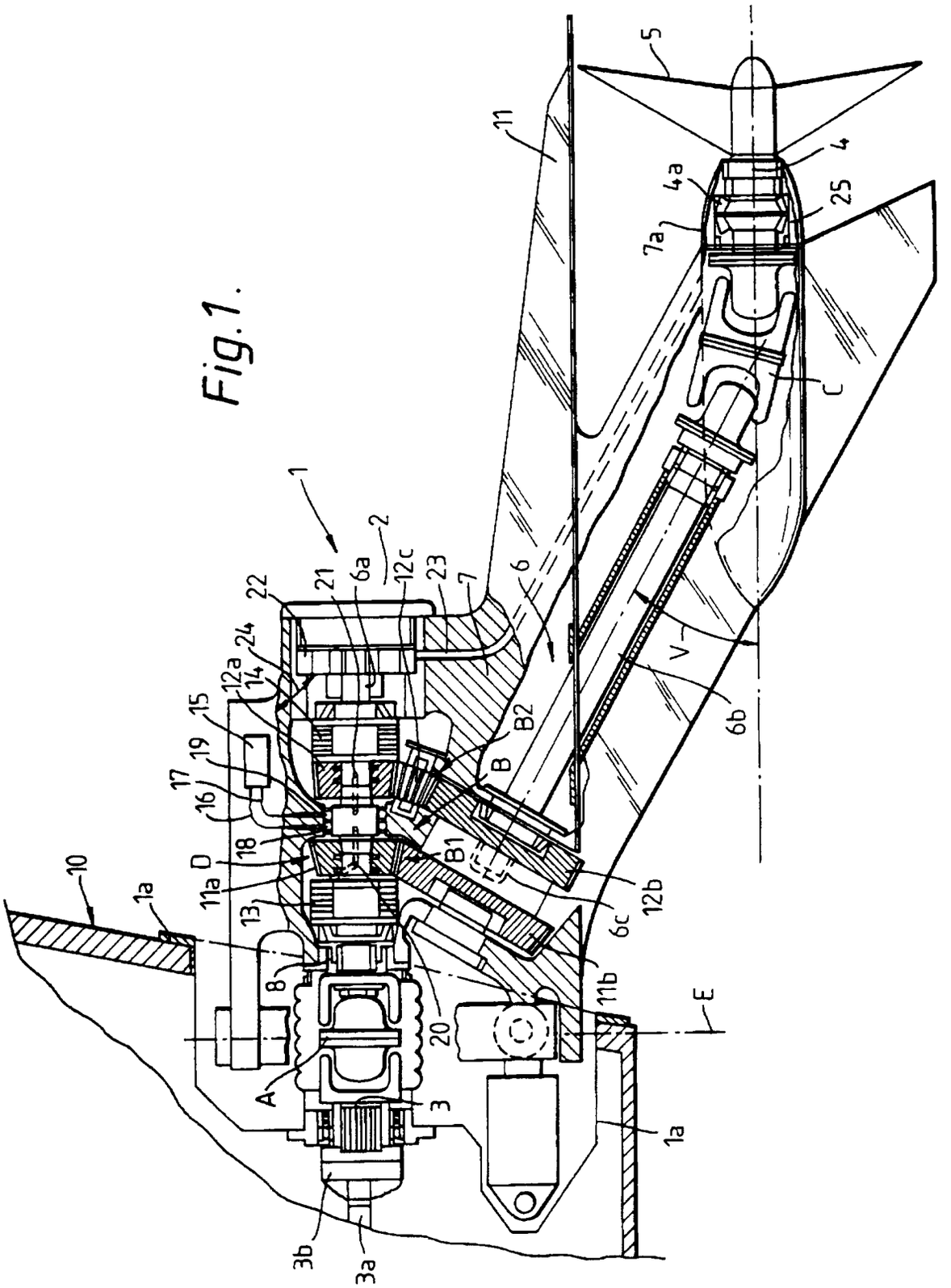
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Fig. 1.

Fig. 2.