(51) International Patent Classification: A01K 73/06, B66D 1/50

(11) International Publication Number: WO 88/05999
(43) International Publication Date: 25 August 1988 (25.08.88)

(21) International Application Number: PCT/DK87/00016
(22) International Filing Date: 19 February 1987 (19.02.87)


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(81) Designated States: AT (European patent), BE (European patent), CH (European patent), DE (European patent), FI, FR (European patent), GB (European patent), IT (European patent), JP, LU (European patent), NL (European patent), NO, SE (European patent), SU, US.

(54) Title: TRAWL WINCH FOR FISHING VESSEL

(57) Abstract

A trawl winch for fishing vessels (1) comprises two cable drums (5, 6) with each its trawl cable (8, 9), said drums being coupled to a common differential (4) with differential lock and where the power input device of the differential which is connected to the drive engine (3) may be blocked. The trawl (2) is a conventional trawl with otter boards (10). The trawl winch moreover comprises a blocking means which may block the power input device to the differential (4). When trawling, the connection between the drive engine (3) and the differential (4) is locked so that the two drums (5, 6) will be freely rotatable, but in opposite directions. This means that the two cables (8, 9) will always be equally loaded.
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TRAWL WINCH FOR FISHING VESSEL

The invention relates to a trawl winch for fishing vessels and of the kind described in the introduction to claim 1, preferably, but not exclusively, for stern trawlers.

When a fishing vessel such as a stern trawler is trawling, it is important that the two trawl cables, the starboard and the port trawl cable, respectively, or cable pairs are equally loaded. Experience has proved that the trawl opening is greatest when the pull in the cables is equal, and maximum opening of the trawl will provide greater or faster catch.

In some trawl winches the pull in the cables is measured and one of the cables is then slackened or tightened to provide an equal pull in both cables, or there is applied a so-called split winch with automatic control of the wire pull. Alternatively, one endeavours in some other way by means of the drive engine or drive engines of the trawl drums to keep the pull in the trawl cables substantially equal. This requires energy and in some structures it is moreover necessary to assign a crew member to control the trawl winch and to adjust the pull during the entire trawling period which perhaps lasts 1/2 - 2 hours or longer. The energy requirement for controlling the trawl winch is considerable and amounts by fishing for 20 hours per day to 19 litres of fuel oil per 100 h.p. of the vessel's propelling machinery. As an example, a stern trawler with 700 h.p. propel-
ling machinery uses 133 litres of oil per day. Even if this does not sound of much, it will nevertheless exceed an amount of 100,000.- Dkr. by 300 fishing days in a year given fuel costs of 3 Dkr. per litre.

The object of the invention is to provide a trawl winch which may in the usual manner be used for letting out and hauling in trawls but which will use no energy during the trawling while always ensuring an equal pull in the trawl cables.

This is achieved by designing the winch according to the invention as further disclosed in the characterising part of claim 1. When the power input device of the differential is blocked, for example by the drive engine, the two drums may freely rotate but in opposite directions. When one of the drums slackens the cable, the other drum will accordingly tighten its cable and vice versa. This means that the total pull of the trawl is transmitted to the two cables with exactly half the pull on each cable. Especially when turning where the load on the inner cable lessens considerably - by trawling on a sea floor slope where the pull would otherwise be quite unequal resulting in a small trawl opening - it is highly advantageous quickly, fully automatically and without extra energy consumption always to have an equal pull in the two cables. If one of the otter boards gets stuck in the sea floor, the other one will move forwards at double speed but the extra load will be distributed by half the load in each cable thereby avoiding damage to the fishing tackle before bringing the vessel to a stop. By conventional trawl winches, where the drums are braked on band brakes, the entire load will be trans-
mitted to the cable on the stuck otter board.

The hauling in of the trawl with the winch according to the invention is performed by activating a differential lock so that the drive engine will transmit the same moment to the two drums. In this way it is possible to let out and haul in the trawl in the usual manner.

By designing the trawl winch according to the invention as further disclosed in the characterising part of claim 2, it is simple to arrange the blocking between the drive unit/drive engine and the differential. The blocking means may be designed so as to be manoeuvrable electrically, hydraulically or mechanically, for example in such a manner that it may be activated from the wheel house. The blocking means may also be executed in a quite simple manner, particularly for small vessels, so that it merely consists of a manually operated arm which blocks the power input device of the differential.

Claim 3 discloses a particularly advantageous embodiment of a very compact design of the trawl winch according to the invention.

Claims 4 and 5 disclose practical and reliable designs of the differential. It is essential that a trawl winch is strongly and reliably structured so that it may stand the tough working environment on the sea.

The invention will now be further described in the following with reference to the drawing showing an
embodiment of the invention wherein

Fig. 1 schematically shows the principal structure and function of the invention, and

Fig. 2 shows an example of a mechanical embodiment of the trawl winch according to the invention.

In Fig. 1 of the drawing the stern of a vessel is shown schematically and is designated 1. On the vessel there is arranged a trawl winch with two cable drums 5 and 6 which through a differential 4 are pulled by a common drive engine or motor 3 which may be any type of engine or motor, such as an electric motor, a hydraulic engine or a combustin engine. From each of the cable drums 5 and 6 the trawl cables 8 and 9 extend through each its block 7 to the trawl 2 which in the usual manner is manoeuvered by two otter boards 10.

When the trawl is set and the vessel 1 pulls the trawl 2, the drive engine 3 or the connection between the drive engine 3 and the differential 4 is stopped and blocked in such a manner that the two cable drums 5 and 6 are still connected via the differential 4. This produces the result that the two drums are freely rotatable but always in opposite directions so that any difference in the pull in the cables 8 and 9 is equalised so that the pull is always quite equal. This results in maximum opening of the trawl 2 and thereby maximum catch.

Fig. 2 shows an example of a trawl winch with a mechanical gear differential between the two drums. The
drive engine 3 with drive gear (driving pinion) 14 is in mesh with the power input device 15 (crown wheel). The blocking means may for example be a mechanical blocking means 19 engaging the drive gear 14 or the power input device 15. It is also possible to perform the blocking by locking the drive engine 3.

The cable drums 5 and 6 for the trawl cables 8 and 9 are arranged on a common shaft 12, 12' on either side of a gear differential 4 in that the drums 5 and 6 on the sides facing the differential are provided with a ring gear 17 operating as drum drives. Said drum drives 17 are in mesh with differential pinion gears 16 arranged on a retaining shaft 18 secured to the power input device 15 forming the crown wheel of the differential. The crown wheel 15 is a circular ring gear welded to the retaining shaft 18 and is designed with a circular ring gear with external teeth. The centre axis of the crown wheel 15 is common with that of the shaft 12 and the retaining shaft is at right angles to the main shaft 12.

The main shaft 12, 12' is embedded in bearing pedestals 11 in the usual manner in that said bearing pedestals 11 are secured to the deck of the vessel.

The two drums 5 and 6 are secured to the shaft 12 by solid bearings 13. The differential operates in the usual manner and for clearness the differential lock is not shown. The differential lock may moreover be designed in a generally known manner and such that it may either be manually operated or operated from the wheel house.
PATENT CLAIMS

1. Trawl winch for fishing vessel (1) comprising two cable drums (5,6) for each its trawl cable (8,9), said drums being operated by a drive engine (3), and means for controlling the cable drums in such a manner that when trawling the pulling action in both cables is substantially equal, characterised in that the two cable drums (5,6) are coupled to a common differential (4) having a differential lock and where the power input device (15) of the differential being coupled to the drive engine (3) may be blocked.

2. Trawl winch according to claim 1, characterised in that it further comprises a blocking means (19) for blocking the power input device (15) to the differential (4).

3. Trawl winch according to claim 1 or 2, characterised in that the two drums (5,6) are arranged on a common shaft (12,12') and on either side of the differential (4).

4. Trawl winch according to any one of claims 1-3, characterised in that the differential (4) is a mechanical gear differential with a crown wheel (15) as power input device, differential pinion gears (16) arranged on a retaining shaft (18) on the crown wheel and ring gears operating as drum drives (17) secured to each its drum (5,6).

5. Trawl winch according to any one of claims 1-4, characterised in that the power input device (15) of the differential is a circular ring gear with exter-
nal teeth and with an axis common with the shaft (12, 12') and secured to the retaining shaft (18) of the differential pinion gears (16) in that the retaining shaft (18) is always at right angles to the shaft (12, 12').
**INTERNATIONAL SEARCH REPORT**

**International Application No**
PCT/DK87/00016

**I. CLASSIFICATION OF SUBJECT MATTER**

A 01 K 73/06, B 66 D 1/50

**II. FIELDS SEARCHED**

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<td>B 66 D 1/00, /16, /18, /22-26, /48, /50, /72; A 01 K 73/00, /02, /053, /06; B 63 B 35/14/-/20, /22</td>
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Documentation Searched other than Minimum Documentation to the Extent that such Documents are Included in the Fields Searched:

SE, NO, DK, FI classes as above

**III. DOCUMENTS CONSIDERED TO BE RELEVANT**

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<th>Category</th>
<th>Citation of Document, with indication, where appropriate, of the relevant passages</th>
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<td>NO, B, 136 747 (MITSUBISHI JUKOGYO KABUSHIKI KAISHA) 20 April 1971 see part 4-1, page 4-5</td>
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<td>US, A, 2 984 455 (W FISHER) 16 May 1961 see column 3, line 50-54 and column 4 line 32-69</td>
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<td>DE, A1, 3 514 048 (BLOHM+VOSS AG) 30 October 1986</td>
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  - "A" document defining the general state of the art which is not considered to be of particular relevance
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- **"A"** document member of the same patent family

**IV. CERTIFICATION**

**Date of the Actual Completion of the International Search**
1987-09-21

**Date of Mailing of this International Search Report**
1987-09-23

**International Searching Authority**
Swedish Patent Office

**Signature of Authorized Officer**
Kerstin Boije-Janson

Form PCT/ISA/12/10 (second sheet) (January 1985)
FURTHER INFORMATION CONTINUED FROM THE SECOND SHEET

II Fields Searched (cont)
114: 255, 254, 253;
43: 4.5, 8

V OBSERVATIONS WHERE CERTAIN CLAIMS WERE FOUND UNSEARCHABLE

This international search report has not been established in respect of certain claims under Article 17(2) (a) for the following reasons:

1. Claim numbers ..........., because they relate to subject matter not required to be searched by this Authority, namely:

2. Claim numbers ..........., because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:

3. Claim numbers ..........., because they are dependent claims and are not drafted in accordance with the second and third sentences of PCT Rule 6.4(a).

VI OBSERVATIONS WHERE UNITY OF INVENTION IS LACING

This International Searching Authority found multiple Inventions in this international application as follows:

1. As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims of the international application.

2. As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims of the international application for which fees were paid, specifically claims:

3. No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claim numbers:

4. As all searchable claims could be searched without effort justifying an additional fee, the International Searching Authority did not invite payment of any additional fee.

Remark on Protest
☐ The additional search fees were accompanied by applicant's protest.
☐ No protest accompanied the payment of additional search fees.