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Datasheet for the decision of 23 June 2015

Case Number: T 1339/13 - 3.2.03

Application Number: 06741314.6

Publication Number: 1888849

IPC: E02F9/06

Language of the proceedings: EN

Title of invention:
APPARATUS WITH FLEXIBLY MOUNTED SPUD CARRIAGE

Patent Proprietor:
Dredging International N.V.

Opponent:
Baggermaatschappij Boskalis B.V.

Headword:

Relevant legal provisions:
EPC Art. 100(a), 100(b), 114(2), 123(2), 123(3), 84, 111(1), 56
RPBA Art. 12(4), 13(3)

Keyword:
Late-filed request - admitted (yes)
Amendments - allowable (yes)
Claims - clarity (yes)
Late-filed document - admitted (yes)
Remittal to the department of first instance - (no)
Inventive step - (yes)

Decisions cited:

Catchword:

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Case Number: T 1339/13 - 3.2.03

D E C I S I O N
of Technical Board of Appeal 3.2.03
of 23 June 2015

Appellant: (Opponent)	Baggermaatschappij Boskalis B.V. Rosmolenweg 20 NL-3356 LK Papendrecht (NL)
Representative:	Jansen, Cornelis Marinus V.O. Johan de Wittlaan 7 2517 JR Den Haag (NL)
Respondent: (Patent Proprietor)	Dredging International N.V. Haven 1025, Scheldedijk 30 2070 Zwijndrecht (BE)
Representative:	Brouwer, Hendrik Rogier Arnold & Siedsma P.O. Box 18558 2502 EN Den Haag (NL)
Decision under appeal:	**Interlocutory decision of the Opposition Division of the European Patent Office posted on 8 April 2013 concerning maintenance of the European Patent No. 1888849 in amended form.**

Composition of the Board:

Chairman	G. Ashley
Members:	V. Bouyssy
	E. Kossonakou

Summary of Facts and Submissions

I. European patent No. 1 888 849 (in the following: "the patent") concerns a dredging vessel with a substantially vertical spud, typically a cutter suction dredger ("CSD").

II. The patent as a whole was opposed on the grounds of Article 100(b) and Article 100(a) EPC for lack of novelty and inventive step over an alleged prior use of a self-propelled CSD named "URSA".

III. The Opposition Division held that the prior use was not sufficiently proven and that, account being taken of the amendments made by the patent proprietor during the opposition proceedings, the patent and the invention to which it relates meet the requirements of the EPC (Article 101(3)(a) EPC).

IV. This decision has been appealed by the opponent (here the appellant).

V. With the summons to oral proceedings, the Board sent a communication pursuant to Article 15(1) RPBA indicating to the parties its preliminary opinion of the case.

VI. Oral proceedings before the Board were held on 23 June 2015.

VII. Requests

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

The patent proprietor (here the respondent) requested that the patent be maintained on the basis of claims 1

to 8 and description pages 2 to 6 filed during the oral proceedings before the Board, together with Figures 1 to 12 of the patent specification.

VIII. Claims of the respondent's sole request

Independent claim 1 reads as follows (compared with claim 1 as originally filed with application WO 2006/130934 A2 and as granted, added features are indicated in bold, deleted features in strike-through):

"1. Apparatus for accommodating a substantially vertical spud (3) of a dredging vessel with a longitudinal direction, comprising a spud carriage (6) which is mounted for limited rotation around a horizontal transverse axis (18),
~~characterized in that~~ **wherein**
- at least a first and a second spring means (40, 41) is arranged under bias between vessel and spud in the longitudinal direction for the purpose of absorbing a moment on the spud carriage, which first and second spring means compensate each other in the non-loaded situation of the spud; and that
- at least one spring means is provided with a spring force limiting means (50) for limiting the tension in said spring element from a determined maximum moment on the spud carriage, **wherein further the first and second spring means are connected by means of respectively a first and second hydraulic cylinder (32, 33) to the vessel for the purpose of applying the desired bias, the spring force limiting means (50) comprises a piston accumulator (51, 52) which is connected to the corresponding hydraulic cylinder, the piston accumulator comprising a cylinder with free piston and an accumulator, arranged such that when the tension in the at least one spring means rises above a determined**

maximum value which is a function of the pressure of the accumulator, pistons of the hydraulic cylinder and the cylinder with free piston move inward and the spring force increases only slowly while the spud carriage rotates."

Dependent claims 2 to 7 define preferred embodiments of the apparatus of claim 1. Independent claim 8 relates to a CSD comprising an apparatus as defined in any of claims 1 to 7.

IX. Cited evidence

In the statement setting out the grounds of appeal, the appellant referred to all documents that were filed in the opposition proceedings in support of the prior use and are cited in the decision under appeal, in particular:

A4: Drawing "Hydraulikanlage Bau 775", Sach-Nr. 1378 131, Orenstein & Koppel, 1985
A5: Drawing "Pfahlführung und Pfahlgerüst", Sach-Nr. 1378 052, Orenstein & Koppel, 1985
A6: Drawing "Hydraulikschema Bau 775", Sach-Nr. 1631 119, Orenstein & Koppel, 1985
A7: Bill of material, Sach-Nr. 1 631 119, Bau 775, 5 February 1986, Orenstein & Koppel
D2: Official record of the provisional hearing of witnesses held on 15 March 2012, case 408377/HA RK 11-736, District Court of The Hague, Civil Law Sector

In addition, the appellant offered to hear Messrs Heidekamp, Kimmann and/or Albers as witnesses, and requested that the Board inspect the URSA.

Further, the appellant relied on evidence items D7 to D34c for the first time, whereby the following are relevant for this decision:

D8: C. Dekker, "Analyse van een spudsysteem voor een deiningsgecompenseerde snijkopzuiger", CO/85/153, Laboratorium voor de Techniek van het Grondverzet, TH Delft, 1985

D9: J. B. A. Kimmann, written statement dated 19 July 2013, with drawings of hydraulic system (D9a and D9b) and schematic drawing of pressure/ elongation of a wire (D9c)

D14: J. L. van Overhagen et al., "On the conceptual design of large Cutter Suction Dredgers; Considerations for making choices", Proceedings of WODCON XVII, Hamburg, Germany, 2004

D15: "Operating and Maintenance Instructions - Spud Hoisting and Shifting Device" for the Bilberg I, Orenstein & Koppel, Sach-Nr 1 670 086 - 12

D16: "Hauptdatenliste für Schneidkopfsaugbagger" for Bilberg I, Orenstein & Koppel,

D17: NL 1011753 C1

D18: US 4 432 420 A

D23: S. A. Miedema, written statement dated 25 June 2013

D23c: Register of graduation papers as of 1975 of students of department "de Techniek van het Grondverzet", TH Delft, 11 January 1984 and 1986

D24: A. A. E. Dresen, "Snijkopzuigers in zeegang - Een inventarisatie van reeds verrichte studies", 94.3.GV.4252, Faculteit der Werktuigbouwkunde en Maritieme Techniek, Vakgroep Transporttechnologie, Sectie Grondverzet, TU Delft, 1994

D26: US 4 033 056 A

D34c: "Making the Choice - Selecting and Applying Piston and Bladder Accumulators", Catalogue 1243/1-GB, Parker Hydraulics, 10/1998

X. The written and oral arguments of the parties, insofar as relevant for the present decision, can be summarised as follows:

a) Consideration of the respondent's request

Appellant's case:

The set of amended claims of the respondent's request corresponds to that of auxiliary request 1 filed with the letter of 26 May 2015. It could and should have been filed earlier in the proceedings and, at first glance, it cannot overcome all of the appellant's objections. Since this belated request is not clearly allowable, it should not be admitted into the proceedings.

Respondent's case:

Auxiliary request 1 has been filed in direct response to the provisional opinion of the Board with respect to the claim construction and the admissibility of D8. The claims differ from the claims as granted only in that further limiting features have been introduced, with the aim of overcoming all of the appellant's objections. The amendments are based on dependent claim 3 as granted, and provide more detail as to how the feature of the "spring force limiting means" should be construed, namely as disclosed in paragraph 8 of the patent specification. The subject-matter now claimed is similar to that of auxiliary request 2 in the decision

under appeal, which had already been addressed by the appellant in the appeal grounds.

b) Claim 1 - Article 123(2) EPC

Appellant's case:

Claim 1 contravenes Article 123(2) EPC because the added features of the piston accumulator amount to an unallowable intermediate generalisation of the preferred embodiment shown in Figure 5, wherein these features are disclosed only in combination with the further features that the hydraulic cylinders 32 and 33 are both provided with a piston accumulator, that the bottom side of the hydraulic cylinder 32 is connected to the piston accumulator 50 and to the accumulator 56 (via undefined element 57) and that, as soon as the tension becomes smaller than the maximum value, the free piston moves outward under the influence of the accumulator (page 10, lines 1 to 15).

Respondent's case:

The subject-matter of claim 1 is supported by the teaching in the application as filed, see in particular claim 3 and page 2, line 21 to page 3, line 1. A skilled reader would recognise that the features of the piston accumulator as added in claim 1 may be combined with the other features disclosed in the general context of claim 1 without creating an objectionable intermediate generalisation.

c) Claim 1 - Article 123(3) EPC

Appellant's case:

In claim 1, the addition of the last feature that "when the tension in the at least one spring means rises above a determined maximum value which is a function of the pressure of the accumulator, pistons of the hydraulic cylinder and the cylinder with free piston move inward and the spring force increases only slowly while the spud carriage rotates" contravenes Article 123(3) EPC. This feature implies that the spring force limiting means allows the tension in the spring means to exceed the maximum value and such an embodiment was not covered by claim 1 as granted, as this claim required the spring force limiting means to prevent the tension from exceeding the maximum value.

Respondent's case:

There is no extension of the protection because the subject-matter of claim 1 corresponds to that of dependent claim 3 as granted. This granted claim should also be read in the light of the description and drawings, as is required by Article 69(1) EPC, see in particular paragraphs 8 and 23 and Figure 5 of the patent specification.

d) Claim 1 - Article 84 EPC

Appellant's case:

Claim 1 contravenes Article 84 EPC. Firstly, the claim requires that the spring force limiting means limits the tension in the spring means to a maximum value and allows the tension to increase only slowly beyond this

value. It is unclear whether these two purposes are the same and/or compatible. Secondly, there can be no "determined maximum on the spud carriage" since the tension and thus the moment can increase further. Thirdly, the definition of the "piston accumulator" in claim 1 is not in conformity with the common understanding of that term; a piston accumulator normally is a cylinder with two chambers that are separated by a floating piston. Fourthly, the expression "the spring force increases only slowly" is broad and unclear.

Respondent's case:

The subject-matter of claim 1 is clearly defined. The expressions "a determined maximum moment" and "a determined maximum value" refer to preset threshold values. The expression "the spring force increases only slowly" means that the tension rises only slightly above the preset threshold value. The claim wording makes it clear that the function of the spring force limiting means is not to prevent any rise of the tension beyond the threshold value but rather to guarantee that, beyond this value, the tension rises only slightly. It is also clear that, in the context of the claim, the term "piston accumulator" has a special meaning which differs from its usual meaning.

e) Article 100(b) EPC

Appellant's case:

The subject-matter of claim 1 is insufficiently disclosed for it to be carried out because, owing to unclarities and internal contradictions in the claim, it is incomprehensible how the spring force limiting

means should be designed. Even the embodiment shown in Figure 5 is insufficiently disclosed, because it comprises an element 57 which apparently plays a vital role but is not defined. When working in harsh conditions, e.g. in high waves, the free piston of the piston accumulator or the piston of the hydraulic cylinder could reach an end position and then the pressure and thus the wire tension would inevitably rise almost infinitely, contrary to the last feature of claim 1.

Respondent's case:

The patent as amended discloses sufficiently how to achieve a spring force limiting means according to the claimed invention. A skilled reader would readily recognise that the slight rise of the tension above a preset threshold value can be achieved by providing the piston accumulator with a gas accumulator of large volume and by biasing the hydraulic cylinder to a pressure higher than that of the accumulator. To meet safety standards, the skilled person would inevitably provide a pressure relief valve in the hydraulic system to prevent an overpressure. In the extreme event that one of the pistons of the piston accumulator and the hydraulic cylinder reaches an end position, the pressure relief valve would be blown off before the wire tension becomes too high.

f) Consideration of D2 and D7 to D34c

Respondent's case:

The Opposition Division decided not to admit D2 into the proceedings. D7 to D34c should also not be admitted into the proceedings because they were filed too late

and could not prove the prior use up to the hilt. If any of these documents were to be admitted, the case should be remitted to the Opposition Division.

Appellant's case:

D2 had been filed in due time and is highly relevant for substantiating the prior use. Since D2 comprises official records of a provisional hearing held before a national court, the Opposition Division should have admitted it into the proceedings because of Article 117(1)(c) EPC, of Article 125 EPC in combination with Article 32 of Council Regulation (EC) Nr. 44/2001 of 22 December 2000 and of Article 6 ECHR.

In the oral proceedings before the Opposition Division, the appellant had been surprised by the decision not to consider D2 nor to hear the witnesses offered in support of D2. The filing of D7 to D34c was a legitimate reaction to this. Of these, D8, D9, D15 and D16 were highly relevant for establishing the technical features of the prior use of the CSD URSA. These documents could be obtained only recently, and thus could not have been filed earlier.

In the event that D8 were to be admitted into the proceedings, D2, D9, D15 and D16 would be of less importance.

g) Public availability of URSA and D8

Appellant's case:

The CSD URSA was originally built in 1986 as the "Bilberg I" by Orenstein & Koppel ("O&K") for Bilfinger & Berger Bau AG. In 1990 it was sold to the

appellant and renamed URSA. It was publicly used throughout the period between its launch in 1986 and the priority date of the patent (6 June 2005). It has been proven beyond reasonable doubt, e.g. by means of D2, D8, D9, D15 and D16, that the spud carriage system in A4 to A7 corresponds to that used on the URSA/ Bilberg I.

D8 is a graduation thesis written by Chris Dekker in the course of 1985 while studying mechanical engineering at the TU Delft, with a specialisation in dredging technology. After its completion, D8 was put in the library of the Department of Dredging Technology of the TU Delft, which was always accessible to students, teachers, professors and interested companies of the dredging and offshore industries (see D23). D8 was publicly accessible from 1985 onwards without any confidentiality clause (see library's register D23c of 1985). This is confirmed by a later MSc thesis (D24), which refers to D8 and discusses its content in detail. Even though a thesis written in cooperation with dredging companies or ship yards might not be published for a maximum of two years after it is finalised (D23), this did not take place with respect to D8; even if it had happened, D8 would have been publicly accessible at the latest after 1987. Hence, D8 was part of the state of the art prior to the priority date of the patent.

Respondent's case:

The appellant has not proven that the spud carriage system of the URSA corresponds to that shown in A4 to A7 and/or that the latter system was publicly available before the priority date. In view of the fact that as owner of the URSA all evidence in support of this prior use lies within the power and knowledge of the

appellant, it should prove its case beyond reasonable doubt. The appellant has failed to do so.

The appellant has also not proven that D8 was publicly available before the priority date. It is possible that D8 was put in a part of the TU Delft library which was not accessible to the public, and that the relevant part of D8 was kept confidential. Be that as it may, on 21 May 2015, enquiries made by the respondent have shown that D8 was not readily available from the TU Delft library.

h) Claim 1 - Inventive step

Appellant's case:

Novelty of claim 1 is not contested. D8 discloses a spud carriage system developed by O&K and mounted on the Bilberg I (Figures 3.5 and 3.6 and pages 17 to 20 of D8). The system comprises a spring means as required in claim 1, in the form of four cross wires connected to the vessel via sheaves ("Seilrolle") and hydraulic cylinders ("Spannzylinder"). Each of the wires is pre-tensioned/biased using a respective hydraulic cylinder. Each cylinder is provided with a pressure relief valve ("overstort") which is activated at a preset maximum pressure in the cylinder to decrease the risk of wire breaking (page 20, lines 8 and 9). Since the pressure relief valve limits the tension in the wire to a preset maximum value of pressure, which corresponds to the value of the wire tension and thus of the moment on the spud carriage, it forms a spring force limiting means.

As shown in Figure 3.5, each hydraulic cylinder can be connected to a gas accumulator to bring the cylinder to a pressure corresponding to the desired pre-tension/

bias in the respective wire (see accumulator symbol in Figure 3.5; "drukvat" and "gasveer" on page 20, lines 12 and 12 and in Figure 3.6). It is implicit that, if the tension in the wire were to rise above the preset bias, the accumulator would slow down the build-up of hydraulic pressure in the system. This inherent dimming effect of the gas accumulator is well known in the art of hydraulics and depends, among other things, on the volume of gas. Thus, it is implicitly disclosed that the accumulator in Figure 3.5 of D8 is "arranged such that when the tension in the at least one spring means rises above a determined maximum value which is a function of the pressure of the accumulator", the piston of the hydraulic cylinder moves "inward and the spring force increases only slowly while the spud carriage rotates".

Therefore, the apparatus defined in claim 1 differs from D8 only in that it further comprises a cylinder with free piston, arranged between the accumulator and the hydraulic cylinder. The patent specification does not disclose any technical effect achieved by using this cylinder. In fact, it serves only as a medium separator between the gas or the hydraulic fluid on either side of the free piston. In the light of common general knowledge in hydraulics, the skilled person would provide such an additional cylinder to separate the accumulator and the hydraulic cylinder in Figure 3.5 of D8. Moreover, starting from D8, it would be an obvious modification in the light of either D34c or D18 to replace the bladder accumulator of D8 by a piston accumulator and, if need be, to add a separating cylinder with a free piston. Thus, claim 1 lacks inventive step when starting from D8.

The same applies if the skilled person were to start from D17. This document discloses an apparatus according to the preamble of claim 1 as granted (see paragraph 3 of the patent specification), comprising elastic wires biased by means of gas cylinders. The apparatus of claim 1 differs from this apparatus only in that it comprises a piston accumulator as defined in claim 1. However, for the reasons already set out when starting from D8, this modification would be obvious for the skilled person in the light of common general knowledge, D34c or D18.

Respondent's case:

The spud carriage system in Figure 3.5 of D8 is the most promising starting point for assessing inventive step. D17 does not disclose such a system for absorbing a moment on the spud carriage, but rather a wire system to displace the spud carriage longitudinally relative to the vessel while forward stepping.

The claimed subject-matter differs from the system in Figure 3.5 of D8 in that at least one spring means, i.e. at least one wire of D8, is provided with a piston accumulator which is connected to the hydraulic cylinder biasing this wire and which comprises a cylinder with free piston and an accumulator, arranged such that, when the tension in this wire rises above a preset threshold value, the pistons of the hydraulic cylinder and the cylinder with free piston move inward and the wire tension increases only slowly while the spud (carriage) tilts.

These modifications allow the connection between spud and vessel to automatically become much less rigid, i.e. much more flexible, when the wire tension exceeds

a preset threshold value resulting from the movement of the vessel in waves. The piston accumulator then allows the spud to tilt around its transverse axis without substantially increasing the wire tension and the moment applied on the spud carriage. Thus, the distinguishing features lead to a reduced risk of damage to the spud (carriage) in waves or swell.

Contrary to the appellant's view, it cannot be derived from D8 that the system disclosed therein is adapted to achieve this effect. On the contrary, it follows from the dotted curve in Figure 3.6 of D8 that the spud force and stiffness both increase continuously with spud tilt, until the pressure relief valve is blown off; then the spud would tilt in an uncontrolled manner and the spring means would need to be re-biased manually, by means of an iterative process.

Starting from D8, the technical problem objectively solved can thus be seen as how to extend the workability of the dredger in waves and swell.

The claimed solution is neither disclosed nor suggested in the cited prior art. In particular, D18 belongs to the remote technical field of riser technology and thus the skilled reader would not consider it.

Thus, claim 1 involves an inventive step.

Reasons for the Decision

1. Consideration of the respondent's request

1.1 The respondent filed its request for the first time during the oral proceedings before the Board. The set of amended claims differs from that of auxiliary request 1 filed in response to the preliminary opinion of the Board accompanying the summons to oral proceedings only in that the wording "characterized in that" has been replaced by "wherein" in claim 1.

1.2 The amendments concern the introduction of limiting features to claim 1 as granted, with the aim of overcoming all appellant's objections and of addressing the Board's preliminary opinion. Claim 1 as amended is based on claim 3 as granted and the description of the "spring force limiting means" given in paragraph 8 of the patent specification. These amendments do not give rise to any new or complex issues that could not be dealt with without adjournment of the oral proceedings. In the opposition and appeal proceedings, the appellant had already made submissions directed at the subject-matter of claim 3 as granted, and throughout the proceedings the respondent consistently argued that the feature of the "spring force limiting means" should be construed in the light of paragraph 8 of the patent specification. Finally, in the Board's view, the amendments *prima facie* would overcome the appellant's objections raised under Articles 123, 84 and 83 EPC.

1.3 For these reasons, the Board decided to take the respondent's (sole) request into consideration (Article 114(2) EPC and Articles 13(1) and (3) RPBA).

2. Interpretation of claim 1 as amended

2.1 Claim 1 is directed to a reader skilled in the art of dredging vessels, in particular CSDs, which are moored in place during dredging operations by a substantially vertical pile, called a spud, accommodated in a spud carriage. Thus, the skilled reader is an offshore and dredging engineer having experience in the design of such large dredging vessels, including common general knowledge in hydrodynamics and hydraulics.

2.2 An important feature of the spud is its high rigidity or stiffness compared with other mooring systems. During dredging operations, the spud point is fixed in the seabed and a longitudinal ground reaction force is exerted on it. This longitudinal spud force creates a bending moment on the spud carriage. At the priority date of the patent, it was common practice to use a rigid spud carriage to absorb high cutting forces while dredging (see e.g. D14, section 5.2). When a vessel heaves and pitches in waves or swell, the spud force and the moment on a rigid spud carriage increase significantly and may eventually damage, or even break, the spud or its carriage. As this would induce significant maintenance costs and down-time, use of such dredgers was usually limited to sheltered and calm waters.

2.3 Claim 1 defines a spud carriage which is allowed to rotate over a limited angle in longitudinal direction and which is rotated back by spring and hydraulic means. The parties dispute how the feature "spring force limiting means" of claim 1 is to be construed.

2.4 Claim 1 requires that "at least a first and a second spring means is arranged under bias between vessel and

spud in the longitudinal direction for the purpose of absorbing a moment on the spud carriage", and that "at least one spring means is provided with a spring force limiting means for limiting the tension in said spring element from a determined maximum moment on the spud carriage".

2.5 At first glance, in the latter feature, the normal meaning of the term "limiting" seems to imply that the the spring force limiting means simply prevents the tension in the spring means from exceeding a maximum value corresponding to a maximum moment on the spud carriage. From this, a skilled reader might understand that the spring force limiting means is simply a load limiter in the form of a standard safety relief valve, which would prevent any overloading of the hydraulic system and the spring means.

2.6 This feature must, however, be read in the context of the claim, and in particular in combination with the requirement in the claim that the spring force limiting means comprises a cylinder with a free piston and an accumulator arranged such that "when the tension in the at least one spring means rises above a determined maximum value which is a function of the pressure of the accumulator, pistons of the hydraulic cylinder and the cylinder with free piston move inward and the spring force increases only slowly while the spud carriage rotates".

2.7 From this, it is apparent for the skilled reader that the function of the spring force limiting means is not to prevent the tension in the spring element from exceeding a maximum value, but rather to guarantee that, when the tension exceeds a preset threshold value (the "determined maximum value"), which is a function

of preset pressure in the accumulator, the tension rises only slightly. This understanding is confirmed in the description as amended (see paragraphs 6, 8, 24 and 25 with Figures 4 and 5). It is thus clear that the spring force limiting means is not merely a safety relief valve.

3. Claim 1 - Article 123(2) EPC

3.1 Article 123(2) EPC states that the patent may not be amended in such a way that it contains subject-matter which extends beyond the content of the application as filed.

3.2 The subject-matter of claim 1 differs from that of claim 3 as originally filed in that it comprises the additional features that the piston accumulator as defined therein comprises "a cylinder with free piston and an accumulator, arranged such that when the tension in the at least one spring means rises above a determined maximum value which is a function of the pressure of the accumulator, pistons of the hydraulic cylinder and the cylinder with free piston move inward and the spring force increases only slowly while the spud carriage rotates".

3.3 This amendment is supported by the description of the preferred embodiment of this piston accumulator in the application documents as originally filed, see in particular page 2, line 28 to page 3, line 1 and page 10, lines 4 to 13 together with Figure 5. It follows from Figure 5 and page 10, lines 1 to 15 that the hydraulic cylinders 32 and 33 are both provided with a piston accumulator, which is connected to the bottom side of the cylinder, and that an element 57 is placed between the cylinder 32 and the accumulator 56

biasing it. However, a skilled reader would recognise that these further features are entirely optional in obtaining the required effect, namely to ensure that the wire tension rises only slightly beyond the preset threshold value. It is also implicit from the wording of the claim at hand that, as soon as the tension returns to below the threshold value, the hydraulic fluid will flow back from the accumulator into the hydraulic system and the pistons will move outward. Consequently, there is no unallowable intermediate generalisation, contrary to the appellant's opinion.

3.4 The Board is thus satisfied that the amendments meet the requirements of Article 123(2) EPC.

4. Claim 1 - Article 123(3) EPC

4.1 Article 123(3) EPC rules that the patent may not be amended in such a way as to extend the protection it confers. Article 69(1) EPC rules that the extent of the protection conferred by a patent shall be determined by the claims, whereby the description and drawings shall be used to interpret the claims.

4.2 The subject-matter of claim 1 corresponds to that of dependent claim 3 as granted, whereby further limiting features have been introduced to restrict the piston accumulator as defined therein to that disclosed in paragraphs 8 and 23 and Figure 5 of the patent specification (see point 3.2 above).

4.3 Claim 1 as granted clearly defined the "spring force limiting means" as a force limiter adapted to limit the tension from a maximum moment on the spud carriage, and claim 3 as granted taught that this means preferably comprises a piston accumulator connected to the

hydraulic cylinder. A skilled reader of claim 3 as granted would have had serious doubts as to the ability of a piston accumulator to perform the force limiting function as it is defined in granted claim 1. Therefore he would have been motivated to consult the description and drawings of the patent specification and, while doing so, he would have immediately recognised from paragraphs 8, 24, 25 and Figures 4 and 5, that the piston accumulator is not meant to limit the tension in the spring means but rather to significantly slow down the rise of the tension. In claim 1 as amended, the respondent has introduced the above mentioned features of the piston accumulator to ensure that its intended function is clear from the wording of the claim. The Board takes the view that a skilled reader of the patent specification would have anticipated this amendment and thus the extent of protection conferred by the claim as amended does not go beyond that of the granted claims.

4.4 The Board thus is satisfied that the amendments meet the requirement of Article 123(3) EPC.

5. Claim 1 - Article 84 EPC

5.1 The Board also considers that the amendments made in claim 1 meet the requirements of Article 84 EPC. In particular, the skilled reader would readily understand from the wording "the spring force increases only slowly while the spud carriage rotates" that the tension in the spring means can still rise, albeit only slightly, while the spud (carriage) tilts (see point 2.7 above).

5.2 The Board agrees with the appellant that the term "only slowly" is a relative term and that it is preferable

not to use such a relative term in a claim. However, in the context of the claim at hand, this term imparts a clear teaching to a skilled reader. In addition, there is no basis in the disclosure for a more precise wording and this feature is not the only feature distinguishing the claimed invention from the prior art (see point 10 below).

5.3 The claim wording clearly defines a particular meaning for the term "piston accumulator": it comprises a cylinder with a free piston and an accumulator.

6. Article 100(b) EPC

6.1 On a normal reading, claim 1 requires that the cylinder with free piston and the accumulator allow the spud carriage system to automatically become much more flexible when the tension exceeds a preset threshold value than it would otherwise. This is in conformity with the teaching in the description as amended (paragraphs 6, 8, 24 and 25) and in Figures 4 and 5.

6.2 In the light of Figures 4 and 5, it is clear for a skilled reader that this effect can be achieved by using a spring means in the form of wires and a gas-oil accumulator (52) with a large gas volume. A pre-charge pressure corresponding to the threshold values for the wire tension and the moment on the spud carriage is established. The hydraulic cylinder (32) is pre-tensioned at a lower pressure corresponding to the desired minimum wire tension, e.g. by means of a separate accumulator (56) connected to the cylinder via a valve (57). It is generally known in hydraulics that in a gas-oil accumulator, the compressible gas functions like a spring and that its "spring stiffness" generally follows the gas law $P.V^n$ = constant, where P

is the working pressure, V the internal gas volume and n is a constant for the gas. Using this knowledge, the skilled reader would recognise that Figure 4 is a schematic representation of wire tension as a function of wire lengthening for the theoretical case of a gas-oil accumulator 52 of almost infinite gas volume. It would also be immediately apparent to the skilled reader that the stroke of the cylinder with a free piston (51) defines the range of allowable tilt for the spud, that is the range of spud tilt that can be automatically and elastically redressed by the spring means.

6.3 Finally, it is common knowledge that, for safety reasons, the hydraulic system must include a pressure relief valve, which is closed under normal working conditions. In the exceptional situation where the tension in the spring means becomes so high that the free piston or the piston of the hydraulic cylinder reaches an end position, this pressure relief valve would activate and release hydraulic fluid from the system. Of course, this would disrupt the bias between the spring means and thus the tilted spud could no longer be automatically brought back to its initial (biased) position by the spring means. Obviously, since this is clearly an exceptional situation, the skilled person will set the pressure relief valve so that it acts only as a last resort safety means, long after the spring force limiting means has significantly reduced the rise of the tension.

6.4 The Board thus shares the respondent's view that a skilled reader would have no difficulty in carrying out the claimed invention.

6.5 Hence, the ground for opposition according to Article 100(b) EPC does not prejudice the maintenance of the patent as amended.

7. Consideration of D2 and D7 to D34c

7.1 Document D2

The Opposition Division decided not to admit D2 into the proceedings, using its discretionary power under Article 114(2) EPC, inter alia because its late filing was an abuse of procedure by the opponent and its admittance would run contrary to procedural expediency. Nonetheless, the appealed decision contains a detailed analysis and evaluation of the evidence contained therein.

In light of the substantive evaluation performed by the Opposition Division, the Board considers that the same conclusion would have been reached, namely that D2 is not sufficient to establish the specific technical features of the prior used spud carriage system, even if D2 had been admitted into the proceedings. Consequently, the Board decided not to take D2 into consideration.

7.2 D7 to D34c

7.2.1 Of these pieces of evidence submitted with the grounds of appeal, the appellant relied essentially on

- D8, D9, D15, D16, D23, D24 to establish the technical features of the alleged prior use and the public prior availability of D8; and
- D8, D9, D14, D17, D18, D26 and D34c to contest novelty and inventive step.

7.2.2 D14 documents the skilled person's common general knowledge at the priority date of the patent and is thus *prima facie* relevant for the case.

7.2.3 D17 and D26 are cited as closest prior art in paragraph 4 of the patent specification and thus are part of the proceedings (see e.g. Case Law of the Boards of Appeal of the EPO, 7th edition, September 2013, IV.C.1.5).

7.2.4 The Board sees no reason to disregard either D18 or D34c, in particular because these documents are *prima facie* relevant for the evaluation of inventive step when starting from D8.

7.2.5 The Board considers that D8, D9, D15 and D16, as well as the offer to hear Messrs Heidekamp, Kimmann and/or Albers as witnesses, could and should have been filed in the opposition proceedings. Indeed all this newly filed evidence was within the power/sphere of influence and knowledge of the appellant, and the Opposition Division had made it clear in its communication annexed to the summons to oral proceedings dated 13 September 2012 that it considered the prior use of the apparatus shown in A4 to A7, i.e. the technical features of the URSA, as not sufficiently proven. Thus, the Board decided not to hear the proposed witnesses nor to take any of D9, D15 and D16 into account (Article 12(4) RPBA).

D8, however, is *prima facie* highly relevant for the evaluation of inventive step (see point 10 below) and cannot be disregarded. Consequently, this document has been taken into consideration, despite its late-filing.

7.2.6 The rest of the newly submitted evidence is essentially related to facts which are not in dispute among the parties, e.g. that the URSA existed and was publicly accessible prior to the priority date or that, at that time, it was a standard practice to use a pressure relief valve as an overpressure safety means in hydraulic systems. For this reason, the Board decided not to consider this evidence.

8. Remittal of the case

8.1 The respondent had requested that the case be remitted to the Opposition Division in the event that the Board intended to admit D8 into the proceedings.

8.2 In view of the fact that the evaluation of D8 was straightforward and could be dealt with within the framework of the proceedings, and taking into consideration the need for procedural efficiency, the Board considered that it was not appropriate to remit the case but decided to instead deal with it itself (Article 111(1) EPC).

9. Availability of D8 to the public

The evidence adduced allows the following conclusions regarding the chain of events in respect of this issue:

9.1 D8 is one of three graduation papers written in Dutch by a Mr Chris Dekker, as part of a master's degree in mechanical engineering at the TH Delft (renamed TU Delft in 1986), specialising in dredging technology (see D8, pages 4 and 5 and D23, point 6), which comprises the analysis of a spud system for an undulation compensating CSD (see title).

9.2 The front page of D8 carries the number CO/85/153, where "CO" stands for "Constructieve Opdracht", i.e. "Construction Assignment", "85" refers to the year when D8 was finished, i.e. 1985, and "153" refers to the fact that D8 was the 153rd graduation paper written at the Department of Dredging Technology (Laboratorium voor de Techniek van het Grondverzet) of TH Delft (D23, point 5; library's register D23c, pages 3 and CO-26).

9.3 D8 was put, along with all graduation papers and handbooks on dredging technology, in the library of this department (D23, points 7 and 8). This is a public university library, i.e. one that should normally be accessible to a broad audience, in particular from the offshore and dredging industry (D23, points 9, 12 to 16).

9.4 D8 figures in a register dated 1986 listing all graduation papers of students in this department (D23c, page CO-26), which was circulated to members of the staff and, upon request, to interested institutions and companies (see D23c, letter dated 11 January 1984).

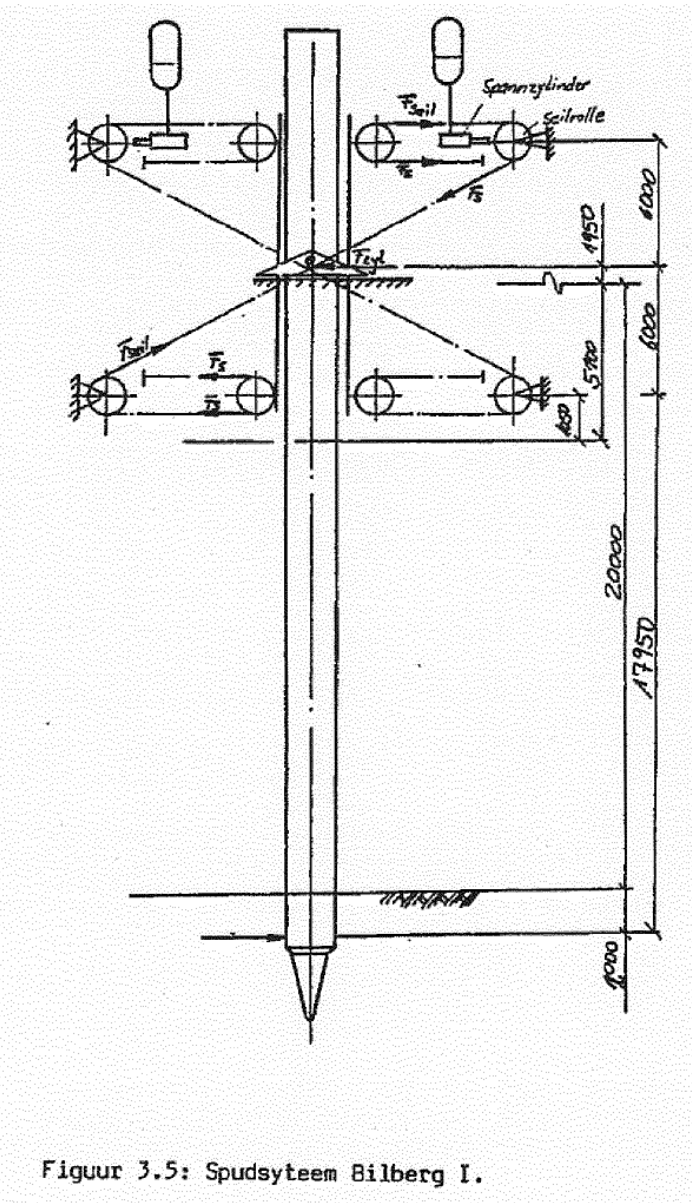
9.5 D8 is cited, and its content is discussed, in a MSc thesis (D24) written in 1994 by a Mr Dresen, then student in the Department of Dredging Technology at TU Delft. D24 comprises an inventory of past studies on CSDs working in waves (see title and page ii), in particular an overview of graduation works written by former students at TU Delft (page vii and Chapter 2). On pages 35 to 38 and 68 of D24, there is an explicit reference to D8 and its disclosure regarding the spud carriage system of O&K as mounted on the CSD Bilberg I.

9.6 Normally, at TU Delft, a graduation paper will be made public after its assessment by the graduation committee, unless it has been sponsored by a company or an institution which requires some parts of the paper to be kept confidential. In such an exceptional case, the paper will not be published for a maximum of 2 years (D23, point 11). This does not appear to have taken place for D8 and, even if it had, D8 would have been made public at the latest in 1987.

9.7 The respondent argued that, up until the priority date, D8 might have been put in a part of the library which was not publicly accessible, or that the relevant part of D8 might have been kept confidential, even though it was referred to in D24. However, the respondent did not furnish any evidence in support of these allegations except for the compte-rendu of an unsuccessful attempt to locate the paper in May 2015. However, the mere fact that on 21 May 2015 D8 was neither digitally nor physically obtainable from the TU Delft library is irrelevant in respect of assessing the document's accessibility at the relevant time. As there is sufficient evidence on file to this end (see in particular points 9.5 and 9.6 above), the Board is convinced that this document was publicly available before the priority date of the patent.

10. Claim 1 - Inventive step

10.1 It is undisputed that the spud carriage system of the CSD Bilberg I as shown in Figure 3.5 and described in page 17 to 21 of D8 is an appropriate starting point for the assessment of inventive step.



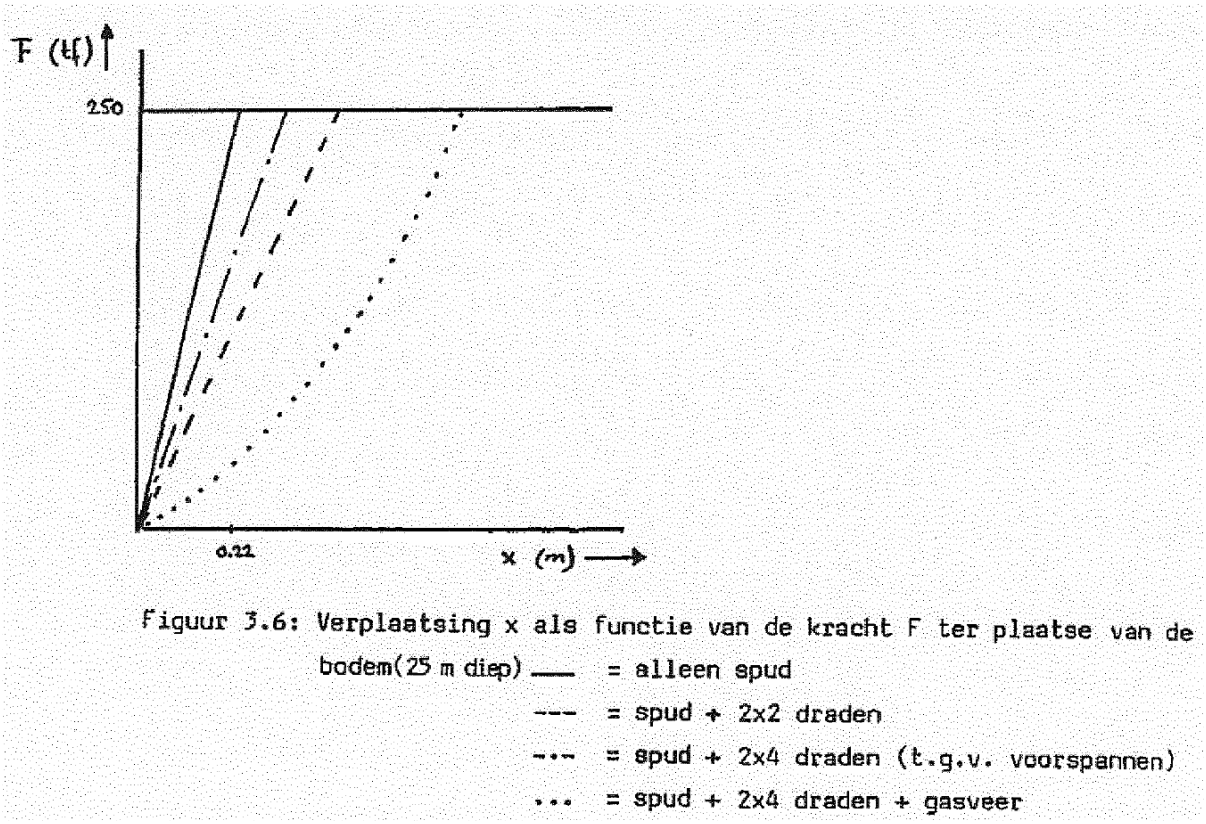
Figuur 3.5: Spudsyteem Bilberg I.

10.2 Figure 3.5 shows that the spud is fixed into the seabed and held in a spud carriage, which is formed by two brackets ("spudbeugels") and is hingedly suspended in a sliding shoe. The shoe is connected to the vessel by means of a hydraulic cylinder (not shown; see cylinder 4 in Figure 3.4 and page 17, line 12 and last paragraph). This cylinder allows the spud carriage to be moved longitudinally relative to the vessel when the latter is moved forward during stepping. Four cross wires are attached to the spud carriage, namely two

wires at its top and two wires at its bottom; these absorb a bending moment on the spud carriage and transfer it to the vessel. The ends of the wires are fixed to the vessel. The wires run over sheaves fixed to the vessel as well as over sheaves fixed to the spud carriage (see "Seilrolle" in Figure 3.5). Each wire is pre-tensioned by means of a hydraulic cylinder connecting a top sheave to the vessel (see page 17, lines 16 to 18, "Spannzylinder" in Figure 3.5 and "hydraulische cilinder" on page 20, line 6). When the pressure is too high, an overflow valve is activated to prevent the wire tension from rising any further, and this reduces the risk of wire breakage (see "overstort", page 20, lines 8 and 9 and F=250 in Figure 3.6). A gas-filled accumulator can be connected to the hydraulic cylinder and, depending on its volume, this results in a gas spring with a certain rigidity (see accumulator symbol in Figure 3.5; "drukvat" and "gasveer" on page 20, lines 12 and 12 and in Figure 3.6). The main purpose of this gas spring is to give the spud some freedom of movement when the cutter ladder is raised (page 21, paragraph 1).

10.3 Contrary to the appellant's opinion, it cannot be derived from D8 that, if the wire tension were to become so large that the pressure on the hydraulic cylinder exceeds the pre-tension set by the gas accumulator, the accumulator would inevitably slow down the rise of the tension, so that the tension increases only slowly as required in claim 1. On the contrary, Figure 3.6 of D18 (see below) shows that, when using the gas spring, the spud force F increases continuously with the vessel displacement x, and thus the tilt angle, up until the pressure relief valve is blown off (see maximum spud force F of 250 tf, i.e. 2452 kN), whereby the spring stiffness of the system increases

steadily (see dotted curve 3.6 of D8 below). Even though Figure 3.6 clearly shows that the gas spring adds flexibility to the spud carriage construction (see the three steep straight lines compared with the dotted curve), it is not apparent from it that the gas spring significantly decreases the stiffness beyond a threshold value of the force.



Figuur 3.6: Verplaatsing x als functie van de kracht F ter plaatse van de bodem(25 m diep) ___ = alleen spud
--- = spud + 2x2 draden
-·- = spud + 2x4 draden (t.g.v. voorspannen)
··· = spud + 2x4 draden + gasveer

10.4 Therefore, the apparatus of claim 1 differs from the spud carriage system of D8 in that at least one spring means, i.e. at least one wire of D8, is provided with a piston accumulator which is connected to the hydraulic cylinder biasing this wire and which comprises a cylinder with free piston and an accumulator, arranged such that, when the tension in this wire exceeds a preset threshold value, the pistons of the hydraulic cylinder and the cylinder with free piston move

inwardly and the wire tension increases only slowly as the spud carriage rotates.

10.5 With these distinguishing features, the spud carriage system automatically becomes flexible in large waves or swell when the tension in the spring means exceeds a preset threshold value. When the tension falls again, the hydraulic fluid flows automatically back from the accumulator into the hydraulic system and the spring means can rotate the tilted spud back towards its non-loaded biased position. The cylinder with free piston does not simply act as a medium separator in the hydraulic system: its stroke defines the range of allowable and reversible tilt for the spud. In conclusion, the distinguishing features reduce the risk of the spud or its carriage being damaged in large waves and swell, and thus allows higher production and uptime of the dredger in these conditions.

10.6 Starting from D8, the objective technical problem solved by the distinguishing features thus is how to improve the workability of the dredger in waves or swell (see paragraph 3 in the description as amended).

10.7 The claimed solution to this problem was not part of common general knowledge, and is neither disclosed nor suggested in the cited prior art.

10.8 A number of solutions are generally known in the art to solve the objective problem: reducing the movements of the dredger in waves by increasing its dimensions or shaping its hull; making the spud carriage system more rigid to allow higher forces; reducing the forces exerted on the construction parts by replacing the spud by a flexible mooring system, e.g. a Christmas tree installation (see e.g. D14, section 5.2). For the

skilled person it would thus be straightforward to apply one or the other of these solutions. By doing so, however, he would not arrive at the distinguishing features of the claim at hand.

10.9 D14 teaches that the workability of a CSD can alternatively be extended by introducing flexibility within the spud carriage construction and that, in the URSA, flexibility in the longitudinal direction is provided by a spud carriage support system of cross wires and sheaves, wherein the wires can be tensioned by hydraulic tensioners, and whereby, because of the hydraulic tensioners, the system can act as a peak load limiter (see page 10, paragraph 2). This teaching does not go beyond that of D8 and thus cannot lead to the solution as claimed.

10.10 In addition, D14 mentions spud carriage systems that can be set rigid for cutting hard material in calm sea conditions, or alternatively, set to be flexible in swell (see page 10, paragraph 3). This, however, does not suggest using a piston accumulator as claimed, which would allow the spud carriage system to automatically pass from a rigid mode to a more flexible mode depending on actual forces and moments.

10.11 A skilled person facing the above defined problem would disregard the teaching of D18 because it is not at all concerned with dredging, let alone with operating a cutter suction dredger in waves or swell, hence it does not address the above problem. D18 is concerned with the tensioning of a riser extending between a floating vessel and a well head by means of a tensioning cable attached between the top of the riser and the vessel and a tensioning device applying force to this cable. D18 aims, among others, to prevent damage to the

tensioning means and potentially to the vessel itself if the cable breaks due to fatigue. This technical problem is remote from the above defined problem. Figure 3 of D18 illustrates a preferred solution to the problem of damage due to cable breakage: a safety valve is installed in the hydraulic fluid supply line of a tensioning cylinder 38; when the tension in the tensioning cable 48 drops below a preset level, the valve is rapidly closed to deactivate the tensioning cylinder 38. Even if the skilled person were to consider D18, this arrangement is not compatible with the spud carriage system of D8.

10.12 D34c discusses the pros and cons of bladder and piston accumulators, but it neither discloses a piston accumulator as defined in claim 1 nor does it address the above defined problem. Thus it cannot lead to the claimed solution.

10.13 D26 discloses that two vertically spaced horizontal jacks can take up the considerable moment on the spud carriage, but it fails to disclose the distinguishing features. Therefore, it cannot lead to the claimed apparatus.

10.14 In conclusion, when starting from D8, the claimed invention involves an inventive step in the sense of Article 56 EPC.

10.15 The same conclusion would be reached if the skilled person were to start from D17, because its teaching does not go beyond that of D8. In addition, D17 is not a promising starting point for assessing inventive step. It discloses that, for stepping the vessel forward, the spud carriage can be moved longitudinally by pulling on cross cables instead of using an

hydraulic cylinder, as is shown in D8 and D26. Thus, contrary to D8 and the claimed invention, D17 is not concerned with the problem of taking up the moment on the spud carriage in waves or swell. D17 teaches that, to prevent a cable overload, at least one cable end is attached to the vessel through a resilient member, for instance an hydraulic cylinder connected to a buffer element. This, however, does not lead to the piston accumulator as claimed.

11. Prior use URSA

11.1 As acknowledged by the appellant, the alleged prior use is not more relevant than Figure 3.5 of D8 for assessing the inventive step of the claimed invention.

11.2 In light of the conclusions reached when starting from D8 as the closest prior art, there is no need to investigate the prior use any further.

12. Dependent claims and description

12.1 The dependent claims have been adapted to claim 1. The above reasoning with respect to inventive step of the apparatus of claim 1 applies to the dependent claims.

12.2 The description has been brought into conformity with the amended claims. The appellant had no objections to these amendments.

Order

For these reasons it is decided that:

1. The decision under appeal is set aside.

2. The case is remitted to the Opposition Division with the order to maintain the patent as amended in the following version:
   - claims 1 to 8 of the main request filed in the oral proceedings before the Board,
   - description: pages 2 to 6 filed in the oral proceedings before the Board,
   - drawings: Figures 1 to 12 of the patent specification.

The Registrar: The Chairman:

C. Spira G. Ashley

Decision electronically authenticated