NOTE: This disposition is nonprecedential.

United States Court of Appeals for the Federal Circuit

(Reexamination No. 95/001,168)

FLUOR TEC, CORP.,
Appellant,

v.

DAVID J. KAPPOS, DIRECTOR, UNITED STATES PATENT AND TRADEMARK OFFICE,
Appellee,

AND

LUMMUS TECHNOLOGY, INC.,
Appellee.

2012-1295

Appeal from the United States Patent and Trademark Office, Board of Patent Appeals and Interferences.

Decided: December 11, 2012

ROBERT D. FISH, Fish & Associates, PC, of Irvine, California, argued for appellant. With him on the brief was MEI TSANG.

RAYMOND T. CHEN, Solicitor, United States Patent and Trademark Office, of Arlington, Virginia, argued for appellee, United States Patent and Trademark Office. With him on the brief were AMY J. NELSON and KRISTI L.R. SAWERT, Associate Solicitors.

JEFFREY S. BERGMAN, Osha Liang LLP, of Houston, Texas, argued for appellee, Lummus Technology, Inc.

Before LOURIE, BRYSON, and WALLACH, *Circuit Judges*.

LOURIE, *Circuit Judge*.

Fluor Tec, Corp. ("Fluor") appeals from the decision of the Board of Patent Appeals and Interferences (the "Board") in an *inter partes* reexamination affirming the Examiner's decision not to reject claims 1–9, 11, 13, 25–29, 31, 33, 37–47, 55, 56, and 58 of U.S. Patent 6,712,880 (the "'880 patent") owned by Lummus Technology, Inc. ("Lummus"). *See Fluor Tec, Corp. v. Patent of Lummus Tech. Inc.*, No. 2011-013099 (B.P.A.I. Dec. 15, 2011) ("*Board Decision*"). Because substantial evidence supports the Board's conclusion that the claimed invention would not have been obvious in view of the cited prior art, we *affirm*.

BACKGROUND

This appeal arises from an *inter partes* reexamination of the '880 patent in the U.S. Patent and Trademark Office (the "PTO"), assigned Patent Reexamination Control Number 95/001,168, which was initiated by third party requester Fluor under 35 U.S.C. § 311 and 37 C.F.R. § 1.913.

The '880 patent is directed to cryogenic processes for separating multi-component gaseous hydrocarbon

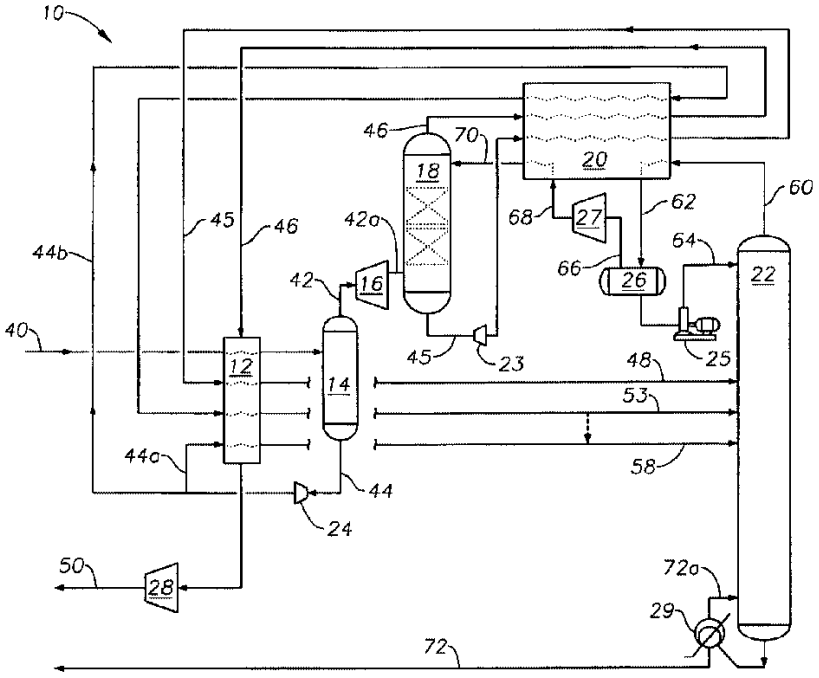
streams to recover both gaseous and liquid compounds using a high pressure absorber. '880 patent col.1 ll.10–15. The abridged claim 1 recited below, as amended during the reexamination proceeding, is representative of the claimed elements in dispute:

> 1. A process for separating a heavy key component from an inlet gas stream containing a mixture of methane, C_2 compounds, C_3 compounds, and heavier compounds, comprising the following steps:
>
> (a) at least partially condensing and separating the inlet gas into a first liquid stream and a first vapor stream;
>
> (b) expanding at least a portion of the first liquid stream, at least a portion of which is then designated as a first fractionation feed stream;
>
> (c) supplying a fractionation column the first fractionation feed stream and a second fractionation feed stream, the fractionation column produces a fractionation overhead vapor stream and a fractionation bottom stream;
>
> (d) expanding at least a portion of the first vapor stream, such expanded portion then designated as an expanded vapor stream;
>
> (e) supplying an absorber the expanded vapor stream and an absorber feed stream, the absorber produces an absorber overhead stream and an absorber bottom stream, the absorber having an absorber pressure that is substantially greater than and at a

> predetermined differential pressure from a fractionation column pressure; . . .

J.A. 325–326 (bracketing and underlining showing changes relative to the original patent claim omitted).

Figure 1, reproduced below, depicts a flow diagram of a separation process according to the '880 patent:

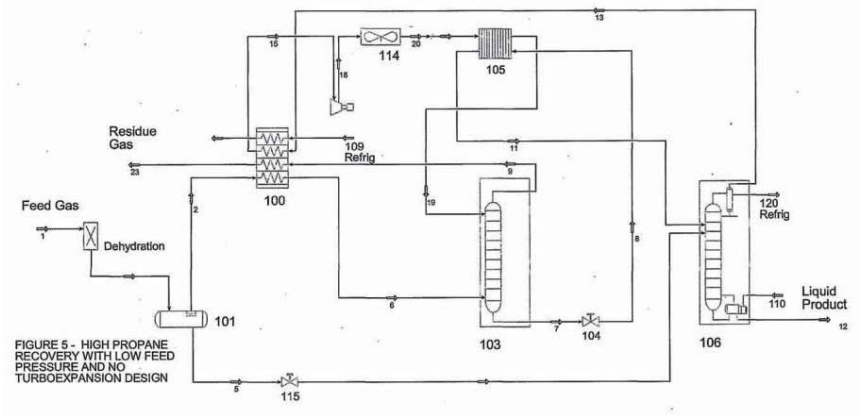


'880 patent fig. 1.

Relevant to the issues argued in this appeal, Lummus's separation apparatus is a two-column system that includes an absorber column [18] and a downstream fractionation column [22], wherein the absorber column is operated at a pressure substantially greater than the fractionation column. '880 patent col.6 ll.52–60, col.3 ll.48–54. Inlet gas [40] is first cooled or condensed in heat exchanger [12] and separated in separator [14] into first

liquid stream [44] and first vapor stream [42]. *Id.* col.7 ll.18–27. The first liquid stream [44] is expanded in expander [24], heated in exchanger [12], and supplied to a middle tray of fractionation column [22] as first fractionation feed stream [58]. *Id.* col.7 ll.31–35. A portion of first liquid stream [44] may be fed to overhead exchanger [20], as well as exchanger [12], before being supplied to fractionation column [22]. *Id.* col.8 ll.5–11. The first vapor stream [42] is expanded in turboexpander [16] to the operating pressure of absorber [18]. *Id.* col.7 ll.29–31. The expanded first vapor stream [42a] is then fed into the lower end of absorber [18]. *Id.* col.7 ll.34–36. In the absorber, heavier compounds in the vapor stream are absorbed by the falling liquid stream to produce absorber bottom stream [45], and lighter compounds rise to the top of the column to produce absorber overhead stream [46]. *Id.* col.7 ll.50–59. Absorber bottom stream [45] is cooled (condensed) in exchangers [20] and [12], and fed into the middle of fractionation column [22] as second fractionation feed stream [48]. *Id.* col.7 ll.60–62, col.8 ll.17–21.

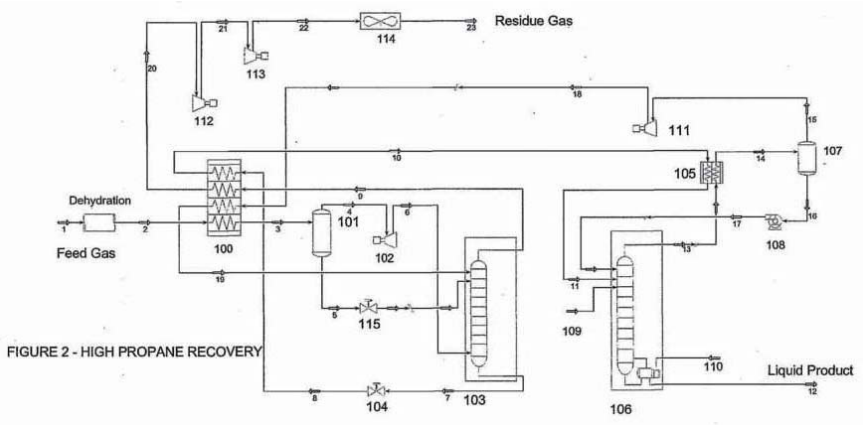
In requesting reexamination, Fluor relied on International Patent Publication Number WO 02/14763 of Mak (the "Mak application") as evidence of unpatentability. The Mak application discloses gas processing methods and configurations suitable for the recovery of propane or ethane that include an absorber and a fractionation column where the absorber is operated at a pressure higher than the fractionation column. Mak Appl. 2–3. The Mak application discloses two different configurations for gas separation, which depend on the pressure of the feed gas. One configuration, designed for use with low-pressure feed gas, does not involve expanding the first vapor stream, and is depicted in a flow diagram in Figure 5, reproduced below:



Mak Appl. fig. 5.

In this low-pressure design, the feed gas [1] is separated in separator [101] into a liquid portion [5] and a gaseous portion [2]. *Id.* at 8. The liquid portion [5] is expanded in Joules-Thompson valve [115] and fed directly into the fractionation column [106], and the gaseous portion [2] is cooled in heat exchanger [100] and fed into absorber [103] without expansion in a turboexpander. *Id.* The absorber overhead stream [9] is heated in exchanger [100] and fed into the gas pipeline without recompression, and the absorber bottom stream [7] is expanded in Joules-Thompson valve [104], which reduces the pressure and temperature, then heated in exchanger [105] and fed into the top of fractionation column [106]. *Id.*

The other configuration disclosed in the Mak application, designed for use with high-pressure feed gas, is depicted in a flow diagram in Figure 2, reproduced below:



Mak Appl. fig. 2.

In this high-pressure design, the feed gas [1], [2] is cooled in heat exchanger [100] and separated in separator [101] into a liquid portion [5] that is fed into the upper end of absorber [103], and a gaseous portion [4] that is expanded in turboexpander [102] and fed into a lower section of absorber [103]. *Id.* at 6. The absorber bottom stream [7] is expanded in Joules-Thompson valve [104], which lowers the pressure and significantly cools the stream, then heated in exchangers [100] and [105] and then fed into the top of fractionation column [106]. *Id.*

During reexamination, the Examiner rejected some of the patent claims as anticipated under 35 U.S.C. § 102(e) by the Mak application, and some of the claims as obvious under 35 U.S.C. § 103 in view of the Mak application. Thereafter, Lummus amended the independent claims to incorporate limitations from the dependent claims. Specifically, claim 1 was amended as excerpted above. Following the amendment, the Examiner withdrew the rejections of the claims in view of the Mak application. In particular, the Examiner found that the vapor stream in Mak's low-pressure configuration (*i.e.*, stream [2], [6] in Figure 5) is not expanded prior to entering the absorber,

as required by the claims. *Right of Appeal Notice dated Jan. 20, 2011 in Control No. 95/001,168*, 20–21. Further, the Examiner noted that, according to Lummus's amended claims, the first fractionation feed stream in the '880 patent has the same chemical composition as the first liquid stream, which is merely renamed after being warmed in the heat exchangers en route to the fractionation column. *Id.* at 14–15. In contrast, the first liquid stream in Mak's high-pressure configuration (*i.e.*, stream [5] in Figure 2) is initially fed to the absorber, where it undergoes chemical processing, and it is the chemically altered absorber bottom stream that is fed into the fractionation column as the first fractionation feed stream. *Id.* at 15–16.

Fluor then appealed to the Board under 35 U.S.C. § 134(c). The Board affirmed the Examiner's finding that the Mak application failed to anticipate the claims, and Fluor does not challenge that holding on appeal. *See Board Decision* at 12. The Board, like the Examiner, also found that it would not have been obvious to add an expander to the low-pressure configuration taught by the Mak application and depicted in Figure 5 because that system was specifically designed and labeled not to include turboexpansion. *Id.* at 12–13. The Board also concluded that the Examiner was correct in finding that there was no motivation for a skilled artisan to modify the high-pressure configuration taught by Mak and depicted in Figure 2 by rerouting the liquid stream to the fractionation column. *Id.* at 13. Accordingly, the Board affirmed the Examiner's decision not to reject the claims.

Fluor timely appealed. We have jurisdiction pursuant to 28 U.S.C. § 1295(a)(4)(A).

DISCUSSION

A claim is invalid for obviousness if, to one of ordinary skill in the pertinent art, "the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made." 35 U.S.C. § 103(a) (2006); *see also KSR Int'l Co. v. Teleflex Inc.*, 550 U.S. 398, 406–07 (2007). Obviousness is a legal conclusion based on underlying factual findings. *In re Kao*, 639 F.3d 1057, 1065 (Fed. Cir. 2011). We review the Board's legal conclusions *de novo* and its factual determinations for substantial evidence. *In re Am. Acad. Sci. Tech. Ctr.*, 367 F.3d 1359, 1363 (Fed. Cir. 2004). Substantial evidence means "such relevant evidence as a reasonable mind might accept as adequate to support a conclusion." *Consol. Edison Co. v. Nat'l Labor Relations Bd.*, 305 U.S. 197, 229 (1938).

I.

The claims of the '880 patent require either "expanding" or an "expansion means" for expanding at least a portion of the first vapor stream, which the specification discloses are to "be effectuated with a turbo-expander, Joules-Thompson expansion valves, a liquid expander, a gas or vapor expander or the like." J.A. 325–326; '880 patent col.6 ll.35–39. Fluor contends that the Board incorrectly determined that it would not have been obvious to add an expander to the low-pressure configuration depicted in Figure 5 of the Mak application. Fluor argues that it would have been a mere design choice for a skilled artisan to add an expander when utilizing Mak's low-pressure system with a high-pressure feed gas in order to improve the efficiency of the absorber, since the need to match the feed gas pressure with the absorber pressure

was well-known in the prior art.[1] We disagree because substantial evidence supports the Board's factual findings underlying its conclusion that the claims would not have been obvious.

The system depicted in Figure 5 of the Mak application does not include expanding at least a portion of the first vapor stream as required by the claims; rather, vapor stream [2], [6] is fed into absorber [103] after cooling in heat exchanger [100], but without passing through an expander. Indeed, Mak's low feed pressure configuration specifically excludes an expander: Figure 5 is expressly labeled as a "No Turboexpansion Design," and the Mak specification recites (i) that "[t]he gaseous portion of [2] is cooled in a heat exchanger [100] and the cooled gaseous portion [6] is then fed into absorber [103] *without expansion in a turboexpander*," Mak Appl. 8 (emphasis added); (ii) that "Figure 5 is a . . . configuration for a gas processing plant *without turboexpander*," *id.* at 4 (emphasis

[1] To support its argument, Fluor relies, in part, on U.S. Patent 4,657,571 issued to Gazzi ("Gazzi"), which is cited in the background section of the '880 patent, but is not incorporated by reference into the patent specification or part of the prosecution history of the reexamination application. Fluor admits that Gazzi was never referenced in arguments to the Examiner or the Board and was not part of the administrative record considered by the Board, but nevertheless contends that it was within the knowledge of a person of ordinary skill in the art and therefore the Board's failure to consider it warrants vacating and remanding the Board's decision. Appellant Reply. Br. 9. However, because 35 U.S.C. § 144 provides that we "review the decision from which an appeal is taken on the record before the [PTO]," Gazzi is not properly before us for consideration on appeal. *In re Watts*, 354 F.3d 1362, 1367 (Fed. Cir. 2004) ("[R]eview of the Board's decision is confined to the 'four corners' of that record.").

added); and (iii) that "the feed gas is fed into the absorber *without passing through a turboexpander*," *id.* at 8 (emphasis added).

We agree with the Board's determination that it would not have been obvious to modify Mak's disclosure to add an expander. *See DePuy Spine, Inc. v. Medtronic Sofamor Danek, Inc.*, 567 F.3d 1314, 1326 (Fed. Cir. 2009) ("An inference of nonobviousness is especially strong where the prior art's teachings undermine the very reason being proffered as to why a person of ordinary skill would have combined the known elements."). The Mak application discloses two different configurations, one designed for high-pressure feed gas and one designed for low-pressure feed gas, and that Mak specifically discusses the advantages of the "no turboexpander design" for low-pressure feed gas. *See* Mak Appl. 8–9. In Mak's system, depicted in Figure 5, the gaseous portion is cooled in a heat exchanger before being fed into the absorber, but if high-pressure feed gas could be accommodated simply by adding an expander to the low-pressure configuration, then there would be no need for the separate high-pressure configuration. *See In re Gal*, 980 F.2d 717, 719 (Fed. Cir. 1992) (holding that different structure to achieve different purpose was not an obvious design choice). Adding an expander to Mak's low-pressure configuration is not simply a design choice that one would employ.

Moreover, a skilled artisan desiring to utilize a high-pressure feed gas would have been directed to follow the alternative systems disclosed in the Mak application that are specifically designed to accommodate a high-pressure feed gas, rather than attempt to modify Mak's low-pressure configuration. *See In re Gurley*, 27 F.3d 551, 553 (Fed. Cir. 1994) (a reference teaches away "when a person of ordinary skill, upon reading the reference . . . would be

led in a direction divergent from the path that was taken by the applicant"). Accordingly, viewing the teachings of the Mak application as a whole, a skilled artisan would not have been motivated to add an expander to the low-pressure configuration depicted in Figure 5 to arrive at the claimed invention. Because the Board's fact-finding is supported by substantial evidence, we affirm its conclusion of nonobviousness. *In re Jolley*, 308 F.3d 1317, 1320 (Fed. Cir. 2002).

II.

The claims of the '880 patent also require that the inlet gas is separated into a first liquid stream and a first vapor stream, and that at least a portion of the first liquid stream is designated as a first fractionation feed stream, which is supplied to a fractionation column. J.A. 325–326.

Fluor contends that the Board incorrectly determined that it would not have been obvious to modify the high-pressure configuration depicted in Figure 2 of the Mak application by rerouting the first liquid stream [5]—produced upon initial separation of feed gas [1], [2] in separator [101]—to the fractionation column [106] instead of to absorber [103] as disclosed. Fluor argues that a skilled artisan would have routed the liquid phase differently depending on the composition of the feed gas itself, *i.e.*, whether it was rich or lean.[2] Fluor asserts that it would have been obvious to reroute the liquid phase to the

[2] A lean gas stream is one that contains a higher proportion of lighter hydrocarbons, such as methane (C_1) and ethane (C_2), and a lower percentage of heavier hydrocarbons, such as propane (C_3) and butane (C_4). In contrast, a rich gas stream is one that contains a lower proportion of lighter hydrocarbons and a higher proportion of heavier hydrocarbon components.

fractionation column as claimed, rather than to the absorber column as described in Mak's high-pressure configuration, when the feed gas is rich because that would provide a more efficient separation in the system depicted in Figure 2, which is specifically designed for lean feed streams. We again disagree because substantial evidence supports the Board's factual findings underlying its conclusion that the claims would not have been obvious.

First, in the system depicted in Figure 2 of the Mak application, the liquid stream [5] is fed into the absorber [103] and undergoes chemical processing in the absorber, by interaction with gas stream [6] and reflux stream [19], to produce a liquid absorber bottom stream [7]. Mak Appl. 6, fig. 2. This chemically altered absorber bottom stream is subsequently expanded in Joules-Thompson valve [104], heated in exchangers [100] and [105], and then fed into fractionation column [106]. *Id.* In contrast, Lummus's claims require that the expanded liquid stream be supplied directly to the fractionation column as a first fractionation feed stream without further chemical processing. The '880 patent specification discloses that, with reference to Figure 1, after the feed gas is separated in separator [12], "[t]he first liquid stream [44] is expanded in expander [24] and then supplied to front end exchanger [12] and warmed . . . then supplied to a mid-column feed tray of fractionation column [22] as a first fractionation feed stream [58]." '880 patent col.7 ll.31–35.

Second, Lummus's claims at issue here are not limited only to a rich feed gas, but encompass any hydrocarbon stream. *See, e.g.*, claim 1 ("inlet gas stream containing a mixture of methane, C_2 compounds, C_3 compounds, and heavier compounds"); *see also* '880 patent abstract, col.1 ll.11–15, col.5 l.65–col.6 l.16. Moreover, neither the claimed invention nor the Mak application discloses or suggests that the mixture of hydrocarbons in the feed gas

should have a direct bearing on the choice of which process should be employed for separation; on the contrary, the disclosure in Mak emphasizes that the choice of configuration should depend on the pressure of the feed gas, not the composition. Mak Appl. 3, 6, 8, 10–11.

Finally, Fluor has provided no evidence or rationale to support its proposition that a skilled artisan would have been motivated to substantially modify Mak's high-pressure configuration by rerouting the first liquid stream depending on the composition of the feed gas. *KSR*, 550 U.S. at 418 (requiring "some articulated reasoning with some rational underpinning to support the legal conclusion of obviousness" (quoting *In re Kahn*, 441 F.3d 977, 988 (Fed. Cir. 2006))); *see also Mintz v. Dietz & Watson, Inc.*, 679 F.3d 1372, 1377 (Fed. Cir. 2012) (obviousness determination improper where "little more than an invocation of the words 'common sense' (without any record support showing that this knowledge would reside in the ordinarily skilled artisan)"). Therefore, again viewing the teachings of the Mak application as a whole, a skilled artisan would not have been motivated to modify the high-pressure configuration depicted in Figure 2 by rerouting the liquid stream to arrive at the claimed invention. Because the Board's fact-finding is supported by substantial evidence, we affirm its conclusion of nonobviousness. *Jolley*, 308 F.3d at 1320.

CONCLUSION

We have considered Fluor's remaining arguments and find them unpersuasive. The Board's judgment is affirmed.

AFFIRMED