UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

AURORA SFC SYSTEMS, INC.,[1]
Respondent, Requester, Cross-Appellant

v.

WATERS TECHNOLOGIES CORPORATION,
Appellant, Patent Owner

Appeal 2014-003320
Reexamination Control 95/001,947
Patent No. 6,648,609 B2[2]
Technology Center 3900

Before STEVEN D.A. McCARTHY, JEFFREY B. ROBERTSON, and DANIEL S. SONG, *Administrative Patent Judges*.

McCARTHY, *Administrative Patent Judge*.

DECISION ON APPEAL

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[1] The Requester identifies the real party in interest as "Agilent Technologies, Inc.[,] the successor-in-interest to the Third Party Reexamination Requester, Aurora SFC Systems, Inc." (Appellants' Brief dated May 8, 2013 ("App. Br. Req'r") at 2; *see also* Respondent's Brief in *Inter Partes* Reexamination dated June 7, 2013 ("Resp. Br. PO") at 2 n.1).

[2] Issued November 18, 2003 to Terry A. Berger; Kimber D. Fogelman; Kenneth Klein; L. Thomas Staats, III; Mark Nickerson; and Paul F. Bente, III (the "'609 patent"). The '609 patent issued from Appl. 10/117,984, filed April 5, 2002.

STATEMENT OF THE CASE

The Appellant/Patent Owner appeals from the Examiner's decision adopting rejections of claims 1-3 and 5-13. Independent claim 1 has been amended to incorporate the subject matter of dependent claim 4 of the '609 patent. The only other independent claim, claim 9, also has been amended to add a limitation formerly appearing in claim 4. Claim 4 of the '609 patent is cancelled. New claims 12 and 13 were added during the reexamination proceeding. ("Appellant's Brief in *Inter Partes* Reexamination dated" May 8, 2013 ("Patent Owner's Appeal Brief" or "App. Br. PO") at 2; *see also* "Appellants' Brief" dated May 8, 2013 ("Requester's Appeal Brief" or "App. Br. Req'r") at 6). The Patent Owner and the Requester participated in oral argument on April 23, 2014, a transcript of which was entered into the record on May 28, 2014. We have jurisdiction over the Patent Owner's appeal under 35 U.S.C. § 134(b) (2011) and 35 U.S.C. § 315(a) (2011).[3]

In a Right of Appeal Notice mailed January 23, 2013 ("RAN")[4], the Examiner adopted proposed rejections of:

> claims 1, 2 and 9-11 under 35 U.S.C. § 102(b) (2011) as being anticipated by Azimov (US 4,799,511, issued Jan. 24, 1989) (Ground 9);

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[3] The Requester and the Patent Owner also are parties to a lawsuit in *Waters Technologies Corp. v. Aurora SFC Systems, Inc.*, Civil Action No. 11-708-RGA (D. Del.). As presently advised, the lawsuit is stayed pending the resolution of this proceeding and of Reexamination Control No. 95/001,910. (App. Br. PO 2).

[4] The Examiner's Answer mailed December 9, 2013, incorporates the RAN by reference.

claims 1, 2, 9, 12 and 13 under 35 U.S.C. § 103(a) (2011) as being unpatentable over Azimov and Admitted Prior Art ("APA") detailed on pages 73-75 of the "Request for *Inter Partes* Reexamination of U.S. Patent No. 6,648,609," dated March 27, 2012 ("Request") (Ground 10);

claim 3 under §103(a) as being unpatentable over Azimov and Wang (US 5,642,278, issued Jun. 24, 1997) (Ground 11);

claim 5 under § 103(a) as being unpatentable over Azimov and Müller-Kuhrt (US 6,532,978 B1, issued Mar. 18, 2003) (Ground 14);

claims 6-8 under § 103(a) as being unpatentable over Azimov, in view of the APA and Müller-Kuhrt (Ground 15); and

claims 5-8 over Gertenbach (Gertenbach *et al.*, *Modeling of Bench-Scale Coal Liquefaction Systems*, 21 INDUSTRIAL & ENG'RING CHEM. PROCESS DESIGN & DEVELOPM'T 490-500 (Am. Chem. Soc'y 1982)), Azimov and Müller-Kuhrt (Ground 22).

(RAN 4-5 and 9-12).

We do not sustain the grounds of rejection adopted by the Examiner.

The Respondent/Requester cross-appeals from the Examiner's non-adoption of a rejection of claims 1, 2 and 9-13 under § 103(a) as being unpatentable over Azimov and Shoji principally based on the fact that claim 4 (now canceled) was previously rejected as being unpatentable over Azimov and Shoji, and the limitation appearing in claim 4 has now been

incorporated into independent claims 1 and 9. (Notice of Cross-Appeal dated March 8, 2013; App. Br. Req'r 9).

"On judicial review, the correctness of the decision appealed from can be defended by the *appellee* on any ground that is supported by the record, whether or not the appellant raised the argument." *Rexnord Indus. LLC v. Kappos*, 705 F.3d 1347, 1355-56 (Fed. Cir. 2013). This is true even if the Examiner did not expressly adopt the ground. *See Randall Mfg. Co. v. Rea*, 733 F.3d 1355, 1363 n.3 (Fed. Cir. 2013). The Requester's right to raise the issue of rejecting claims 1, 2 and 9-13 under § 103(a) as being unpatentable over Azimov and Shoji is supported by the particular record here because: (1) the Requester proposed rejecting claim 4 on this ground at pages 81-84 the Request; (2) the Examiner initially determined that the Requester had shown a reasonable likelihood of prevailing as to the rejection of claim 4 on this ground (Order Granting/Denying Request for *Inter Partes* Reexamination mailed May 7, 2012 at 15-16); and (3) the Patent Owner amended independent claims 1 and 9 to incorporate the limitation separately recited in claim 4 of the '609 patent (App. Br. PO 2; App. Br. Req'r 6).

Pursuant to our authority under 37 C.F.R. § 41.77(b) (2011), we enter a new ground of rejection against claims 1, 2 and 9-11 under § 103(a) as being unpatentable over Azimov and Shoji. We decline to enter a new ground of rejection against claims 12 and 13 under §103(a) as beng unpatentable over Azimov and Shoji.

THE CLAIMED SUBJECT MATTER

Claims 1 and 9 are independent. Claim 1, reproduced with italics added for emphasis, is illustrative:

> 1. A system for using a pump as a pressure source in a flow stream containing a highly compressed gas, compressible liquid, or supercritical fluid, comprising:
>
> a restrictor for restricting flow downstream of the pump;
>
> a forward pressure regulator located upstream of the restrictor for controlling the outlet pressure from the pump; and
>
> a back-pressure regulator located downstream of the restrictor, *and a differential pressure transducer, where the back-pressure regulator, forward pressure regulator, and the differential pressure transducer control the pressure drop across the restrictor*.

(App. Br. PO at 32 (Claims App'x)).

Claim 9 similarly recites a "system for using a pump as a pressure source in a flow stream containing a highly compressed gas, compressible liquid, or supercritical fluid." The system of claim 9, like that of claim 1, includes a differential pressure transducer, "where the pressure regulators and the differential pressure transducer control the pressure drop across the orifice." (*See* App. Br. Req'r 8 ("However, as the first pressure regulator is recited as located upstream of the orifice/restrictor, and the second pressure regulator is recited as located downstream of the orifice/restrictor, there is no difference between Claims 1 and 9 in terms of their elements, other than semantics.")).

THE RECORD

The Patent Owner relies on the Patent Owner's Appeal Brief; a Respondent's Brief in *Inter Partes* Reexamination dated June 7, 2013 ("Patent Owner's Resp. Brief" or "Resp. Br. PO"); and a Rebuttal Brief dated January 9, 2014 ("Patent Owner's Rebuttal Brief" or "Reb. Br. PO"). The Patent Owner also relies on a Declaration Pursuant to 37 C.F.R. § 1.132 executed by Dr. Lalit Chordia on July 9, 2012 ("Chordia Decl."). The Requester relies on the Requester's Appeal Brief; a "Respondent's Brief" dated August 15, 2013 ("Requester's Respondent Brief" or "Resp. Br. Req'r"); and a Third Party Requester's Rebuttal Brief dated January 9, 2014 ("Requester's Rebuttal Brief" or "Reb. Br. Req'r"). The RAN incorporates by reference portions of the Request.

ISSUES

The Patent Owner does not argue the patentability of claims 2 and 9-13 separately from the patentability of claim 1 in this appeal. Two issues are dispositive: *First*, does Azimov describe a system including a differential pressure transducer, where a back-pressure regulator, a forward pressure regulator and the differential pressure transducer control a pressure drop across a restrictor? *Second*, if not, does Shoji remedy the deficiency?

CLAIM INTERPRETATION

During reexamination, claim terms are given their broadest reasonable interpretation consistent with the specification. "Therefore, we look to the specification to see if it provides a definition for claim terms, but otherwise

apply a broad interpretation." *In re ICON Health & Fitness, Inc.*, 496 F.3d 1374, 1379 (Fed. Cir. 2007).

"Pump"

The Patent Owner argues that the preamble recitations of claims 1 and 9 limit the subject matter of those claims. "[A] claim preamble has the import that the claim as a whole suggests for it." *Bell Communications Research, Inc. v. Vitalink Communications Corp.*, 55 F.3d 615, 620 (Fed. Cir. 1995).

> If, however, the body of the claim fully and intrinsically sets forth the complete invention, including all of its limitations, and the preamble offers no distinct definition of any of the claimed invention's limitations, but rather merely states, for example, the purpose or intended use of the invention, then the preamble is of no significance to claim construction because it cannot be said to constitute or explain a claim limitation.

Pitney Bowes, Inc. v. Hewlett-Packard Co., 182 F.3d 1298, 1305 (Fed. Cir. 1999). The Patent Owner has not cited to any authority suggesting that, if one term in the preamble limits the claimed subject matter, the entire preamble must be limiting.

The preambles of claims 1 and 9 identically recite "system[s] *for using* a pump as a pressure source in a flow stream containing a highly compressed gas, compressible liquid, or supercritical fluid." (Italics added for emphasis). The language "system for using . . ." implies that the preambles recite intended uses or purposes of the claimed systems. As such,

the preambles of claims 1 and 9 as a whole do not limit the subject matter of the claims.

The body of claim 1 recites "a restrictor for restricting flow *downstream of the pump*; a forward pressure regulator located upstream of the restrictor . . . [and] a back-pressure regulator located downstream of the restrictor." In other words, claim 1 uses the pump to define the location of the restrictor and uses the location of the restrictor to define the location of the forward pressure regulator and the back-pressure regulator. Because the recitation of the pump in the preamble helps to define the limitations set forth in the body of the claim, the recitation of a pump in the preamble is limiting. (*See* Resp. Br. PO 11; Reb. Br. PO 11-12).

Nevertheless, as pointed out by counsel for the Requester during oral argument, the inclusion of the pump in the claimed combination does not imply that the claimed combination must include a pump specifically used as a pressure source in a flow stream containing a highly compressed gas, compressible liquid, or supercritical fluid. (*See* Record of Oral Hearing 17, ll. 17-24 and 18, l. 19 – 19, l. 4). In particular, the Patent Owner has not pointed to any recitation in claim 1 or claim 9, or to any disclaimer in the Specification, which persuasively suggests that the nature of the fluid material to be pumped through the system should be read as a limitation on the system itself.

"Flow Stream Containing a Highly Compressed Gas, Compressible Liquid, or Supercritical Fluid"

The Patent Owner argues that the "flow stream containing a highly compressed gas, compressible liquid, or supercritical fluid" recited in the

preambles of claims 1 and 9 must be understood as the flow stream in a supercritical fluid chromatography ("SFC") apparatus or a similar high pressure chromatography apparatus. (*See* App. Br. PO 10). Neither claim 1 nor claim 9 positively recites SFC apparatus. This omission implies that the broadest reasonable interpretation of claim 1 and claim 9 does not limit those claims to systems conducting flows for use in SFC processes or limit the claimed subject matter to only those systems with pumps designed for SFC processes. (*See* RAN 24).

This understanding is consistent with the Specification, which describes the claimed subject matter as "well suited" to an SFC environment but does not limit the subject matter to that environment: "However, as one skilled in the art will recognize, the invention may be used in any system where it is necessary to obtain steady flow of liquid at high pressure with high degrees of accuracy of pressure and flow using an imprecise pressure source." ('609 patent, col. 8, ll. 57-64). Although the Specification states that "[t]he invention *relates* to a device and method for using a pump as a pressure source . . . in a high-pressure chromatography system, such as supercritical fluid chromatography," ('609 patent, col. 1, ll. 9-12 (italics added for emphasis)), nothing in the Specification states that the claimed subject matter is limited to an SFC or high pressure chromatography environment. (*See* Resp. Br. Req'r 9-10; Record of Oral Hearing 20, ll. 15-17 and 21, ll. 5-22).

"Differential Pressure Transducer"

The Patent Owner does not appear to identify any formal definition or clear disclaimer in the Specification which might suggest that claims 1 and 9

use the term "differential pressure transducer" more narrowly than its ordinary usage. We agree with the Patent Owner that a "transducer is simply a device that transmits a signal in one form of energy, based on measurement of another form of energy." (Resp. Br. Req'r 15; *accord* MCGRAW-HILL DICTIONARY OF ENG'RING (McGraw-Hill, 2nd edition, 2003)("transducer")("any device or element which converts an input signal into an output signal of a different form")). A "differential pressure transducer" is a device that transmits a signal in one form of energy (such as an electrical signal) based on measurement of differential pressure.

"Where the Back-Pressure Regulator, Forward Pressure Regulator, and the Differential Pressure Transducer Control the Pressure Drop Across the Restrictor"

Neither the Examiner nor the Requester appears to identify any formal definition or clear disclaimer in the Specification which might suggest that claims 1 and 9 use the term "control" more broadly than its ordinary usage. Neither does the Patent Owner appear to identify any evidence or persuasive technical argument suggesting that one of ordinary skill in the art might understand the term differently than a lay person. The Requester argues that, "[i]n failing to offer a definition of a term—control—which [the Patent Owner] now relies on to distinguish the claimed invention from the prior art, the patent should be construed using the plain and ordinary meaning of the term 'control.'" (Resp. Br. Req'r 13). The Requester does not appear to state what it believes to be the ordinary meaning of the term, however.

Therefore, we agree with the Patent Owner that the ordinary meaning of the term "control" is "to adjust to a requirement" or to "regulate." (Reb.

Br. PO 2 and n.1). This usage is consistent with that in the Specification. (*See* App. Br. PO 17 ("The [S]pecification makes clear that the claimed components, including the differential pressure transducer, 'regulate' the pressure drop across the restrictor/orifice. *See* '609 patent at 4:24-42. To 'regulate' connotes active control or adjustment of the pressure as the highly variable media (*e.g.*, CO_2, operating at or near supercritical level) oscillates in mass flow and pressure.")). Although, as the Requester points out at pages 17-19 of its Respondent Brief, neither claim 1 nor claim 9 recites that the control is "dynamic," the term "control" itself implies adjustment or regulation.

The Requester concedes that "[i]t is immediately apparent that amended claim 1 and original claim 4 are of identical scope." (App. Br. Req'r 11). Claim 4, as it existed in the '609 patent prior to this reexamination proceeding, recited the "system of claim 1, further comprising: a differential pressure transducer to control pressure drops across the restrictor." In other words, claim 4 independently recited that the differential pressure transducer controlled the pressure drop. Since the amended claim 1 on appeal in this proceeding is identical in scope to claim 4, claim 1 must also be read as limited to a system in which the differential pressure transducer controls the pressure drop. (*Cf.* Record of Oral Hearing dated May 28, 2014 at 22, l. 8 – 23, l. 2 (arguing that, since claim 1 as originally issued in the '609 patent recites control of the pressure drop by the pressure regulators without reference to the differential pressure transducer, amended claims 1 and 9 are not limited to systems in which the pressure regulators and the differential pressure transducers cooperate to control the pressure drop)). Despite the Requester's argument to the contrary at pages

17-19 of the Requester's Respondent Brief, the differential pressure transducer recited in claims 1 and 9 either must itself control the pressure drop across the restrictor or orifice, or it must contribute to the control of that pressure drop.

FINDINGS OF FACT

The record supports the following findings of fact ("FF") by a preponderance of the evidence.

Azimov

1. Azimov describes "provid[ing] a linear flow system of static parameters to accurately and continuously maintain a constant rate of flow of a fluid or a gas to a discharge point despite significant fluctuations in supply line and discharge line pressures." (Azimov, col. 3, ll. 21–26). In particular, Azimov teaches supplying heating oil or natural gas to a furnace or boiler at a precisely controlled constant discharge rate. (Azimov, col. 5, ll. 40-43).

2. Azimov describes a fuel delivery system *10* including a supply line conduit *12* and a discharge conduit *52*. (Azimov, col. 5, ll. 62–66; col. 11, l. 67 – col. 12, l. 3; and Fig. 2[5]). Azimov generally describes "flowing material enter[ing] the system via a conduit system and pump apparatus provid[ing an] initial unregulated rate [of] flow and pressure." (Azimov, col. 3, ll. 41-43; *see also id.*, col. 8, ll. 2–5).

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[5] Although columns 5-7 of Azimov describe the embodiment of Figure 1, the embodiment of Figure 2 includes similar components acting in a similar fashion.

3. Azimov's system *10* includes a pressure regulator *24* for maintaining a constant pressure *P1* in a conduit *26* downstream of the pressure regulator *24*. (Azimov, col. 6, ll. 20–23 and Fig. 2). In addition, the system *10* includes a back pressure regulator *44* for maintaining a constant pressure *P2* in a conduit line *40* upstream of the back pressure regulator *44*. (Azimov, col. 6, ll. 44–48 and Fig. 2). Conduit *26* communicates with the conduit *40* through a flow regulating device *38* in the form of an orifice. (Azimov, col. 6, ll. 31–35 and Fig. 2). In other words, the pressure regulator *24*, the back pressure regulator *44* and the flow regulating device *38* are connected in series, with the pressure regulator *24* upstream of the flow regulating device *38* and the back pressure regulator *44* downstream of the flow regulation device *38*.

4. Azimov teaches that:

> The ability of the system to provide precise amounts of material at constant discharge rate and pressure range is based on the combination of components employed therein. By utilizing a downstream [that is, forward] pressure regulating device [*24*] which is capable of maintaining a constant conduit line pressure **P1** and an upstream [that is, back] pressure regulator [*44*] which is capable of maintaining a second constant conduit line pressure **P2**, a constant pressure differential over the flow regulating device [*38*] delta-**P** may be kept constant. By keeping the pressure through the flow regulating device constant as well as by keeping the effective orifice area through the flow regulating device constant, the system is able to dispense a constant amount of material. Hence, by taking advantage of the unique combination of components, a material such as heating oil may be

> pumped into the system at an unregulated pressure and rate of flow wherein the pressure and flow rate are modified to constant levels which comport with the needs of the burner or other discharge apparatus.

(Azimov, col. 7, ll. 34–53). After providing a more abbreviated description of the system operation earlier in the written disclosure, Azimov states that "it is evident that there is no need for a by-pass line to sample internal conditions and to regulate the system; a linear self-maintaining system results." (Azimov, col. 3, ll. 56-59).

5. Azimov's system *10* includes a flow switch or transducer *32*. The flow switch *32* monitors the flow between the pressure regulator *24* and the flow regulating device *38* to detect inadequate or excessive flow. (Azimov, col. 8, l. 67 – col. 9, l. 14 and Fig. 2). Azimov teaches that:

> A change in the delta-**P** value changes the pressure with which the material moves through the flow metering device, and this increase or decrease of pressure forces either more or less material through the unchanging orifice within the flow regulating device [*38*]. Changing the rate of flow within the system, in turn, triggers the flow switch [*32*] to intercede, thereby stopping the continued functioning of the system through the intervention of the servo-mechanism [no reference numeral].

(Azimov, col. 9, ll. 21–29).

6. Azimov teaches the use of either mechanically-controlled or electrically-controlled components for regulating pressure. (*Compare* Azimov, col. 1, ll. 55-68 *with id.*, col. 2, l. 65 – col. 3, l. 4). Azimov does not appear to criticize or disparage the use of electrically-controlled components for regulating pressure. (*See, e.g., id.*)

Azimov is Not Non-Analogous Art

7. The Patent Owner argues that Azimov is non-analogous art. (*See* App. Br. PO 24-26). Azimov is *reasonably* pertinent to the problem with which the named inventors of the '609 patent were involved. The '609 patent teaches that the claimed subject matter is "suitable" for use in SFC but states that the claimed subject matter may also address a broader problem. The '609 patent identifies that problem generally as "obtain[ing] steady flow of liquid at high pressures with high degrees of accuracy of pressure and flow using an imprecise pressure source." ('609 patent, col. 8, ll. 59-64). Azimov teaches a system which receives fluid at an initially unregulated pressure and flow rate. Azimov's system produces a flow of material having accurately maintained flow rate and discharge pressure. (*See* FF 4, quoting Azimov, col. 7, ll. 34–53). Although Azimov does not specifically address a flow system for use in SFC, it is reasonably pertinent to the problem stated in the Specification of the '609 patent.

8. The Patent Owner's expert states that he "would not have looked to Azimov for a solution for use in chromatography because Azimov's shut-down feature would not meet precise SFC pumping requirements. . . . Furthermore, Azimov does not pertain to chromatography. As a result, Azimov's device does not have an immediate applicability for use in SFC systems." (Chordia Decl., para. 34). The expert's statement is not persuasive. As the Requester points out, the Patent Owner's expert is not an expert in patent law. As such, the expert has identified the problem with which the named inventors were involved too narrowly as SFC or high pressure chromatography rather than as defined by the preamble of claims 1

and 9, and by the Specification of the '609 patent as a whole. (*See* Resp. Br. Req'r 20-21).

Azimov Does Not Anticipate Independent Claim 1 or Independent Claim 9

9. Azimov describes a system *10* for using a pump. In particular, Azimov describes the use of a "pump apparatus provid[ing an] initial unregulated rate [of] flow and pressure" to the system. (FF 2, quoting Azimov, col. 3, ll. 41-43; *see also id.*, col. 8, ll. 2-5; Resp. Br. Req'r 14).

10. Specific to claim 1, Azimov's system *10* includes a restrictor for restricting flow downstream of the pump. The restrictor takes the form of the flow regulation device *38*, which may be an orifice. (FF 3).

11. Azimov's system *10* also includes the forward pressure regulator *24* and the back pressure regulator *44*. The forward pressure regulator *24* is upstream of the restrictor or flow regulating device *38* and the back pressure regulator *44* is downstream of the restrictor. (FF 3). The forward pressure regulator *24* controls the outlet pressure from the pump by maintaining a constant pressure *P1* in supply line conduit *12* downstream of the pressure regulator *24*. (*Id.*)

12. Specific to claim 9, Azimov's system *10* includes an orifice. The orifice is an element of the flow regulation device *38*. (FF 3 and 10).

13. Azimov's system *10* also includes a first pressure regulator *24* located upstream of the orifice of the flow regulating device *38* and a second pressure regulator *44* located downstream of the orifice. (*See* FF 3 and 11).

14. Both the Examiner and the Requester identify Azimov's flow switch *32* as corresponding to the differential pressure transducer recited in claim 1 and claim 9. (*See* RAN 9, incorporating by reference Request 81;

Resp. Br. Req'r 15-17). Azimov's flow switch *32* is a differential pressure transducer because it senses a flow signal near the flow regulating device *38* and transmits that flow signal to a servo-mechanism. (FF 5, citing Azimov, col. 8, l. 67 – col. 9, l. 14; *see also* Resp. Br. Req'r 15-16). Since the flow through the flow regulation device *38* correlates with the pressure differential across the flow regulation device, the flow switch *32* is a differential pressure transducer. (FF 5, citing Azimov, col. 9, ll. 21–29; *see also* Resp. Br. Req'r 16).

15. Although most of the limitations of claim 1 read on the system described by Azimov, Azimov does not anticipate claim 1. In particular, neither the Examiner nor the Requester has proven that Azimov describes a system in which "the back-pressure regulator, forward pressure regulator, *and* the differential pressure transducer control the pressure drop across the restrictor." (Italics added for emphasis).

16. Azimov's flow switch *32* does not control the pressure drop across the restrictor as recited in claim 1. Azimov's flow switch *32* is capable only of monitoring and shutting off a pressure drop across the flow regulation device *38*. The flow switch *32* does not adjust or regulate the pressure drop either during the period when the flow is maintained. (*See* App. Br. PO 18; Reb. Br. PO 2). There is no pressure drop to adjust or regulate during the period when the flow is shut off.

17. Neither the Examiner nor the Requester identifies any other structure described by Azimov which might correspond to the differential pressure transducer recited in claim 1.

Wang, Müller-Kuhrt and Gertenbach

18. In rejecting claim 3, the Examiner cites Wang as teaching the use of a pressure controller in a flow stream containing a highly compressed gas, compressible liquid or supercritical fluid. (RAN 28-29; *see also* RAN 10, incorporating by reference Request 79 (quoting Wang, col. 5, ll. 34-39)).

19. In rejecting claim 5, the Examiner finds that Müller-Kuhrt "is seen to teach a plurality of channels in a high pressure flow system with controls for the respective flows through each of the channels." (RAN 29; *see also* RAN 11, incorporating by reference Request 87 (quoting Müller-Kuhrt, col. 7, l. 68 – col. 8, l. 10)). That said, the Examiner also finds that Müller-Kuhrt "does not teach differential pressure transducers in conjunction with pressure regulators which are positioned upstream and downstream from a restrictor." (RAN 29-30).

20. The Examiner correctly finds that "Gertenbach does not teach the combination of a differential pressure transducer with a forward and back pressure regulator to control the pressure drop across a restrictor." (Ans. 20 (referring to Ground 20)).

Shoji

21. Figure 1 of Shoji depicts a prior art gas chromatograph including a pressurized tank or bomb *1* for supplying a carrier gas; a sample introducing portion *6*; an analysis column *7* for separating a sample introduced into the carrier gas in the sample introducing portion *6*; and a detecting portion *8* for analyzing the separated components of the sample. (Shoji, col. 1, ll. 21-27; *see also id.*, col. 1, ll. 50-56). Shoji teaches that it was known to precisely control the carrier gas introduced from the bomb *1*

into the sample introducing portion *6* to ensure the accuracy of the chromatographic analysis. (Shoji, col. 1, ll. 14-20).

22. The prior art gas chromatograph depicted in Figure 1 also includes a resistance tube *3* downstream of the bomb *1*; a pressure regulator *2* located upstream of the resistance tube *3*; and a control valve *5* located downstream of the resistance tube *3*. (Shoji, col. 1, ll. 21-27).

23. Shoji teaches measuring and controlling the carrier gas introduced into the sample introducing portion *6* by means of a differential pressure transducer or sensor *4* which measures the difference in pressure between the upstream and downstream sides of the resistance tube *3*. (*See* Shoji, col. 1, ll. 14-20 and 28-29). The differential pressure sensor *4* transmits a signal representative of the differential pressure to a control portion *9*. The control portion *9* signals the control valve *5* based on the signal from the differential pressure sensor *4* so as to maintain the pressure differential across the resistance tube *3* at a set pressure difference. (Shoji, col. 1, ll. 41-50).

24. In this manner, the differential pressure sensor *4* together with the pressure regulator *2* and the control valve *5* controls the flow rate of gas introduced into the sample introducing portion *6*. (*Id.*) The description in Shoji implies that the differential pressure sensor or transducer *4* and the control valve *5* together act as a back pressure regulator to maintain the pressure drop between the forward pressure regulator *2* and the back pressure regulator.

25. Shoji teaches that the flow rate of the carrier gas is proportional to the pressure of the gas flow upstream of the resistance tube *3* and to the pressure drop across the resistance tube *3*. (Shoji, col. 1, ll. 29-40). Shoji

additionally teaches that the pressure regulator *2* maintains the upstream pressure uniform. (Shoji, col. 1, l. 57 – col. 2, l. 2).

26. Shoji teaches that the pressure supplied from the bomb *1* varies depending on the quantity of gas remaining in the bomb, the temperature and the like. (Shoij, col. 1, ll. 57-59). Shoji does not mention any substantial pressure fluctuations in the supply pressure upstream of the pressure regulator *2* or the discharge pressure downstream of the control valve *5*.

27. Shoji teaches that the pressure regulator *2* is expensive. (Shoji, col. 1, l. 65 – col. 2, l. 2). In order to reduce or eliminate the cost of the expensive pressure regulator, Shoji teaches replacing the pressure regulator with a pressure sensor upstream of the resistance tube. (*See* Shoji, col. 2, ll. 52-63; *compare id.*, Fig. 1 *with id.*, Fig. 2). The control portion *9* takes into account both the signal from the differential pressure sensor *4* and the upstream pressure sensor *21* in controlling the control valve *5* to maintain a constant flow rate of the carrier gas. (Shoji, col. 2, l. 64 – col. 3, l. 10).

Shoji is Not Non-Analogous Art

28. The Patent Owner argues that Shoji is non-analogous art. (*See* Resp. Br. PO 13-14). Shoji is within the same field of endeavor as the subject matter of claims 1 and 9. Even if we assume without deciding that the pertinent field of endeavor relates narrowly to SFC or high pressure chromatography, one of ordinary skill in the art would have looked to other forms of chromatography for guidance in addressing the problem of accurately maintaining pressure and flow rate.

29. The testimony by the Patent Owner's declarant stating that "I would not have looked to a [gas chromatography] reference in attempting to

solve the problem addressed by the claimed invention or to cure the deficiencies of a primary reference including a pump" (Chordia Decl., para. 46) because Shoji's system uses a bomb rather than a pump as a pressure source (*id*, para. 43) is not persuasive. Shoji, like the claimed subject matter, addresses the problem of obtaining steady flow of fluid with high degrees of accuracy of pressure and flow using an imprecise pressure source.

ANALYSIS

Claim 1 recites a system including "a differential pressure transducer, where the back-pressure regulator, forward pressure regulator, and the differential pressure transducer control the pressure drop across the restrictor." Claim 9 includes a similar limitation. Neither the Requester nor the Examiner has proven that Azimov's system includes pressure regulators and a differential pressure transducer that control the pressure drop across the restrictor or orifice. (*See* FF 5 and 14-17). We do not sustain the rejection of independent claims 1 and 9 under § 102(b) as being anticipated by Azimov. For similar reasons, we do not sustain the rejection of dependent claims 2, 10 and 11 under § 102(b) as being anticipated by Azimov.

Neither the Examiner nor the Requester persuasively explains how the Admitted Prior Art as set forth on pages 73 through 75 of the Request might remedy failure of Azimov to teach a differential pressure transducer, "where the back-pressure regulator, forward pressure regulator, and the differential pressure transducer control the pressure drop across the" restrictor or orifice as recited in claim 1. (*See* App. Br. PO 27). We do not sustain the rejection of claims 1, 2, 9, 12 and 13 under §103(a) as being unpatentable over

Azimov and the Admitted Prior Art. Neither does the Examiner or the Requester explain how the teachings of Wang as applied to claim 3 or Müller-Kuhrt as applied to claims 5-8 might remedy this failure. (*See* FF 18 and 19; *see also* App. Br. PO 28 and 29). We do not sustain the rejection of claim 3 under § 103(a) as being unpatentable over Azimov and Wang; the rejection of claim 5 under § 103(a) as being unpatentable over Azimov and Müller-Kuhrt; or the rejection of claim 6-8 under § 103(a) as being unpatentable over Azimov, the Admitted Prior Art and Müller-Kuhrt.

In rejecting claims 5-8 under § 103(a) as being unpatentable over Gertenbach, Azimov and Müller-Kuhrt, the Examiner finds that Gertenbach fails to teach the use of a differential pressure regulator. (FF 20). Azimov fails to remedy this deficiency. (FF 14-17; *see also* App. Br. PO 29-30). Neither the Examiner nor the Requester cites Müller-Kuhrt for a teaching which might remedy this deficiency. (*See* FF 19). We do not sustain the rejection of claims 5-8 under § 103(a) as being unpatentable over Gertenbach, Azimov and Müller-Kuhrt.

NEW GROUND OF REJECTION OF CLAIMS 1, 2 AND 9-11 UNDER § 103(A) AS BEING UNPATENTABLE OVER AZIMOV AND SHOJI

Azimov's system includes each and every limitation of claim 1 and claim 9 except a differential pressure transducer, where the pressure regulators and the differential pressure transducer control the pressure drop across the restrictor or orifice. (FF 6-9 and 13-16). In particular, Azimov's system *10* satisfies the positive limitations of the preamble of claim 1 insofar as it is a system which includes a pump. (*See* FF 6 and 13). Shoji describes a system including a forward pressure regulator *2* and a back-pressure

regulator surrounding a flow restrictor in the form of a resistance tube *3*. Shoji's back-pressure regulator consists of a control valve *5* controlled by a differential pressure sensor and a control portion *9*. (*See* FF 22 and 23).

"[W]hen a patent claims a structure already known in the prior art that is altered by the mere substitution of one element for another known in the field, the combination must do more than yield a predictable result." *KSR Int'l Co. v. Teleflex, Inc.*, 550 U.S. 398, 416 (2007). It would have been obvious to substitute an electrically-controlled pressure regulator for the mechanical back-pressure regulator *44* described in Azimov. More specifically, it would have been obvious to substitute the combination of a differential pressure transducer, similar to the differential pressure transducer *4* described by Shoji, and a control valve used as a pressure regulator, similar to the control valve *5* described by Shoji, for the mechanical back-pressure regulator *44* of Azimov's system. (*See* Req. 83 ("One of ordinary skill in the art would have recognized that the exemplary system of forward pressure regulator/restrictor/differential pressure regulator of *Shoji* where a differential pressure sensor (4) and the control portion (9) control the pressure drop across the restrictor (3) has an immediate application to *Azimov*.")). The combination of the differential pressure transducer and the control valve used as a pressure regulator would have operated in the same manner as the pressure regulator *44* in Azimov's system. The teachings of Shoji would have provided one of ordinary skill guidance in implementing the substitution.

Once one of ordinary skill in the art made the proposed substitution, the combination of the differential pressure transducer and the control valve, together with the forward pressure regulator *24* described by Azimov, would

have controlled the pressure drop across the flow regulating device *38* so as to maintain constant pressure level upstream and downstream of the flow regulation device *38*. (*See* FF 3). The difference between the upstream and downstream pressures would have controlled the pressure drop across the flow regulating device *38*, thereby controlling the flow rate. (*Cf.* FF 4, 24 and 25 (describing the control of upstream and downstream pressure levels to control the pressure drop across the flow regulating device)).

Thus, one of ordinary skill in the art would have had reason to substitute the combination of the differential pressure transducer and the control valve in order to cooperate with the forward pressure regulator *24* to control the pressure drop across the flow regulating device *38*. This is true despite Azimov's teaching to use the flow switch *32*, itself a differential pressure transducer (*see* FF 14), merely to monitor and shut off the pressure drop (*see* FF 16). If one substituted the combination of the differential pressure transducer and the control valve as taught by Shoji for the back-pressure regulator *44* of Azimov, one would have to allow the combination of the differential pressure transducer and the control valve to actively adjust to pressure fluctuations in order to maintain the constant downstream pressure level necessary for a steady pressure drop and flow rate. Azimov's teachings concerning the flow switch *32* would not have deterred one of ordinary skill in the art making the proposed substitution from using the forward pressure regulator *24*, the differential pressure transducer and the control valve to control the pressure drop across the flow regulation device *38*.

The system described by Azimov includes both a forward pressure regulator *24* and a back-pressure regulator *44* to maintain a steady pressure

drop across a flow restrictor located between the flow regulators. (FF 3 and 4). Shoji teaches substituting a less expensive pressure gauge for a more expensive forward pressure regulator upstream of the flow restrictor in a system using a bomb or tank as a pressure source. (FF 27). The Examiner reasons, and the Patent Owner argues, that this teaching would have discouraged one of ordinary skill in the art from applying the teachings of Shoji to Azimov's system as proposed by the Requester without also removing the relatively expensive forward pressure regulator upstream of the flow restrictor. (*E.g.*, Resp. Br. PO 6-7 (citing RAN 29) and 12-13). This argument is not persuasive because a known arrangement of parts would not have been non-obvious merely because one of the parts was relatively expensive. *In re Farrenkopf*, 713 F.2d 714, 718 (Fed. Cir. 1983) ("That a given combination would not be made by businessmen for economic reasons does not mean that persons skilled in the art would not make the combination because of some technological incompatibility. Only the latter fact would be relevant."). (*See also* Reb. Br. Req'r 11-12; Record of Oral Hearing 26, ll. 12-17). Furthermore, the Examiner's reasoning fails to take into account the teachings of the art as a whole.

"[A] given course of action often has simultaneous advantages and disadvantages, and this does not necessarily obviate motivation to combine." *Medichem, S.A. v. Rolabo, S.L.*, 437 F.3d 1157, 1165 (Fed. Cir. 2006). Azimov's system *10*, in which a "pump apparatus" drives the flow (FF 2), includes both a forward pressure regulator *24* and a back pressure regulator *44*. Azimov describes the system *10* as being designed to "provide a linear flow system of static parameters to accurately and continuously maintain a constant rate of flow of a fluid or a gas to a discharge point *despite*

significant fluctuations in supply line and discharge line pressures." (FF 1, quoting Azimov, col. 3, ll. 21-26 (italics added for emphasis)). On the other hand, Shoji teaches the use of a bomb or pressurized tank to drive flow through a gas chromatography system. (*See* FF 21 and 26). A bomb or pressure tank used as a pressure source will not cause flow oscillations similar to the fluctuations produced by a pump. (Chordia Decl., paras. 20 and 43). Despite Shoji's teaching that one might satisfactorily regulate flow driven by a bomb or pressure tank, it would have been obvious to one of ordinary skill in the art that both an upstream forward pressure regulator and a downstream back pressure regulator as taught by Azimov could have been used effectively to control the fluctuations produced when using a pump as a pressure source. Shoji's teaching to replace a relatively expensive forward pressure regulator with a pressure gauge when using a bomb as a pressure source would not have discouraged one of ordinary skill in the art from using such a forward pressure regulator when using a pump as a pressure source.

In addition, the Patent Owner argues that "Azimov teaches a static system, and as such, teaches away from the active controls of the '609 patent claims." (App. Br. PO 25; *see also* Resp. Br. PO 14). Azimov teaches to "provide a linear flow system of *static parameters* to accurately and continuously maintain a constant rate of flow of a fluid or a gas to a discharge point despite significant fluctuations in supply line and discharge line pressures." (FF 1, quoting Azimov, col. 3, ll. 21-26 (italics added for emphasis)). Azimov also states that "it is evident that there is no need for a by-pass line to sample internal conditions and to regulate the system; a linear self-maintained system results." (FF 4, quoting Azimov, col. 3, ll. 56-59).

Although Azimov teaches a "self-maintained system" using "static parameters," it does not teach the use of static or inactive pressure regulators. At the very least, Azimov's pressure regulators would have to regulate transients, such as those occurring at system start-up or following significant fluctuations in supply line and discharge pressure. Furthermore, as the Requester points out at pages 18-19 of the Requester's Respondent Brief, the adjustability of the system implies that the pressure regulators actively maintain pressure and flow static parameters across the flow restrictor.

It would have been obvious from the combined teachings of Azimov and Shoji the use a forward pressure regulator, a back-pressure regulator and a differential pressure transducer to control the pressure drop across a restrictor. As discussed earlier, Azimov teaches the use of a forward pressure regulator *24* upstream of a restrictor or flow regulation device *38*; and a back-pressure regulator *44* downstream of the restrictor to control the pressure drop across the restrictor. Shoji teaches using the combination of a differential pressure transducer and a control valve to act as a back-pressure regulator. It would have been obvious from the combined teachings of Azimov and Shoji to substitute the combination of the differential pressure transducer and the control valve taught by Shoji for the back-pressure regulator described by Azimov so that the combination might act as a back-pressure regulator in Azimov's system. This substitution presupposes that the differential pressure transducer substituted with the control valve into Azimov's system acts to control the pressure drop across the restrictor or flow regulation device *38* rather than merely monitoring and shutting off the flow as does Azimov's flow switch *32*. If the differential pressure

transducer merely monitored the pressure and signaled the control valve to shut off the flow, the combination of the differential pressure transducer and the control valve would not have performed the same function as the back-pressure regulator described by Azimov and would not have been a suitable substitute.

Although Azimov teaches that there is no need for a by-pass line to sample internal conditions and to regulate the system, Azimov does not criticize or disparage the use of electrically-controlled pressure regulators. (FF 6). Consequently, Azimov would not have taught away from the substitution of an active electronic pressure regulator driven by a differential pressure transducer for a purely mechanical pressure regulator. For these reasons, we agree with the Requester that the subject matter of claim 1 would have been obvious from the combined teachings of Azimov and Shoji.

Claim 2 recites the "system of claim 1, wherein the restrictor is a precision orifice." Azimov describes the flow regulating device *38* as taking in the form of an orifice. (FF 3; *see also* Request, App'x CC-B at 8, citing Azimov, col. 4, ll. 41-45). Therefore, we agree with the Requester that the subject matter of claim 2 would have been obvious from the combined teachings of Azimov and Shoji.

As noted earlier, the preamble of independent claim 9 is not a limitation on the claim except for the limitation that the claimed system must be a "system for using a pump." Azimov teaches the use of a pump for driving a flow stream. (*See* FF 2). Azimov's system includes an orifice, that is, the flow regulation device *38*, located downstream from the pump; a first, forward pressure regulator *24* upstream of the restrictor or flow regulation

device *38*; and second, back-pressure regulator *44* downstream of the restrictor. (*See* FF 3). As noted earlier, it would have been obvious to merely substitute the combination of a differential pressure transducer and a control valve as taught by Shoji for the back-pressure regulator described by Azimov. Once the substitution was made, the first, forward pressure regulator *24*; the second regulator in the form of the control valve; and the differential pressure transducer would have controlled the pressure drop across the orifice, that is, the flow regulation device *38*. Therefore, we agree with the Requester that the subject matter of claim 9 would have been obvious from the combined teachings of Azimov and Shoji.

Claim 10 recites the "system of claim 9, wherein: the first pressure regulator is a forward pressure regulator." Claim 11 recites the "system of claim 9, wherein: the second pressure regulator is [a] back pressure regulator." The first pressure regulator in Azimov's system was the forward pressure regulator *24*. (*See* FF 3; *see also* Request 25-26). It would have been obvious to substitute the combination of the differential pressure regulator and the control valve as taught by Shoji for the second, back-pressure regulator *44* described by Azimov. Once the substitution was made, the control valve would have regulated the pressure upstream of the control valve to control the pressure drop across the flow regulation device *38*. In other words, the control valve would have been a second, back-pressure regulator. Therefore, we agree with the Requester that the subject matter of claims 10 and 11 would have been obvious from the combined teachings of Azimov and Shoji.

We decline to enter new grounds of rejection against claims 12 and 13. Claim 12 recites the "system of claim 1, wherein the flow stream

comprises CO_2." Claim 13 recites the "system of claim 9, wherein the flow stream comprises CO_2." The Requester does not explain how either Azimov or Shoji, or a combination of the two, teaches or suggests these limitations.

DECISION

We REVERSE the Examiner's rejections of claims 1-3 and 5-13.

Pursuant to our authority under 37 C.F.R. § 41.77(b), we enter a new ground of rejection against claims 1, 2 and 9-11 under § 103(a) as being unpatentable over Azimov and Shoji.

NEW GROUND OF REJECTION

37 C.F.R. § 41.77(b) states that "[a]ny decision which includes a new ground of rejection pursuant to this paragraph shall not be considered final for judicial review." Furthermore,

> When the Board makes a new ground of rejection, the owner, within one month from the date of the decision, must exercise one of the following two options with respect to the new ground of rejection to avoid termination of the appeal proceeding as to the rejected claim:
>
> (1) *Reopen prosecution.* The owner may file a response requesting reopening of prosecution before the examiner. Such a response must be either an amendment of the claims so rejected or new evidence relating to the claims so rejected, or both.
>
> (2) *Request rehearing.* The owner may request that the proceeding be reheard under § 41.79 by the Board upon the same record. The request for rehearing must address any new ground

> of rejection and state with particularity the points believed to have been misapprehended or overlooked in entering the new ground of rejection and also state all other grounds upon which rehearing is sought.

Requests for extensions of time in this *inter partes* reexamination proceeding are governed by 37 C.F.R. § 1.956 (2011). *See* 37 C.F.R. § 41.79 (2011).

REVERSED; 37 C.F.R. § 41.77(b)

peb

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