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Datasheet for the decision of 14 January 2020

Case Number: T 1546/15 - 3.5.02

Application Number: 08164976.6

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Language of the proceedings: EN

Title of invention:
Pressure compensator

Patent Proprietor:
ABB Schweiz AG

Opponent:
Siemens Aktiengesellschaft

Relevant legal provisions:
EPC Art. 100(a), 54(2), 56

Keyword:
Novelty - (yes)
Inventive step - (yes)

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Case Number: T 1546/15 - 3.5.02

D E C I S I O N
of Technical Board of Appeal 3.5.02
of 14 January 2020

Appellant: (Opponent)	Siemens Aktiengesellschaft Werner-von-Siemens-Straße 1 80333 München (DE)
Representative:	Siemens AG Postfach 22 16 34 80506 München (DE)
Respondent: (Patent Proprietor)	ABB Schweiz AG Brown Boveri Strasse 6 5400 Baden (CH)
Representative:	Peterreins Schley Patent- und Rechtsanwälte Hermann-Sack-Strasse 3 80331 München (DE)
Decision under appeal:	**Decision of the Opposition Division of the European Patent Office posted on 5 June 2015 rejecting the opposition filed against European patent No. 2169690 pursuant to Article 101(2) EPC.**

Composition of the Board:

Chairman	R. Lord
Members:	H. Bronold
	R. Cramer

Summary of Facts and Submissions

I. The appeal of the opponent lies from the decision of the opposition division rejecting the opposition against European patent No. 2 169 690.

The opposition division found that the subject-matter of claim 1 of the opposed patent was new over documents D1 and D2 and involved an inventive starting from any of documents D4, D9 and D5.

II. The appellant (opponent) requested, that the decision under appeal be set aside and that the patent be revoked.

III. The respondent (patent proprietor) requested, that the appeal be dismissed, or alternatively that the decision under appeal be set aside and the patent be maintained in amended form on the basis of the claims of one of auxiliary requests 1 to 7, filed with the letter of 18 January 2016.

IV. The following documents cited in the proceedings before the first instance are relevant for this appeal:

D1 : US 2,700,306
D2 : GB 1 600 095
D4 : Bernt Bjerkreim et al. : OTC18969 "Ormen Lange Subsea Compression Pilot" prepared for presentation at the 2007 Offshore Technology Conference, Houston, Texas, USA, 30 April to 3 May 2007
D5 : WO 2007/055588 A1
D8 : JP 2000 046181
D9 : US 2004/0051615 A1

D17: Norsok Standard Common Requirements, "Subsea Production Control Systems"; U-CR-005, Rev. 1. Jan. 1995, pp. 1-25
D19: Statoil governing document, "Subsea Production Control System", Technical and professional requirements, TR1233, Final Ver. 2, pp. 1-100
D20 : OTC 18965, "Ormen Lange Subsea Production System", Thomas Bernt, Hydro, and Endre Smedsrud, FMC Technologies, prepared for presentation at the 2007 Offshore Technology Conference, Houston, Texas, USA, 30 April to 3 May 2007
D23: WO 2007/009960 A1

V. In a communication under Article 15(1) RPBA the board informed the parties that it was inclined to hold the subject-matter of claim 1 of the patent as granted new over documents D1 and D2 as well as involving an inventive step starting from document D4 in combination with the common general knowledge of the person skilled in the art, D20, D23 or D1, or when starting from document D9 in combination with the common general knowledge of the person skilled in the art, or starting from document D5 in combination with document D8, and consequently, that the board was minded to dismiss the appeal.

VI. Oral proceedings were held before the board on 14 January 2020.

VII. Claim 1 of the patent as granted (main request) reads as follows:

"Pressure compensator configured to compensate volume variations of an insulation medium or other liquid of a subsea installation (1), comprising a first bellows chamber (6) comprising a first bellows part (7), the

first bellows chamber being in flow connection with an insulation medium or liquid chamber of the subsea installation and the walls of the first bellows chamber (6) being configured to separate the insulating medium from surroundings, characterized in that the first bellows chamber (6) is surrounded by a second bellows chamber (8) comprising a second bellows part (9), the second bellows chamber (8) being configured to form a closed intermediate space around the first bellows chamber (6), the walls of the second bellows chamber being configured to separate at least the bellows parts (7) of the first bellows chamber (6) from the surrounding sea water, the second bellows chamber (8) being further filled with an intermediate medium (10)."

Claims 2 to 15 depend on claim 1.

VIII. The arguments of the appellant, as far as they are relevant for this appeal, can be summarised as follows:

Novelty

The shore wave recorder of D1 comprised a metal bellows 44 which was surrounded by a rubber bellows 32. From column 1, lines 15 to 20 and column 2, lines 16 to 20 it followed that during operation, bellows 32 and 44 were compressed due to wave pressure. According to column 3, lines 55 to 60 the instant pressure on the bellows resulted in movement of the bellows. Thus, bellows 44 and 32 constituted a pressure compensator in the sense of claim 1. The pressure compensator of D1 also disclosed the remaining features of claim 1, namely a first and a second bellows chamber filled with an insulation medium and an intermediate medium, respectively. Thus, claim 1 was not new over the disclosure of D1.

Claim 1 was further not new over the disclosure of document D2. Document D2 disclosed in figures 1, 2 and 6 a first bellows chamber 126 surrounded by a second bellows chamber 50. Both bellows chambers were filled with an insulation medium. Although bellows 50 was not surrounded by sea water itself, it was clear from page 2, lines 110 to 116 that bellows 50 constituted a redundant variable volume chamber for the outer housing structures, i.e. the protective housing 12 surrounded by sea water. Thus, bellows 50 provided the same function as the outer protective housing 12 and therefore fell under the definition of the claimed feature "the walls of the second bellows chamber being configured to separate at least the ... first bellows chamber (6) from the surrounding sea water".

Inventive step

Document D4 disclosed a pressure compensator with a metal bellows including an additional rubber barrier. Starting from document D4, the objective technical problem was to implement the second rubber barrier to be separately testable because two separately testable barriers were mandatory in the field of subsea installations, as was evident from document D17 or D19. In view of the limited freedom of design regarding barriers against sea water, the person skilled in the art would therefore have separated the rubber barrier from the steel bellows and have provided it as separate rubber bellows around the steel bellows and thus have arrived at the subject-matter of claim 1 in an obvious manner.

The subject-matter of claim 1 was also rendered obvious by any of the combinations of document D4 with D20, D23 or D1.

Document D20 on pages 6 and 7 disclosed two pressure compensated and testable barriers in the field of subsea power transformers. Starting from the metal bellows disclosed in document D4 and the fact that two barriers were mandatory for subsea installations, the addition of the second barrier as rubber bellows was obvious for the person skilled in the art.

From document D23, page 5, lines 24 to 26, a double-walled bellows was known that allowed for leakage testing. The fact that D23 was not directed to subsea installations, but instead to standard transformers, did not hinder the person skilled in the art from applying the teaching of D23, i.e. compensating pressure variations from inside the housing, conversely to subsea transformers having to deal with pressure variations from outside the housing, as the variations disclosed in document D4.

As already discussed with respect to novelty, document D1 disclosed a pressure compensator with all characterising features of claim 1. According to D1, the rubber bellows was foreseen to protect the metal bellows from corrosion. Starting from the steel bellows of D4, which had to be protected against corrosion, it was therefore obvious for the person skilled in the art to implement the pressure compensator having two bellows chambers as disclosed in document D1.

From document D9, figure 3, a double pressure compensator 34 was known, wherein a first pressure compensator was surrounded by a second pressure

compensator. The only difference to the subject-matter of claim 1 was therefore that the pressure compensators were implemented as bellows. Since bellows were the most common types of pressure compensators in the field of subsea installations, it was obvious for the person skilled in the art to replace the bladders or pistons disclosed in document D9 by bellows. Thus, the subject-matter of claim 1 did not involve an inventive step.

Starting from document D5, a double-walled metal bellows was known, which according to page 5 was provided to be testable. The subject-matter of claim 1 therefore differed from the disclosure of D5 only in a second bellows. The objective problem resulting from this difference was to provide protection against corrosion. A solution for this problem was already known from document D1, which suggested a rubber bellows surrounding a metal bellows for protection against corrosion, or from document D8, which disclosed a double-walled metal bellows for this purpose. The attack based on a combination of documents D5 and D1 was part of the opposition proceedings and was therefore admissible.

IX. The arguments of the respondent, as far as they are relevant for this appeal, can be summarised as follows:

Novelty

Claim 1 defined a pressure compensator configured to compensate volume variations of an insulation medium of a subsea installation. In contrast to that, the volume of the subsea installation of D1, i.e. the casing formed by elements 26 and 27, was not subject to volume changes because the casing was mechanically strong and the depths for which it was foreseen were just up to

600 feet. As a consequence, the insulation medium in the casing 26 was not subject to volume changes. In addition, the shore wave recorder of D1 comprised a helium compartment 69 connected to the casing 26 via an additional bellows 39. Thus, the pressure exerted by waves on bellows 32 and 44 resulted in a movement of the bellows 32 and 44 as well as of bellows 39. However, the volume of the insulation medium inside the casing did not change. Therefore, bellows 32 and 44 did not constitute a pressure compensator in the sense of claim 1.

While document D2 disclosed a pressure compensator for subsea installations in elements 30 and 32, the bellows 50 and 126 did not constitute a pressure compensator in the sense of claim 1. In particular, both bellows 126 and 50 were located inside an outer protective casing 12. Therefore, bellows 50 according to D2 did not separate at least the bellows parts of the first bellows chamber from surrounding sea water and consequently could not be interpreted as a second bellows chamber in the sense of claim 1.

The subject-matter of claim 1 was thus new with respect to both document D1 and D2.

Inventive step

Document D4 disclosed merely a pressure compensator with a single double-walled bellows, i.e. a metal bellows with rubber protection. Nothing in document D4 hinted at providing the rubber protection as separate bellows implying a separate bellows chamber filled with an intermediate medium.

The common general knowledge of the person skilled in the art merely included providing pressure compensators for subsea installations with two separately testable barriers. Since there was a plurality of different ways to realise two separately testable barriers, the appellant's argument, that this implied a metal bellows surrounded by a rubber bellows, was purely based on hindsight.

Document D20 contained no specification of the two barriers at all and according to document D23 just a single double-walled bellows was disclosed, which was not even suitable for subsea installations. Therefore, neither document D20 nor document D23 added anything to the disclosure of document D4.

As already set out with respect to novelty, the two bellows disclosed in document D1 did not constitute a pressure compensator, such that document D1 did not provide any teaching towards the subject-matter of claim 1.

Document D9 disclosed two pressure compensators connected in series. However, the second pressure compensator could not be interpreted as surrounding the first pressure compensator because according to D9 the two pressure compensators were connected in series. It was incorrect that bellows constituted the most common type of pressure compensator. Even if the person skilled in the art replaced the two piston-type pressure compensators by bellows, one would still not surround the other.

The attack based on a combination of documents D5 and D1 had been raised for the first time with letter dated 13 December 2019 and was therefore inadmissible. In

substance, document D5 merely disclosed a single bellows for use with pressure compensators. Since document D1 did not disclose a pressure compensator with two bellows, a combination of documents D5 and D1 was not suitable to render the subject-matter of claim 1 obvious. The same applied for a combination of documents D5 and D8, which disclosed just a single double-walled bellows for application with hot gases, with no relation to subsea installations.

Consequently, none of the combinations brought forward by the appellant rendered the subject-matter of claim 1 obvious.

Reasons for the Decision

1. Admissibility of the appeal

The appeal was filed in due time and form and sufficiently substantiated. Consequently, the appeal is admissible.

2. Novelty

The board is not convinced by the appellant's reasoning that the subject-matter of claim 1 lacks novelty.

2.1 Document D1

In particular, document D1 does not disclose the claimed pressure compensator because bellows 32 and 44

according to D1 do not function as a pressure compensator. The reasoning provided by the appellant ignores the fact that on top of the vessel 26, 27, the shore wave recorder of D1 has a third bellows 39 in the top chamber 28 of the shore wave recorder. The purpose of this bellows 39 is to allow, in cooperation with bellows 32 and 44, a movement which corresponds to the wave pressure such that changes of the wave pressure can be recorded inside the vessel.

According to column 4, lines 15 to 26 of D1, pressure compensation in an installation phase of the shore wave recorder according to document D1 is achieved by container 69 and tube 71. These are filled with helium and not with a fluid as bellows 32 and 44. Over time after the installation, valve 72 will be closed due to a reaction of sea water with magnesium wires that keep valve 72 open. Pressure compensation according to document D1 is thereafter carried out only via helium filled container 69 situated in flow connection with the top chamber 28. Thus, movement of bellows 32 and 44 due to waves passing the shore wave recorder will be transferred to the upper bellows 39, which in turn will compress the helium in container 69. The medium inside the vessel 26, 27 is incompressible. Consequently, there is no volume change inside the vessel 26, 27. This is also consistent with the description of D1 according to which instant pressure, i.e. pressure due to waves passing the shore wave recorder, arriving at bellows 32 is transferred with "negligible loss through the medium of kerosene" (column 3, lines 58 and 59). Bellows 32 and 44 thus do not provide any pressure compensating function.

Thus, document D1 does not disclose all features of claim 1. Consequently, the subject-matter of claim 1 is new over the disclosure of document D1.

2.2 Document D2

Contrary to the appellant's arguments, document D2 does not disclose a second bellows part, whose walls are configured to separate at least the bellows part of the first bellows chamber from the surrounding sea water. The board is in particular not convinced by the appellant's interpretation, that the bellows 126 and 50 according to document D2 corresponded to the first and second bellows chambers as defined in claim 1, respectively. Since bellows 126 is located inside bellows 50 and bellows 50 is located inside the outer protective housing 12 of the sub-sea equipment of document D2, bellows 50 can not be regarded as being configured to separate the bellows parts of the first bellows chamber from the surrounding sea water. It merely separates the first bellows chamber 126 from surrounding protective fluid. The passage on page 2, lines 110 to 116 of D2 that "inner and outer housing structures defining redundant variable volume chambers .... filled with a substantially incompressible protective fluid medium" does not mean that the inner housing structure, i.e. bellows 50, has the same function as the outer protective housing 12. Further, bellows 50 is not in flow communication with the subsea installation, as claimed, since bellows 50 is located inside the subsea installation of D2. Moreover, the only pressure compensator disclosed in document D2 is the bladder 32 mounted in a separate housing 30 and being connected to the outer protective housing 12 via tube 26. However, this pressure compensator disclosed in D2 does not comprise bellows.

Thus, document D2 does not disclose all features of claim 1 either. Consequently, the subject-matter of claim 1 is also new over the disclosure of document D2.

2.3 The board has therefore arrived at the conclusion that the subject-matter of claim 1 according to the main request is new in the sense of Article 54(2) EPC. Consequently, the ground for opposition under Article 100(a) EPC in conjunction with Article 54 EPC does not prejudice the maintenance of the patent.

3. Inventive step

The board is further not convinced that the subject-matter of claim 1 is rendered obvious by any of the following combinations of prior art presented by the appellant during the appeal procedure.

3.1 Document D4 and common general knowledge

It is uncontested that document D4 discloses a single metal bellows with additional rubber barrier/ protection. Regarding the alleged common general knowledge of the person skilled in the art based on documents D17 and D19, the board agrees with the respondent in that the dual barriers required by the disclosures of these documents are directed to electrical insulation of subsea equipment and not to pressure compensation. Therefore, as the invention according to the patent is directed to a pressure compensator for subsea installations, the passages cited by the appellant in documents D17 and D19 are not pertinent for the present appeal.

The appellant's interpretation that, taking into account the common general knowledge that dual barrier protection was mandatory in the field (based on document D17 and D19), it was evident for the person skilled in the art to separate the rubber barrier disclosed in D4 from the steel barrier, is an argument based on hindsight. The board could not identify any disclosure in the cited passages of D4 that would hint towards the appellant's interpretation. Nor do documents D17 and D19 deal with two separate bellows chambers. It might be true that two separately testable barriers are mandatory for pressure compensators of subsea installations. However, in view of the plurality of possibilities to fulfil such obligation, the appellant's interpretation that those barriers have to be implemented in the same way as claimed in claim 1, i.e. by two bellows chambers, one surrounding the other, is clearly based on hindsight.

3.2 Documents D4 and D20

Regarding a combination of document D4 with D20, the board does not agree with the appellant's interpretation that the skilled person would have implemented the rubber barrier of document D4 as a pressure compensated and separately testable barrier. Document D20 contains no detailed information about the technical implementation of two separately testable barriers. It is merely disclosed that "electrical cables are terminated in several pressure compensated chambers". Even if the person skilled in that art were to consider combining the disclosures of documents D4 and D20, such a combination would not necessarily result in two bellows chambers as claimed in claim 1, because bellows are not the only possible solution for pressure compensation around electric subsea cables.

Therefore, the appellant's argument regarding a combination of document D4 and D20 is also based on hindsight.

Having regard to the fact that the board concluded that a combination of documents D4 and D20 does not render the subject-matter of claim 1 obvious, the question of whether document D20 is prior art, since it was not proven what had actually been disclosed at the conference on 30 April to 3 May 2007, as argued by the respondent, is not decisive for the present appeal and can thus be left open.

3.3 Documents D4 and D23

As regards the combination of document D4 with D23, the board is not convinced that the person skilled in the art would consider D23 at all, because D23 does not deal with subsea pressure compensation. Even if the person skilled in the art would do so, the isolated sentence on page 5, lines 24 to 26 merely discloses a single double-walled bellows. Document D23 thus adds nothing to the disclosure of document D4, which already discloses a single double-walled bellows.

3.4 Documents D4 and D1

With respect to the combination of document D4 with D1, it has to be considered that D1 does not deal with pressure compensation but discloses a shore wave recorder. Thus, the board is not convinced that the person skilled in the art would even consider combining the disclosure of document D4 with the disclosure of D1. Moreover, as discussed above with respect to novelty under 2.1, document D1 does not disclose two separate bellows chambers acting as a pressure

compensator according to claim 1 either. Pressure compensation according to D1 is achieved via a helium container 69 and functions by compression / expansion of the helium instead of by a bellows allowing variable volumes of a chamber. Moreover the volume of the insulating medium inside the subsea installation of D1, i.e. the casing 26, 27, does not change. Therefore, even if the person skilled in the art were to combine documents D4 and D1, such a combination would not render the subject-matter of claim 1 obvious.

3.5 Document D9 and common general knowledge

Concerning the disclosure of document D9, the board is not convinced that the only remaining difference between D9 and the subject-matter of claim 1 is that the expansion chambers of D9 are flexible membranes or pistons instead of bellows.

Document D9 further does not disclose that the second expansion chamber surrounds the first expansion chamber. In particular, from figure 3 of document D9 and the corresponding description it is clear that the two expansion chambers are connected in series. According to figure 3, the two expansion chambers are clearly separate chambers, arranged in separate cylindrical housings and linked via a tube. Thus, the board does not agree with the appellant's interpretation of figure 3 that one chamber of D9 surrounds the other in the sense of claim 1. Therefore, even if the person skilled in the art would implement the pressure compensators according to D9 as bellows, this would not result in the arrangement of two bellows chambers as claimed in claim 1.

3.6 Documents D5 and D8

Document D5 merely discloses a single double-walled bellows as pressure compensator of a subsea installation. The board is further not convinced that the person skilled in the art would combine the disclosures of documents D5 and D8, because document D8 does not relate to pressure compensation for subsea equipment, but rather to vibration absorption in pipes for high temperature corrosive gases. Consequently, the combination of documents D5 and D8 does not render the subject-matter of claim 1 obvious.

3.7 Documents D5 and D1

Without prejudice to the admissibility of the new line of argument based on a combination of documents D5 and D1, the board has come to the conclusion, that, as already set out above under 3.6 and 2.1, D5 merely discloses a single double-walled bellows and document D1 does not disclose the claimed structure comprising a metal bellows and a rubber bellows for the purpose of pressure compensation either. Pressure compensation according to document D1 is accomplished by a helium container. Therefore, even if the person skilled in the art were to have combined the teachings of documents D5 and D1, he would not have arrived at the subject-matter of claim 1.

The question of admissibility of this new line of argument can therefore be left open, since in substance, it is not decisive for the present appeal.

3.8 In summary, none of the combinations of prior art brought forward by the appellant renders the subject-matter of claim 1 obvious.

Therefore, the board has arrived at the conclusion that the subject-matter of claim 1 involves an inventive step in the sense of Article 56 EPC. Consequently, the ground for opposition under Article 100(a) EPC in conjunction with Article 56 EPC also does not prejudice the maintenance of the patent.

4. Conclusion

In absence of any pertinent ground of opposition brought forward by the appellant that prejudices the maintenance of the patent, the board has to accede to the respondent's request to dismiss the appeal.

Order

For these reasons it is decided that:

The appeal is dismissed.

The Registrar: The Chairman:

U. Bultmann R. Lord

Decision electronically authenticated