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**Datasheet for the decision
of 29 October 2012**

Case Number: T 1023/09 - 3.2.01

Application Number: 99944654.5

Publication Number: 1119486

IPC: B63H 5/125, B63H 21/17,
B63H 25/24

Language of the proceedings: EN

Title of invention:
Arrangement and method for turning a propulsion unit

Patentee:
ABB Oy

Opponent:
Rolls-Royce Aktiebolag

Headword:
-

Relevant legal provisions (EPC 1973):
EPC Art. 56

Keyword:
"Inventive step (sole request): no"

Decisions cited:
-

Catchword:
-



Case Number: T 1023/09 - 3.2.01

DECISION
of the Technical Board of Appeal 3.2.01
of 29 October 2012

Appellant: ABB Oy
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Decision under appeal: Interlocutory decision of the Opposition
Division of the European Patent Office posted
17 March 2009 concerning maintenance of
European patent No. 1119486 in amended form.

Composition of the Board:

Chairman: G. Pricolo
Members: H. Geuss
S. Hoffmann

Summary of Facts and Submissions

- I. The appeals are directed against the interlocutory decision of the Opposition Division, posted on 17 March 2009, concerning maintenance of European Patent No. 1119486 in amended form.

The opposition division held that the subject-matter of claim 1, according to the auxiliary request at that time, met the requirements of Art. 56 EPC 1973 with respect to documents

US 5,361,024 (D1),
US 2,586,019 (D3),
US 4,223,624 (D7),
McGraw-Hill, Encyclopedia of Science and Technology,
Vol. 1 (1977), pages 319 to 323 (D9) and
WO 96/ 14241 (D10).

- II. The patent proprietor and the opponent appealed against this decision.
- III. Oral proceedings were held on 29 October 2012.
- IV. The appellant-patent proprietor requested that the decision under appeal be set aside and that the patent be maintained on the basis of the claims of the main request filed as first auxiliary request with letter dated 2 December 2011.

The appellant-opponent requested that the decision under appeal be set aside and that the European patent be revoked.

V. Claim 1 according to the sole request of the appellant-patent proprietor reads as follows (the feature identifiers shown in bold in square brackets have been added by the Board):

A propeller drive arrangement suitable for moving and steering a vessel travelling in water, which arrangement comprises [**P1**]
an azimuthing propulsion unit (6), which comprises a pod (1) adapted to be positioned outside said vessel below sea level, a first electric motor (2) or the like operating device positioned inside the pod, for rotating a propeller (5) connected to said pod, and a shaft means (8) connected to said pod for supporting said pod in a rotatable manner to the hull of said vessel (9) [**P2**], operating means for turning said azimuthing propulsion unit (6) in relation to said hull of said vessel (9) for steering said vessel in accordance with a steering command originating from a vessel's steering control device (38) [**P3**], wherein said operating means comprises a second electric motor (20) for turning said azimuthing propulsion unit (6) via a mechanical power transmission machinery (40) connected to said second electric motor [**P4**],
characterized in the arrangement further comprising
a power supply unit (30) comprising an AC inverter for supplying electric power to said second electric motor (20) [**C1bis**],
a control unit (34) for controlling the operation of said second electric motor by controlling said power supply unit (30) [**C2**],

a sensor means (16) functionally connected (18) to said control unit (34) for detecting the rotational position of said azimuthing propulsion unit (6) [C3],
said control unit (34) being arranged for processing both a steering command information originating from said steering control device (38) and rotational position information originating from said sensor means (15) and to control the operation of the second electric motor (20) on the basis of said processing [C4],
a brake means (26) for halting the rotation of said azimuthing propulsion unit (6) and/or maintaining the turning position thereof [C5.1],
and a functional connection between said brake means and said AC inverter for transferring control commands to the brake means (26) [C5.2].

VI. The appellant-opponent argued as follows:

Document D3 is considered to be the closest prior art and discloses all the features of the preamble of claim 1. Furthermore, D3 discloses implicitly a power supply unit for supplying electric power to said second motor, since the motor must be supplied with energy. However, an AC inverter is not mentioned in document D3.

Additionally, D3 discloses a control unit in the sense of the second feature of the characterizing portion of claim 1 (feature C2).

The worm gear 102 in functional connection with the motor 101 of D3 represents a brake means for halting the rotation of said azimuthing propulsion unit and/or

maintaining the turning position thereof, cf. col. 7, lines 53 et seq. Indeed the worm gear provides a self-locking function. Since the motor 101 is controlled by the control unit to start or discontinue its operation, the control unit sends commands to the brake means, which is composed of motor 101 and worm gear 102.

In fact, the use of a self-locking transmission specifically as a brake was even mentioned in the patent specification, cf. column 8, lines 54 et seq. The patent specification further explains (see page 9, lines 2 et seq.) that the motor itself can be used for braking/holding and that the motor could even be used during braking as a generator. The use of an electric motor also for braking is however matter of common general knowledge for a skilled person.

In the azimuthing propulsion unit according to D3, the control unit performs at least the functions of providing the motor, via the power supply, with an operating voltage which causes the motor to rotate. In the case that the control unit cuts the operating voltage, the motor is no longer driven, the azimuthing propulsion unit is slowed down, stops, and is held in this position by the worm gear and the motor, whereby both parts act as a brake. Consequently, the brake means - consisting of the motor and the worm gear - is functionally connected to the power supply.

As a result, the subject-matter of claim 1 differs from the propeller drive unit of D3 by the features C3, C4 and the AC inverter feature.

The use of an AC inverter as a power source for the electrical motor is, however, again part of the common general knowledge of a person skilled in the art. An AC inverter is a standard device used in various fields of technology for allowing the variable speed operation of AC motors. Accordingly, it would be obvious for a skilled person to use an AC inverter for controlling the speed of the motor 101 of the arrangement of D3.

A set-actual value comparison as defined by features C3 and C4 is disclosed in document D7. Although D7 concerns in particular small vessels with a rudder device, it shows a control unit with sensor means detecting the actual position of the rudder (cf. figures 2 to 5: potentiometer element 16). The detected information is used for controlling the rudder to take a desired position.

Since claim 1 does not require any particular properties of the control unit as defined by features C3 and C4 in connection with its use for controlling an azimuthing propulsion unit, the skilled person would take D7 into consideration even if this document relates to controlling a rudder device. In fact D7 confirms that the well-known control procedure, based on set-actual value comparison which is applied in many areas of technology, is also used in the marine environment.

Thus, the subject-matter of claim 1 does not involve an inventive step.

VII. The appellant-patent proprietor replied as follows:

It is agreed that Document D3 represents the closest prior art. This document does not disclose the features C3, C4, C5.1, C5.2 and the AC inverter feature.

It is the combination of these features which defines the basic idea of the invention. In particular, the features C3, C4 and the AC inverter feature could not be regarded separately, since the problem to be solved is to optimize the steering of a boat. The control of a large vessel asks for special requirements. Firstly, internal and external forces affect the azimuthing propulsion unit, and secondly, very small steering amplitudes are sufficient to steer a large ship.

Therefore, it is of importance to supply power to the electric motor so that the created torque is appropriate to set the azimuthing propulsion unit exactly in the desired position.

Nevertheless, the conventional technology is not precise enough to control the torque of the electric motor exactly. This leads to oversteer effects and then makes permanent steering corrections necessary.

Therefore, the use of a - per se known - AC inverter in the environment of an azimuthing propulsion unit is based on an inventive step, since the torque of the electric motor can be set in such a way that the azimuthing propulsion unit is precisely adjustable.

Moreover, no document in the state of the art discloses an AC inverter in combination with an azimuthing propulsion unit.

The feedback control, as defined in accordance with features C3 and C4, completes the control unit and further provides a high directional stability of the vessel through a feedback loop.

It is acknowledged that document D7 discloses the features C3 and C4, applied to a rudder. However, the skilled person would not take D7 into consideration, since the teaching of this document concerns small boats with a rudder arrangement. The relation of acting forces and the further circumstances are not comparable to those of a vessel with an azimuthing propulsion unit.

With regard to feature C5.1, the skilled person would never in practice rely only on a brake mechanism which consists of a self-locking worm gear. Worm gears themselves always have a certain play and thus adversely affect the control accuracy of the vessel for the reason mentioned above. In the disputed patent, therefore, a brake means always signifies an external brake, i.e. the brake is distinct from the electric motor, as exemplified in figure 1 and defined in dependent claim 3. But additionally, as explained in the description, the motor can operate as a brake.

As a result, the subject-matter of claim 1 involves an inventive step.

Reasons for the Decision

1. The appeal is admissible.
2. The subject-matter of claim 1 is not inventive (Article 56 EPC 1973).
- 2.1 D3 is indisputably considered to be the closest prior art. This document discloses:

a propeller drive arrangement suitable for moving and steering a vessel travelling in water, which arrangement comprises [**P1**] (figures 1 and 3, column 1, lines 1 to 13)

an azimuthing propulsion unit, which comprises a pod adapted to be positioned outside said vessel below sea level (figure 1),

a drive pinion adapted for mesh engagement with a bevel drive gear forming part of the propeller shaft for rotating a propeller connected to said pod

(corresponding to "or the like operating device positioned inside the pod", cf. figures 1 and 3 and column 5, lines 65 et seq.; a first electric motor 104 is however shown outside the pod in Fig. 1),

and a shaft means connected to said pod for supporting said pod in a rotatable manner to the hull of said vessel [**P2**] (figure 3),

operating means for turning said azimuthing propulsion unit in relation to said hull of said vessel for steering said vessel in accordance with a steering command originating from a vessel's steering control device (38) [**P3**] (cf. column 3, lines 57 et seq.), wherein

said operating means comprises a second electric motor for turning said azimuthing propulsion unit via a mechanical power transmission machinery connected to said second electric motor [**P4**] (101, figure 3, column 7, lines 69 et seq.), wherein the arrangement further comprising a power supply unit (...) for supplying electric power to said second electric motor (20) [**C1bis**], a control unit for controlling the operation of said second electric motor by controlling said power supply unit [**C2**] (not explicitly disclosed, but the motor must be supplied with electric energy; electric energy must be controlled; see also point 2.1.2, 3rd paragraph, below),

(...)

a brake means for halting the rotation of said azimuthing propulsion unit and/or maintaining the turning position thereof [**C5.1**] (figures 1 and 4, column 7, lines 56 et seq.), and a functional connection between said brake means and said power supply unit for transferring control commands to the brake means [**C5.2**] (figure 4, see point 2.1.1, below).

- 2.1.1 The appellant-patent proprietor submits that brake means according to features C5.1 and C5.2 are not disclosed in D3. According to figure 1 of the patent specification and present dependent claim 3 (corresponding to granted claim 5), brake means according to claim 1 have to be understood as being distinct from the electric motor and the gear mechanism.

The board does not accept this argument. In paragraph [0038] of the description of the patent specification

it is clearly stated that in accordance with one alternative of the brake means "said gearing 22 or the cogging affecting said gear rim 10 is selected so that it brakes against the rotating movement emanating from the propeller unit, but allows a rotation emanating from said motor 20, i.e. it is of a type which allows turning power from only one direction to be carried forward".

These passage leaves no doubt that an arrangement as shown in D3, consisting of a worm gear 102 which is driven by an electric motor 101 is also a "brake means for halting the rotation of said azimuthing propulsion unit (6) and/or maintaining the turning position thereof" in the sense of the claim.

2.1.2 The appellant-patent proprietor argues furthermore that no control command is transferred from an AC inverter to the brake means.

It was not disputed that D3 discloses no AC inverter. Regardless of that, the board considers that the motor 101 in D3 is without doubt driven by a control unit, cf. also feature C2.

The control unit performs at least the functions of providing the motor, via the power supply, with an operating voltage which causes the motor to rotate and of cutting the operating voltage. In the latter case, the motor is no longer driven and the azimuthing propulsion unit is slowed down, stops, and is held in this position by the worm gear and the motor acting as a brake.

Thus, when the operation voltage is cut, the power supply no longer controls, via the second electrical motor, the azimuthing propulsion unit. The latter is only controlled (held in position) by the brake means. There is therefore a functional connection between the brake means and the power supply for transferring control commands to the brake means.

2.2 Thus, the disputed invention differs from the azimuthing propulsion unit according to D3 by the following features:

- (C3) a sensor means (16) functionally connected (18) to said control unit (34) for detecting the rotational position of said azimuthing propulsion unit (6), and
- (C4) said control unit (34) being arranged for processing both a steering command information originating from said steering control device (38) and rotational position information originating from said sensor means (16) and to control the operation of the electric motor (20) on the basis of said processing, and
- (C1bis) the power supply unit comprises an AC inverter.

2.2.1 According to the established case law of the boards of appeal, a combination of features, i.e. of a so-called combination invention, is to be viewed differently from the mere existence of partial problems, i.e. of an aggregation of features.

The existence of a combination invention requires that the relationship between the features (or group of features) be one of functional reciprocity or that they show a combinative effect beyond the sum of their individual effects. On the contrary, partial problems exist if the features (or group of features) of a claim are a mere aggregation of these features (or group of features) which are not functionally interdependent, i.e. do not mutually influence each other to achieve a technical success over and above the sum of their respective individual effects, cf. Case Law of the Boards of Appeal of the European Patent Office, 6th edition, 2010, I.D.8.2.

- 2.2.2 In view of the patent specification, the board holds that the AC inverter feature contributes to the solution of a different technical problem than that underlying the group of features C3 and C4.

The objective problem solved by features C3 and C4 is to improve the steering accuracy, whereas the problem solved by the AC inverter feature is to implement an alternative power supply technique.

Consequently, features C3 and C4 have to be regarded independently of the AC inverter feature for the assessment of inventive step.

- 2.2.3 The appellant-patent proprietor submits that features C3, C4 and the AC inverter feature are functionally interdependent. The objective problem to be solved by this group of features is a control system which makes it possible to adjust the torque of an electric drive for an azimuthing propulsion unit in such a way that,

respecting the internal and external forces which act on the azimuthing propulsion unit, a precise steering of a large vessel is possible. The appellant-patent proprietor further states that the combination of these features provides in particular advantages for large vessels, since with an AC inverter it is possible to operate the electric motor in very small angular sectors with a favourable torque range, which is not possible with electric drives which have a disadvantageous torque diagram.

2.2.4 The board does not accept this argument. The functional interdependence between the features C3, C4 and the AC inverter feature is neither apparent from claim 1 nor from the description. Above all, it is nowhere specified in the patent specification that the control circuit according to the features C3 and C4 has particular advantages in connection with a power supply unit comprising an AC inverter. It is not even described how the AC inverter is incorporated into the feedback control according to the features C3 and C4 or how the inverter operates the electric motor in a favourable torque range.

2.2.5 For these reasons, the board cannot derive from the patent specification that features C3, C4 and the AC inverter feature show a combinative effect beyond the sum of their individual effects.

Consequently, the underlying features and the respective partial problems that they solve, to be taken into account for the assessment of inventive step are:

- (i) group of features C3 and C4: improvement of steering accuracy.
- (ii) AC inverter feature: implementation of an alternative power supply technique.

2.3 The appellant-patent proprietor did not dispute that feedback systems with sensors in which a set-actual value comparison is performed belong to the common general knowledge of the skilled person. Nor did the appellant-patent proprietor dispute that document D7 discloses an application of this known technique to an auto-steering system with a rudder control circuit, having a position sensor (figure 3) and a differential amplifier (figure 2) acting as a control unit. Therefore, the features C3 and C4 are essentially disclosed in D7, however not for detecting and controlling an azimuthing propulsion unit but of a rudder.

2.3.1 The appellant-patent proprietor submits that the skilled person would not consider D7 in order to solve the given problem, because the situation of a small boat with a rudder device is technically not comparable with an azimuthing propulsion unit in a large vessel.

2.3.2 Again, the board is not convinced by the appellant-patent proprietor's argument.

The board agrees with the appellant-patent proprietor's argument in as much as the steering system according to D7 is a rudder angle control circuit which is intended for small-size boats. However, the board is not convinced that the different size of ships changes the feedback control conditions in such a way that the

skilled person would not take document D7 into consideration.

Furthermore in this case neither the description nor the claims of the patent in dispute give an indication that the sensors or the control unit according to the features C3 and C4 are not required to have a particular arrangement in order to be suitable for the azimuthing propulsion unit.

Thus, document D7 teaches the skilled person that a system with sensors and a set-actual-value comparison can be used in the marine environment, and specifically for improving the steering accuracy (partial problem (i); see D7, col.4, lines 28 et seq.)

Consequently, the board holds that the integration of the above mentioned features which are well-known in the art, and particularly shown in D7 in a marine environment in an azimuthing propulsion unit in order to improve the steering accuracy would represent an obvious manner of solving the above-mentioned partial problem (i).

2.4 Furthermore, an AC inverter is an obvious choice for the skilled person when looking for an alternative power supply.

2.4.1 Contrary to what the appellant-patent proprietor asserts, the patent specification is silent about the AC inverter improving the control accuracy of the azimuthing propulsion unit by setting more exactly the torque of the electric motor, thus avoiding permanent corrections of the direction of the vessel.

2.4.2 AC inverters are generally known in the art for controlling alternate-current motors. The description of the patent discloses in this respect (cf. paragraph [0029]) that the "operating principle of the AC inverter is a technology known to a person skilled in the art, and so there is no need to explain it here apart from stating that the general main components of the AC inverter are a rectifier, a direct voltage intermediate circuit and a inverter rectifier (=inverter component). AC inverters are generally used nowadays, inter alia, as input devices for alternating-current motors, and they are particularly advantageous in various controllable electrical drives. The most commonly employed AC inverters include PWM inverters based on pulse width modulation and fitted with a voltage intermediate circuit".

Therefore, the board is convinced that the skilled person faced with problem (ii) would regard it as obvious to provide an AC inverter in the power supply unit of electric motor 101 of D3.

2.5 By modifying the propeller drive arrangement according to D3 in the obvious manner described above for solving partial problems (i) and (ii) the skilled person would directly arrive at an arrangement in accordance with claim 1. Therefore the subject-matter of claim 1 lacks inventive step (Article 56 EPC 1973).

Order

For these reasons it is decided that:

1. The decision under appeal is set aside.
2. The patent is revoked.

The Registrar:

The Chairman:

A. Vottner

G. Pricolo