

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

TRANE U.S. INC.,
Petitioner,

v.

SEMCO, LLC,
Patent Owner.

Case IPR2018-00514
Patent 6,199,388 B1

Before JOSIAH C. COCKS, CARL M. DEFRANCO, and
JASON W. MELVIN, *Administrative Patent Judges*.

DEFRANCO, *Administrative Patent Judge*.

FINAL WRITTEN DECISION
35 U.S.C. § 318(a) and 37 C.F.R. § 42.73

SEMCO, LLC (“SEMCO”) is the owner of U.S. Patent No. 6,199,388 B1 (“the ’388 patent”). Trane U.S. Inc. (“Trane”) filed a petition requesting *inter partes* review of claims 1–15, 18, 19, 25, 28, 29, 36–40, 42, 44–47, and 49 of the ’388 patent. Paper 1 (“Pet.”). After determining that Trane satisfied the threshold of 35 U.S.C. § 314(a), we instituted *inter partes* review (“IPR”) of all the challenged claims. Paper 12 (Inst. Dec.”).

SEMCO, in turn, opposed Trane’s petition. Paper 38 (“PO Resp.”).¹ Trane replied. Paper 18 (“Pet. Reply”). With our authorization, SEMCO filed a sur-reply. Paper 20 (“PO Sur-Reply”). Trane then moved to strike certain portions of SEMCO’s sur-reply because they raised arguments and evidence regarding objective indicia of non-obviousness for the first time since institution. Paper 27. We granted Trane’s motion. Paper 36. An oral hearing was conducted on April 24, 2019. Paper 39 (“Hr’g Tr.”).

We have jurisdiction under 35 U.S.C. § 6. After considering the parties’ arguments and supporting evidence, we determine that Trane has proven claims 1–15, 18, 19, 25, 28, 29, 36–40, 42, 44–47, and 49 unpatentable by a preponderance of the evidence. 35 U.S.C. § 316(e).

I. BACKGROUND

A. *Related Matters*

The ’388 patent is presently the subject of an infringement action in *SEMCO, LLC v. Trane US, Inc.*, Case No. 2:17-cv-04077 (W.D. Mo.). Paper 14, 2–3. The ’388 patent was also the subject of an earlier infringement action, *SEMCO, LLC v. Huntair, Inc.*, Case No. 2:11-cv-4026 (W.D. Mo.), in which the district court conducted a *Markman* hearing and construed many of the claim terms of the ’388 patent. *See* Ex. 2003 (“*Markman* Order”). Shortly after the district court issued its *Markman* Order, the case settled pursuant to a Consent Judgment entered on February 21, 2012. *See* Ex. 2004 (“Consent Judgment”).

¹ Paper 38 is a Corrected Patent Owner Response; it replaced Paper 15, SEMCO’s original Patent Owner Response that had two minor errors.

B. The '388 Patent

The '388 patent is directed generally to a system and method for controlling the temperature and humidity level of air supplied to a controlled space. Ex. 1001, Abstract, 2:11–28. “One of the most effective design solutions for controlling the temperature and humidity of a controlled space,” according to the '388 patent, is a “desiccant-based system.” *Id.* at 2:11–28. Desiccants are solid or liquid substances that absorb moisture from the air, and, in an air supply system, are typically found in what is known as a “desiccant wheel.” *Id.* at 2:31–41. In describing prior art desiccant wheel systems, the '388 patent states:

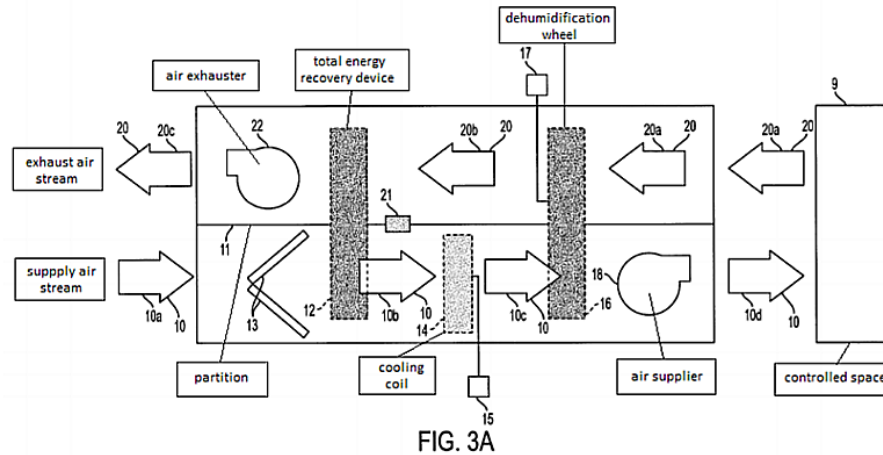
The wheel is frequently contained in duct work or in an air handling system that is divided into two sections. The wheel is rotated slowly on its axis such that a given zone of the wheel is sequentially exposed to the two sections. In the first section, the desiccant is contacted by the supply/outdoor air. In this section, the desiccant wheel dehumidifies the supply/outdoor air stream by absorbing moisture from the air onto its desiccant surface.

In the second section of the desiccant wheel, the desiccant contacts the return/exhaust air being discharged from the space. This return/exhaust air desorbs the moisture from the desiccant that was adsorbed from the supply/outdoor air. By cycling the wheel through these two air streams, the adsorbing/desorbing operation of the wheel is continuous and occurs simultaneously.

Id. at 2:45–60.

The desiccant wheel system of the '388 patent includes *dual* desiccant wheels—a total energy recovery wheel that transfers moisture and heat from the supply air stream to the exhaust air stream *and* a dehumidification wheel that exchanges only moisture between the two air streams. *Id.* at 8:22–40, 9:19–23, 10:33–36. The dual wheel system is illustrated in Figure 3A of the

'388 patent, reproduced below and annotated by Trane to identify the various system components. Pet. 12.



As shown in Figure 3A above, air supplier 18 creates supply air stream 10 to controlled space 9, and air exhauster 22 creates exhaust air stream 20 from the controlled space. *Id.* at 8:22–30. A partition separates the supply air stream from the exhaust air stream. *Id.* Total energy recovery wheel 12 and dehumidification wheel 16 rotate through the supply and exhaust air streams to exchange heat and moisture between the two air streams. *Id.* at 8:30–40.

Notably, “[i]n one preferred embodiment, the dehumidification wheel is a *passive* desiccant-based wheel that does not require any additional high temperature regeneration energy in order to regenerate the wheel.” *Id.* at 10:40–44 (emphasis added). “However,” according to the ’388 patent,

those skilled in the art will appreciate that many traditional desiccant-based dehumidification wheels will provide some benefit when applied in the novel fashion described herein, the resulting effectiveness depending upon the operating properties (isotherm) of the desiccant utilized, the desiccant loading, the non-desiccant mass of the wheel and other physical parameters. *Therefore, the claims of this invention should not be limited to a particular type of dehumidification wheel.*

Id. at 10:52–61 (emphasis added).

C. The Challenged Claims

Of the challenged claims, claims 1, 36, 37, and 44 are independent. Claims 1 and 36 recite a “system” for controlling the temperature and humidity of a controlled space, while claims 37 and 44 recite a “method” for doing the same. Claim 1 is illustrative and recites:

1. A system for controlling the temperature and humidity level of a controlled space, the system comprising:
 - a) an air supplier adapted to supply air to the controlled space, creating a supply air stream;
 - b) an air exhauster adapted to exhaust air out of the controlled space, creating an exhaust air stream adjacent to the supply air stream;
 - c) a partition disposed between the supply and exhaust air streams that separates the supply and exhaust air streams;
 - d) a total energy recovery device in contact with the supply air stream and exhaust air stream that exchanges heat and moisture between the supply and exhaust air streams;
 - e) a dehumidification wheel positioned to rotate through the supply air stream and the exhaust air stream that exchanges heat and moisture between the supply and exhaust air streams; and
 - f) a cooler disposed in the supply air stream between the total energy recovery device and the dehumidification wheel, the cooler adapted to cool and dehumidify the supply air stream.

Ex. 1001, 20:41–63.

D. The Asserted Grounds of Unpatentability

Trane asserts four grounds of unpatentability—one based on anticipation and three based on obviousness. Pet. 8–9. In particular, Trane challenges claims 1–3, 5–10, 12–15, 18, 19, 25, 28, 29, 36, 37, 39, 40, 42,

44, 46, 47, and 49 of the '388 patent as anticipated by Meckler.² *Id.* at 8, 30–52. In addition, Trane challenges claims 1–15, 18, 19, 25, 28, 29, 36–40, 42, 44–47, and 49 on alternative grounds of obviousness that include: (1) Meckler and “the knowledge of a person of ordinary skill in the art;” (2) Meckler in combination with TWDS;³ and (3) TWDS in combination with TSDD.⁴ *Id.* at 9, 53–85.

In support of these grounds, Trane proffers the declaration of William R. Acorn, P.E., an expert retained for purposes of this proceeding. Ex. 1002. In rebuttal, SEMCO relies heavily on a declaration from John C. Fischer, Jr., the named inventor on the '388 patent. Exs. 2001, 2034. As stated in his declaration, Mr. Fischer receives royalties for the '388 patent, serves as “Director of Technology and Strategic Business Development” for SEMCO, and is paid a monthly consulting fee by SEMCO. Ex. 2001 ¶¶ 2–6. SEMCO also proffers the declaration of Orjan E. Isacson, an expert retained for purposes of this proceeding. Exs. 2002, 2035; Ex. 1027, 17:15–21.

II. ANALYSIS

A. Claim Construction

As mentioned above, the U.S. District Court for the Western District of Missouri conducted a *Markman* hearing and issued a *Markman* Order construing many of the terms in the challenged claims, including “supply air stream,” “exhaust air stream,” “partition,” “total energy recovery device,”

² U.S. Patent No. 4,903,503, iss. Feb. 27, 1990 (Ex. 1003, “Meckler”).

³ U.S. Dept. of Energy, *Two-Wheel Desiccant Dehumidification System*, FEDERAL TECHNOLOGY ALERT (Apr. 1997) (Ex. 1005, “TWDS”).

⁴ G. Meckler, *Two-Stage Desiccant Dehumidification in Commercial Building HVAC Systems*, ASHRAE TRANSACTIONS, Vol. 95, Part 2, pp. 1116–1123 (1989) (Ex. 1006, “TSDD”).

“dehumidification wheel,” “passive dehumidification wheel,” and “cooler.” See Ex. 2003. Shortly after Trane filed its petition, SEMCO moved “that a district court-type claim construction be used in this IPR” based on the expiration of the ’388 patent before the deadline for issuing a final written decision. Paper 6. We granted SEMCO’s motion for a district court-type claim construction, and, in instituting this IPR, construed the claim terms in a manner consistent with the district court’s *Markman* Order. See Inst. Dec. 5–8.

Trane’s proposed claim constructions do not differ appreciably from the constructions set forth in the district court’s *Markman* Order. Compare Pet. 26–29, with Ex. 2003, 8–13. With one exception, SEMCO agrees that the district court’s *Markman* Order “sets out the correct District Court-type construction.” PO Resp. 10–11. The exception, according to SEMCO, is that the district court should have construed the term “exhaust air stream” more narrowly than it did. *Id.* The district court construed “exhaust air stream” simply as “air drawn from the controlled space or from a variety of other sources,” which is the very construction SEMCO urged the district court to adopt at the time. Ex. 2003, 10; see also Ex. 1022, 25–26. That construction is also consistent with the specification of the ’388 patent, which provides that “[t]he term ‘exhaust air stream’ used herein is *intended to be construed broadly* to include ‘return air.’” Ex. 1001, 8:67–9:2 (emphasis added).

Although the district court adopted SEMCO’s construction, SEMCO now argues that the district court’s construction should be revised because it failed to address the “flowpath” of the exhaust air stream. PO Resp. 11, 13, 15. Trane replies that, because the district court adopted SEMCO’s broader

construction of “exhaust air stream,” the doctrine of “judicial estoppel” serves to preclude SEMCO from now asserting a “new” construction of that same term. Pet. Reply 4–5.

We disagree that judicial estoppel applies here. The earlier district court action in which SEMCO allegedly took an inconsistent position ended in settlement before the completion of discovery and almost a year before the scheduled trial. A district court is always free to revisit an initial claim construction when made before full development of the record and refinement of the issues. *See Sandisk Corp. v. Memorex Prods.*, 415 F.3d 1278, 1291 (Fed. Cir. 2005) (citation omitted); *see also* Fed. R. Civ. P. 54(b). Because the district court action settled before the issue of claim construction could be said to have been fully adjudicated, we do not consider SEMCO’s earlier position to have been a “judicial success,” which is a key factor in determining whether judicial estoppel applies. *Water Tech. Corp. v. Calco, Ltd.*, 850 F.2d 660, 665–66 (Fed. Cir. 1988); *see also* *Konstantinidis v. Chen*, 626 F.2d 933, 939 (D.C. Cir. 1980) (“A settlement neither requires nor implies any judicial endorsement of either party’s claims or theories, and thus a settlement does not provide the prior success necessary for judicial estoppel.”). As such, judicial estoppel does not prevent SEMCO from arguing in this proceeding for a narrower construction of the term “exhaust air stream.”

In that vein, SEMCO argues that, when the “flowpath” of the “exhaust air stream” is taken into consideration, the term should be construed more narrowly to mean “an *unbroken* flow of *unheated* air drawn from the controlled space and may additionally include air drawn from a variety of other sources *that flows serially through a portion of the dehumidification*

wheel and then through a portion of the total energy recovery device.” PO Resp. 13. It is clear that SEMCO seeks to introduce these narrowing limitations—that the exhaust air stream be “unbroken,” “unheated,” and flows “serially” through the dehumidification wheel “and then” through the TER wheel—so as to overcome the prior art asserted against the challenged claims. See PO Resp. 22 (explaining it is “important to understand” that “*the exhaust air stream . . . means substantially the entire (‘unbroken’) exhaust air stream and not just a portion of the exhaust air stream . . .* because in Trane’s primary reference . . . Meckler’s exhaust air is repeatedly subdivided and reduced before passing through Meckler’s dehumidification wheel”).

We reject SEMCO’s attempt to narrow the district court’s construction of “exhaust air stream” so as to avoid the prior art, for neither the claim language nor the specification supports such a narrow reading. First, contrary to what SEMCO argues, the claims already define a flowpath for each of the two claimed air streams—“supply air *to* the controlled space, creating a supply air stream” and “exhaust air *out of* the controlled space, creating an exhaust air stream.” Ex. 1001, 20:43–46, 24:54–57, 25:61–63, 26:47–49 (emphases added). As for what happens to the air streams as they flow “to” and “out of” the controlled space, the claims require only that they “contact” or “pass[] . . . through” the two wheels. *Id.* at 20:52–59. Nowhere does the claim language suggest a particular order for the two wheels. Indeed, the abstract of the ’388 patent provides simply that the system functions effectively “by operating the two wheels in series,” without any limitation on which wheel is first. *Id.*, Abstract.

Moreover, had a particular order for the wheels been intended to be claimed, the applicant for the '388 patent knew how to do so, for elsewhere in the claims, the disposition of another component is claimed expressly—"a cooler disposed in the air supply stream *between* the total energy recovery device and the dehumidification wheel." Ex. 1001, 20:60–62 (emphasis added). But noticeably missing is any claim language restricting which wheel comes before the cooler and which wheel comes after it. *See id.* at 20:52–59. That obvious omission indicates the applicant's intent to obtain coverage that does not depend on the particular order of the wheels. Thus, absent a reason for doing so, we will not inject into the claims a sequence or order for the two desiccant wheels, particularly where, as here, the inventor himself was sophisticated in the art of claim drafting and understood the patent process "quite well." Ex. 1026, 36:16–24; *see also id.* at 36:25–42:9 (Mr. Fischer testifying that he was "involved in drafting the claims" and "at least 70, 75, 80 percent" of the '388 patent, and "you want the broadest possible claim that the patent office will allow because . . . that's going to protect the most against infringement.").

In furtherance of its narrower construction, SEMCO turns to the specification and figures of the '388 patent and argues that they "only show" the exhaust air stream passing "*first* through dehumidification wheel 16 and *then* through TER wheel 12." PO Resp. 16 (citing Ex. 2035 ¶¶ 15–16) (emphases added); *see also id.* at 18 (arguing that "the only descriptions" in the specification require a specific sequence for the wheels). We disagree.

Although the '388 patent may describe one embodiment in which the exhaust air passes through the wheels in a specific order (*see* Ex. 1001, 17:57–64), it clearly contemplates another embodiment in which the exhaust

air stream passes through the wheels in no particular order. For instance, SEMCO's designated expert and the named inventor of the '388 patent, Mr. Fischer, confirms that Figure 3A of the '388 patent depicts an embodiment in which a recirculation damper (element 21) is provided to divert air back into the supply air stream after passing through only one of the wheels.

Ex. 1027, 59:20–65:8. According to Mr. Fischer, the amount of the exhaust air stream passing through the damper, and bypassing the other wheel, may be “100 percent” or “it might be 50 percent . . . depending upon the codes [and] density of people.” *Id.* at 62:19–64:20. So, at least in the case of the Figure 3A embodiment, the exhaust air stream is untethered to the order of the wheels, thereby contradicting SEMCO's assertion as to the importance of their sequential order.⁵ And, importantly, Mr. Fischer confirms that the claims cover the Figure 3A embodiment. *Id.* at 62:16–18 (“Claim 1 covers Figure 3A.”). Thus, contrary to SEMCO's argument, neither the claim language nor the specification are limited to the preferred embodiment, and, thus, do not narrow the construction of the claimed “exhaust air stream” to a particular flowpath through the two desiccant wheels.

SEMCO also tries to instill the term “unbroken flow” into the meaning of “exhaust air stream.” PO Resp. 19. But, as discussed above, the Figure 3A embodiment of the '388 patent negates SEMCO's argument by depicting a recirculation damper that is capable of diverting, *i.e.*, *breaking*, the exhaust air stream so that some or all of the exhaust air stream flows into

⁵ SEMCO acknowledges that “patent drawings are highly relevant to construing the . . . limitations of the claims.” PO Resp. 10 (citing *Advanced Steel Recovery, LLC v. X-Body Equip., Inc.*, 808 F.3d 1313, 1317 (Fed. Cir. 2015)); *see also* 35 U.S.C. § 113.

the supply air stream without ever flowing through the second desiccant wheel. See Ex. 1001, Fig. 3A (showing recirculation damper 21). Mr. Fischer confirms the operating mode in which the recirculation damper would break the air stream flow. See Ex. 1027, 62:16–65:8. In addition, the specification contemplates that the exhaust air stream may be broken by allowing “air from a variety of other sources” to be mixed with the exhaust air stream. Ex. 1001, 8:60–9:2. Thus, we reject SEMCO’s attempt to read the term “unbroken” into the meaning of “exhaust air stream” when neither the claim language nor the specification supports such a construction.

Finally, SEMCO argues that the exhaust air stream must be construed to mean it is “unheated.” PO Resp. 19; *see also* PO Sur-Reply 15. In support, SEMCO cites the specification’s disclosure of a preferred embodiment that describes an unheated dehumidification wheel. *Id.* at 20 (citing Ex. 1001, 17:11–13, 17:57–61, 18:31–34). But each of the cited disclosures simply states an “example” of the temperature for the exhaust air. *Id.* Indeed, the specification states repeatedly that “the temperature and humidity levels are provided by way of a[n] example only and should not be construed as a limitation.” Ex. 1001, 17:21–23, 17:66–18:2, 18:41–43, 19:13–15; *see also id.* at 20:17–25 (essentially same). And, consistent with those disclosures, SEMCO’s other expert, Mr. Isacson, admits that the exhaust air stream, as claimed, should not be construed to be unheated:

Q: For your definition of exhaust air stream, you’d want to add unheated to that claim term?

A: No, not necessarily, no. It's still an exhaust air stream, you know, in certain cases, yeah, even if you heat it. . . . It doesn't have to be unheated.

Ex. 1028, 40:5–14; *see also id.* at 41:20–42:2 (again confirming that the claimed exhaust air stream could be heated), 52:8–10 (similar testimony). Given that SEMCO's own expert confirms that the exhaust air stream, as claimed, could be heated or unheated, we are not inclined to adopt SEMCO's proposed construction that the exhaust air stream is limited to one that is unheated.

In the end, we see no reason to stray from the district court's broader construction of the term "exhaust air stream," for it is fully supported by the claim language and the specification. Thus, we reject SEMCO's proposed narrower construction, and, instead, construe the term "exhaust air stream" without any limitation on the temperature, diversion, or order of its flowpath through the two desiccant wheels. We also adopt the district court's constructions of the additional claim terms, which neither party disputes for purposes of this proceeding. *See* Ex. 2003.⁶

B. Anticipation by Meckler

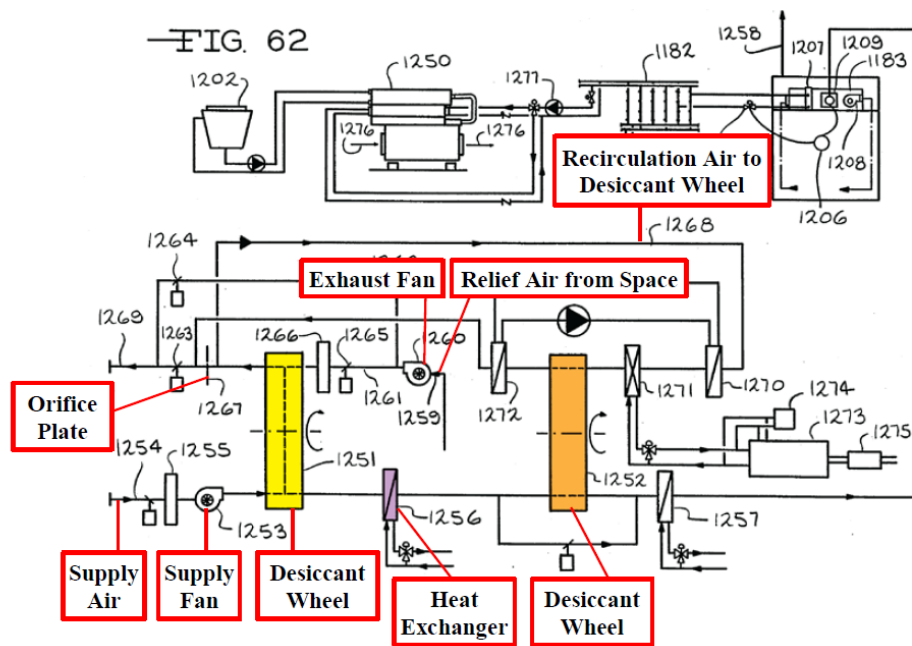
Trane challenges claims 1–3, 5–10, 12–15, 18, 19, 25, 28, 29, 36, 37, 39, 40, 42, 44, 46, 47, and 49 of the '388 patent as anticipated by Meckler.

⁶ Before institution, SEMCO asserted in its preliminary response that several of the district court's claim constructions were "modified" by the district court's entry of the "Consent Judgment" (Ex. 2004). Paper 9, 13. We rejected SEMCO's assertion because the claim constructions in the Consent Judgment were a condition of the parties' settlement agreement, not part of a meaningful legal analysis by the district court. SEMCO no longer maintains that argument. *See* PO Resp. 9–13. Thus, the argument is deemed waived. *See* Paper 13, 3 (emphasizing that "*any arguments for patentability not raised and fully briefed in the response will be deemed waived*").

Pet. 30–46. The four independent claims—claims 1, 36, 37, and 44—recite limitations that overlap significantly. In opposing Trane’s anticipation challenge, SEMCO does not differentiate between the independent claims, limiting its arguments to independent claim 1 and arguing only dependent claims 15 and 25 separately. See PO Resp. 23–30 (arguing “Claim 1”), 31–32 (arguing “Claims 15 and 25”).

1. Independent Claim 1

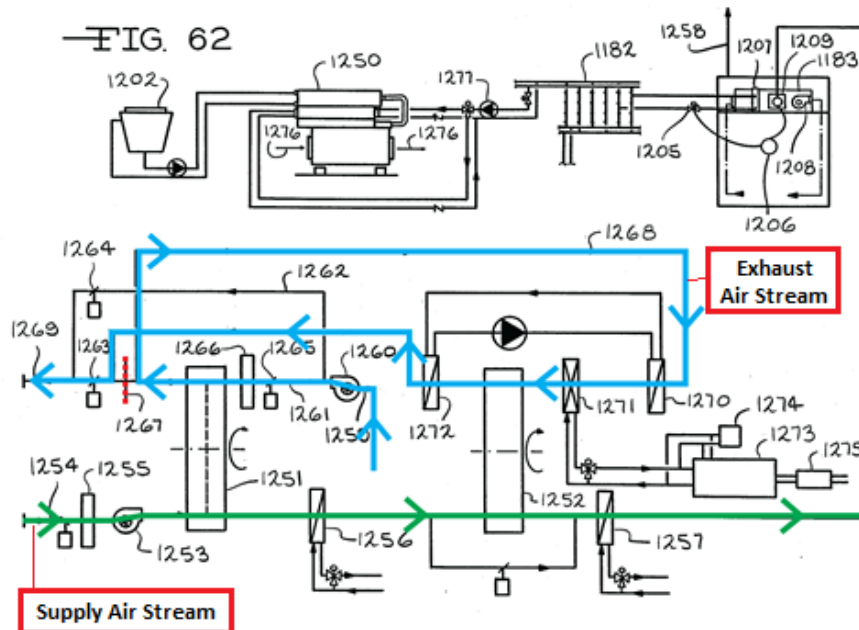
Like claim 1, Meckler describes a two-stage, desiccant-based HVAC system. Ex. 1003, 75:40–77:23, Fig. 62; see also Ex. 1002 ¶¶ 132, 143–184 (mapping Meckler’s system to claim 1). Figure 62 of Meckler, reproduced below, is a schematic diagram of Meckler’s system annotated by Trane to show the various system components. Pet. 31.



As shown in annotated Figure 62 above, Meckler’s system includes first desiccant wheel 1251 (yellow) in series with a second desiccant wheel (orange). See *id.* It is undisputed that Meckler’s desiccant wheel 1251 is an

“enthalpy (total energy recovery– TER) wheel” and that desiccant wheel 1252 is a “dehumidification wheel.” PO Resp. 25–26.

In another annotation of Figure 62, reproduced below, Trane illustrates the flowpath of the supply and exhaust air streams through the two desiccant wheels. Pet. 33–36.



As shown in annotated Figure 62 above, the flowpath includes a supply air stream (green) into air-conditioned space 1206 (upper right corner) and an exhaust air stream (blue) out of the air-conditioned space. Ex. 1003, 75:40–54 (describing supply air stream), 75:63–76:13 (describing exhaust air stream). The flowpath of the supply air stream (green) passes through a lower portion of TER wheel 1251 and then through a lower portion of dehumidification wheel 1252 before entering air-conditioned space 1206. *Id.* at 75:49–54. After leaving the air-conditioned space, the flowpath of the exhaust air stream (blue) passes through an upper portion of TER wheel 1251 and then an upper portion of dehumidification wheel 1252, where the wheels are “regenerated by relief air.” *Id.* at 75:63–68. More specifically,

after leaving air-conditioned space 1206, the exhaust air stream (blue) enters duct 1261 and passes through TER wheel 1251, then enters duct 1268 and passes through dehumidification wheel 1252. *Id.* at 75:68–76:13. As the wheels rotate, they exchange heat and moisture with the exhaust air stream in order to regenerate the desiccant wheels before the wheels again come into contact with the supply air stream. *Id.* at 76:22–62.

SEMCO does not dispute that Meckler discloses all of the system components of claim 1, but instead contends that Meckler’s system differs from the claimed invention because it is not “arranged as in” the challenged claims. PO Resp. 25–27. According to SEMCO, “all of the exhaust air from fan 1260 *first* flows through TER wheel 1251 or is exhausted — none of Meckler’s exhaust air *first* flows through a dehumidification wheel as required by all of the Challenged Claims.” *Id.* at 26. In other words, SEMCO attempts to distinguish the claimed invention by faulting the configuration of Meckler’s exhaust air stream for flowing through TER wheel 1251 *before* dehumidification wheel 1252.

We are not persuaded by SEMCO’s argument, for it is predicated on a construction of “exhaust air stream” that we have determined is improper. As discussed above, we do not construe the term “exhaust air stream” as limiting the particular order of the claimed TER wheel and dehumidification wheel. SEMCO offers no argument that Meckler does not anticipate the challenged independent claims if the district court’s claim construction for exhaust air stream is adopted. *See* PO Resp. 25–27. When properly construed, the claimed “exhaust air stream” is disclosed by Meckler. Pet. 35–36, 40–46. Indeed, SEMCO’s expert, Mr. Fischer, concedes that

Meckler discloses the claimed exhaust air stream when construed per the district court's *Markman* Order:

Q: If you flip to page 10 [of Exhibit 2003], then, *we have the exhaust air stream. And this is construed the same way at the bottom of page 10, air drawn from a controlled space or from a variety of other sources.* Do you see that?

A: I do see that.

Q: And again, *there's no limitation there that it be unbroken, unheated, or serial;* correct? [Objection from SEMCO's counsel]

A: It is what it is [referring to Exhibit 2003].

Q: Okay. And if you -- lots of prior art, you know, your Figure 1, *Meckler Patent, I mean these all have an exhaust air stream; right?*

A: Yes.

Ex. 1027, 101:1–17 (emphases added).

Likewise, SEMCO's other expert, Mr. Isacson, confirms not only that Meckler discloses an "exhaust air stream," but that it also discloses the additional components of the challenged independent claims, including a "supply air stream," "partition," "total energy recovery wheel," "dehumidifier wheel," and "cooler." Ex. 1027, 75:18–83:3. Thus, when adopting the district court's construction, both of SEMCO's experts concede that Meckler discloses the claimed "exhaust air stream."

We are also not persuaded by SEMCO's argument faulting Meckler's exhaust air stream for being "bifurcated"—with one portion "exhausted to the atmosphere" through orifice plate 1267 (shown in red in annotated Figure 62 above) and another portion "directed, via a 'loop around' duct

1260, to a position upstream of the dehumidification wheel.”⁷ PO Resp. 26 (discussing “Portion[] 3 and Portion 4” of Meckler’s exhaust air stream); *see also* PO Sur-Reply 13–15 (same). Like it did in faulting the sequential order of Meckler’s wheels, SEMCO premises its argument as to the bifurcation of Meckler’s exhaust air stream entirely on an improper construction of “exhaust air stream.” *See* PO Sur-Reply 13–15. Also premised on SEMCO’s improper construction is its argument faulting Meckler’s “looped around” portion for being “heated to an elevated temperature.” PO Resp. 27, 29–30; *see also* PO Sur-Reply 13–16 (same). As discussed above, the proper construction of “exhaust air stream” requires neither an “unbroken” nor an “unheated” flowpath. Nor does it require a particular order for the flowpath through the desiccant wheels, as also discussed above. Thus, despite Meckler’s flowpath being bifurcated and heated, as well as passing through the TER wheel before the dehumidification wheel, we find that Meckler nonetheless meets the “exhaust air stream” limitation of the challenged claims when viewed under the district court’s construction, which we determined is the proper construction to be applied here.

As for the remaining elements of claim 1, Trane provides a detailed analysis of content within Meckler that discloses each and every element of claim 1. Pet. 46–52. SEMCO offers no argument disputing Meckler’s disclosure of the other elements of claim 1 in the event we adopt the district

⁷ To the extent SEMCO maintains that Meckler’s exhaust air stream is also bifurcated *before* it passes through first wheel, SEMCO is wrong. *See* PO Resp. 26 (describing Portions 1 and 2). Meckler clearly contemplates that the exhaust air stream may enter solely duct 1261, thereby bypassing duct 1262, “depending upon the positions of dampers 1263, 1264 and 1265.” Ex. 1003, 75:68–76:2.

court's construction of "exhaust air stream," which we do here. *See* PO Resp. 25–30; PO Sur-Reply 13–16. "Any material fact not specifically denied may be considered admitted." 37 C.F.R. § 42.23(a); *see also* Paper 13, 3 (emphasizing "*any arguments for patentability not raised and fully briefed in the response will be deemed waived*"). Thus, given our adoption of the district court's construction of "exhaust air stream," we determine that Trane has shown by a preponderance of the evidence that Meckler discloses each and every element as arranged in claim 1, and thus, claim 1 is unpatentable as anticipated by Meckler. *See* Pet. 32–40.

2. The Additional Challenged Claims Aside from Claims 15 and 25

SEMCO does not argue independent claims 36, 37, and 44 separately from claim 1. As with claim 1, Trane provides a persuasive showing of where each element of independent claims 36, 37, and 44 resides in Meckler. *See* Pet. 40–46 (citing Ex. 1002 ¶¶ 186, 193–203, 205–207). Thus, under the district court's proper construction of the claim terms, we conclude that Trane has shown by a preponderance of the evidence that independent claims 36, 37, and 44 are anticipated by Meckler.

Also, SEMCO does not dispute Trane's showing that Meckler discloses the dependent limitations of claims 2, 3, 5–10, 12–14, 18, 19, 28, 29, 39, 40, 42, 46, 47, and 49. *Compare* Pet. 46–52 (mapping the challenged dependent claims to Meckler), *with* PO Resp. 25–30 (omitting any discussion of the challenged dependent claims aside from claims 15 and 25). Those material facts being undisputed, we consider them admitted. *See* 37 C.F.R. § 42.23(a). Thus, we determine that Trane has shown by preponderant evidence that the challenged dependent claims 2, 3, 5–10, 12–14, 18, 19, 28, 29, 39, 40, 42, 46, 47, and 49 are anticipated by Meckler.

3. *Dependent Claims 15 and 25*

Trane argues that Meckler also anticipates dependent claims 15 and 25, each of which requires that “the exhaust air stream is passed through the cool and moist zone of the dehumidification wheel as it rotates through the exhaust air stream.” Pet. 50–51 (citing Ex. 1002 ¶¶ 240–248). SEMCO responds that the only portion of Meckler’s exhaust air stream that passes through the dehumidification wheel “is heated” and “must therefore lack the ‘cool and moist zone’ required by Challenged Claims 15 and 25.” PO Resp. 29–32. But SEMCO’s argument relies on a construction of “cool and moist zone” that is inconsistent with the construction SEMCO advanced during the district court’s *Markman* hearing.

Here, for instance, SEMCO argues repeatedly that “cool and moist,” as recited by claims 15 and 25, is directed to the *temperature* of the exhaust air stream and requires that the exhaust air stream be “unheated” as it passes through the dehumidification wheel. *See id.* That new argument by SEMCO stands in contrast to SEMCO’s argument to the district court that the term “cool and moist” merely refers to a “portion” of the wheel rather than the temperature or humidity level of the air stream entering the wheel. *See Ex. 2003, 17.* Indeed, the district court agreed with SEMCO, finding that “[i]t is plain from the context of the patent that the terms ‘cool,’ . . . ‘moist,’ . . . are *relative to other areas* of the patented device.” *Id.* (emphasis added). As such, the district court construed the term “cool and moist zone” of the dehumidification wheel to be “the *portion* of the wheel exposed to the exhaust air stream.” *Id.* at 18 (emphasis added).

Given the district court’s construction, which we adopt here, it is undisputed that a portion of Meckler’s dehumidification wheel is exposed to

the exhaust air stream, as even SEMCO's expert, Mr. Fischer, admits. Ex. 1027, 160:8–19. SEMCO makes no further arguments with respect to Trane's challenge of dependent claims 15 and 25, except to repeat the arguments it made against Trane's challenge of base claim 1, which we have already addressed and rejected. See PO Resp. 29–30. After considering the entirety of the record, we determine that Meckler anticipates dependent claims 15 and 25 under the properly applied district court construction of “cool and moist zone.”

C. Obviousness Over Meckler

1. Dependent Claims 4, 11, 38, and 45

Dependent claims 4, 11, 38, and 45 further limit the “dehumidification wheel” of their respective base claims by requiring that it be “passive.” Trane acknowledges that Meckler's dehumidification wheel 1252 is not “explicitly disclosed” as being passive, but rather would have been obvious “by Meckler in view of the common knowledge of a POSITA.” Pet. 59–62; Pet. Reply 15–17.

The district court construed the “passive dehumidification wheel” of dependent claims 4, 11, 38, and 45 exactly as it is defined in the '388 patent—a “desiccant-based wheel that does not require any *additional high temperature regeneration energy* in order to regenerate the wheel.” Ex. 2003, 15 (citing Ex. 1001, 10:41–45) (emphasis added). SEMCO does not dispute that construction. See PO Resp. 11 (disputing only the district court's construction of “exhaust air stream”). And the '388 patent explains that additional high temperature energy for active regeneration “require[s] an external heat source” that “adds complexity to the system's operation.” Ex. 1001, 5:44–61. Thus, the '388 patent informs us that a *passive*

dehumidification wheel does not require the use of additional high temperature heat from an external source for regeneration of the desiccant wheel.

Although Meckler uses an *active* dehumidification wheel, i.e., one that requires an additional heat source to regenerate the wheel, Trane argues that a skilled artisan would have known “to substitute the dehumidification wheel 1252 of Meckler with a passive dehumidification wheel” because “there are only two options”—“either active or passive” dehumidification wheels, and “the ability to passively regenerate a desiccant wheel was not novel, nor was it unanticipated – the entire dehumidification industry was aware of the advantages of passive regeneration.” Pet. 59–61 (citing Ex. 1002 ¶¶ 218, 219). In response, SEMCO raises two points. First, SEMCO argues that Trane has made no showing that the substitution would remedy that the “exhaust air passes first through the dehumidification wheel and then through the TER wheel,” as required by “the properly construed ‘exhaust air stream.’” PO Resp. 44; *see also* PO Sur-Reply 16 (“Trane’s obviousness argument is predicated on an overly broad construction of ‘exhaust air stream.’”). As discussed above, however, we rejected SEMCO’s construction of “exhaust air stream” as requiring a sequential order to the wheels. Thus, SEMCO’s argument on this point is unpersuasive.

Second, SEMCO argues that “Trane proffers no factual basis as to why a PHOSITA would be motivated” to replace Meckler’s active dehumidification wheel with a passive one. PO Resp. 44–45; *see also* PO Sur-Reply 17–18. We disagree. Contrary to SEMCO’s argument, Trane proffers a myriad of evidence reflecting the common knowledge in the art of

passively regenerating a dehumidification wheel without additional high temperature heat.

To begin, Trane points to an industry handbook, published in 1996 by the American Society of Heating, Refrigerating, and Air-Conditioning Engineers, Inc. (“ASHRAE”),⁸ which teaches that “inexpensive, low-grade heat sources, such as waste heat, cogeneration heat, or rejected heat from refrigeration condensers, can be used to reactivate the desiccant at a low cost.” See Pet. 19–20 (citing Ex. 1004, 57); *see also* Pet. Reply 19–20 (citing Ex. 1002 ¶¶ 117, 218–222). That disclosure of utilizing low-cost, low-grade heat suggests passive regeneration of the desiccant wheel because, as defined by the ’388 patent, a passive desiccant wheel operates “without the need for any additional high temperature regeneration energy typical of conventional desiccant-based dehumidification applications using active desiccant dehumidification wheels” that “require an external heat source.” Ex. 1001, 5:44–61, 10:41–45. In fact, the ASHRAE handbook contemplates a regenerative air stream “only heated to 100° F.” Ex. 1004, 57. That temperature is far below what is required for “active” regeneration, which, according to the ’388 patent, requires that the “air stream is passed through the regenerating heating source where it is typically heated to a temperature in the range of 175° F to 300° F.” Ex. 1001, 4:5–13, Fig. 2.

As further evidence of the widely known benefits of passive regeneration, Trane cites unrebutted testimony from its expert that “[r]esearchers beginning . . . in the mid-1960s were disclosing two-stage regeneration processes in which at least a portion of the regeneration process

⁸ The ’388 patent cites extensively to ASHRAE as a widely-accepted standard in the HVAC industry. Ex. 1001, 1:33–36, 2:63, 4:44, 5:38, 13:22.

was accomplished with ambient (passive) air.” Pet. 60–61 (citing Ex. 1002 ¶ 218); *see also* Ex. 1002 ¶¶ 88–98, 120–123, 127–130 (describing evolution of passive regeneration of desiccant wheels). Trane further points to Cromer⁹ as an example of passive regeneration that uses warm, dry relief air from the controlled space. Pet. 18; *see also* Ex. 1009, 5:46–49 (“[T]he dry air entering the inlet passage 32 evaporates the moisture from the [desiccant] plates back into the air in a continuing rotation.”). Indeed, the ’388 patent itself recognizes that “[t]he prior art generally includes two types of desiccant wheel systems”—“passive” or “active”—and depicts a “Prior Art” desiccant wheel performing regeneration with “Return Air” at room temperature of “75 DEG.” Ex. 1001, 2:61–64, Fig. 1B. With that figure in mind, SEMCO’s expert admits “it was known that a desiccant-based wheel . . . can be passively regenerated using room temperature air.” Ex. 1027, 167:6–15; *see also id.* at 166:12–18 (same).

Based on that contemporaneous evidence, along with the testimony of Trane’s expert and the admission of SEMCO’s expert, we are persuaded that a skilled artisan would have had reason to use a passive dehumidification wheel in place of Meckler’s active dehumidification wheel as a “low cost” remedy for regeneration of the desiccant. Ex. 1002 ¶¶ 117–118, 221. That the relevant industry was moving toward cost-efficient regeneration of desiccant wheels utilizing inexpensive, low-grade heat, which requires no additional heat source, supports that replacing or modifying Meckler’s active dehumidification wheel with a passive dehumidification wheel would have been a predictable variation in the eyes of a skilled artisan. *See* Ex. 1002

⁹ U.S. Patent No. 4,719,761, iss. Jan. 19, 1988 (Ex. 1009, “Cromer”).

¶¶ 218–222. SEMCO provides no rebuttal to that relevant knowledge in the art. See PO Resp. 43–46; PO Sur-Reply 16–20. In contrast, Trane provides ample evidence that low-cost, passive regeneration of desiccant wheels was well-known in the art and a skilled artisan would have appreciated that Meckler’s dehumidification wheel “may be operated without using high temperature regeneration heat (i.e., it does not *require* use of the heater) in some conditions.” Pet. Reply 18 (citing Ex. 1002 ¶ 219). Thus, we conclude that Trane has demonstrated by a preponderance of the evidence that a skilled artisan would have viewed the claimed “passive” dehumidification wheel of dependent claims 4, 11, 38, and 45 as obvious over Meckler’s desiccant-based system and the high level of knowledge in the art of regenerating desiccant wheels, including passive regeneration.

2. Additional Claims Challenged for Obviousness

We have already determined that claims 1–3, 5–10, 12–15, 18, 19, 25, 28, 29, 36, 37, 39, 40, 42, 44, 46, 47, and 49 are unpatentable as anticipated by Meckler. To the extent Meckler does not meet the claimed “exhaust air stream,” Trane argues that these claims are rendered obvious by Meckler and the common knowledge in the art. Pet. 53–59; Pet. Reply 20–21. In particular, Trane argues that a skilled artisan would have understood that Meckler’s orifice plate 1267 “may be so sized (or alternatively, plugged) so that substantially all of the exhaust air is cycled through duct 1268 to regenerate desiccant wheel 1252,” such that the flowpath of the exhaust air stream is unbroken. Pet. 54–55 (citing Ex. 1002 ¶¶ 169–170). Moreover, according to Trane’s expert, a skilled artisan would have understood that the extra ductwork, dampers, and heaters through which Meckler’s exhaust air stream pass are not required and, depending on the particular application,

could be “simplified” to form a “single counterflow regeneration air stream.” Ex. 1002 ¶ 168.

SEMCO disputes that a skilled artisan would have modified Meckler, arguing that Trane’s expert “only offers conclusory statements regarding motivation that are not based on any facts stated in the prior art.” PO Resp. 38 (citing Ex. 2001 ¶¶ 123–124); *see also* PO Sur-Reply 20 (arguing “Trane’s Petition and Reply fail to provide a sufficient ‘factual foundation’ to support motivation.”). We disagree.

As argued in the Petition, Trane’s factual foundation comes from the common knowledge of “prior art systems that had two counterflow supply and exhaust air streams.” Pet. 55 (citing “*supra* at 12–24” for level of knowledge in the art). For instance, Trane points to the ASHRAE handbook for teaching a rotary desiccant dehumidifier that includes a single, unbroken exhaust air stream for regeneration of a desiccant wheel. *Id.* at 16 (citing Ex. 1004, 57, Fig. 5). And SEMCO’s expert admits “it was known to have an unbroken exhaust air stream prior to the [claimed] invention.” Ex. 1027, 42:21–43:2.

Also, the ASHRAE handbook describes a number of “variables of operations” considered by HVAC engineers in designing rotary desiccant dehumidification systems. Ex. 1004, 54–59. As discussed above with respect to claims 4, 11, 38, and 45, one of those variables includes the potential to use “inexpensive, low-grade heat sources” for regeneration of the desiccant wheel. *Id.* at 57. Moreover, SEMCO’s expert admits “it was known to have an unheated exhaust air stream prior to the [claimed] invention, . . . traveling serially through one wheel and then the other.” Ex. 1027, 43:3–14; *see also* Ex. 1001, Fig. 1B (depicting “Prior Art”

desiccant wheel using “Return Air” at room temperature of “75 DEG” for regeneration). SEMCO draws no distinction between that knowledge in the industry and the ’388 patent’s disclosure of “preferably utiliz[ing] the relatively warm and dry exhaust air [] from the controlled space ‘9’ to warm and dry the secondary side of the dehumidification wheel 16.” Ex. 1001, 11:63–66.

Another variable considered in the design of rotary desiccant systems is the potential to use “two” desiccant wheels “placed in series” so as “to provide air at low dew points.” Ex. 1004, 58–59. Again, SEMCO offers no distinction between that knowledge in the industry and the ’388 patent’s description of “operating the two wheels in series” so as “to provide the lowest possible dew point” to the controlled space. Ex. 1001, Abstract, 12:34–36. Indeed, according to the ASHRAE handbook, the industry recognized that “[i]n rotary desiccant dehumidifiers, there are more than 22 variables that affect performance” and “these variables change because of weather, variations in moisture load, and fluctuation in reactivation energy levels.” Ex. 1004, 57.

That evidence reflects that simply using an unbroken flow of unheated return air for regeneration rather than the more complex addition of high temperature heat and a bifurcating orifice plate, would have been well within the grasp of what an HVAC design engineer would have chosen to regenerate a dual-wheel desiccant system such as Meckler’s. Ex. 1002 ¶ 221 (“The type of desiccant wheel a design engineer would choose depends on both technical and economic considerations, including but not limited to: the available desiccant material, how much moisture needs to be removed from the air, and the availability of low cost reactivation energy.”); *see also id.*

¶ 222 (“[R]egenerat[ion] using no additional heat is a predictable variation of using a dehumidification wheel”). Thus, as with claims 4, 11, 38, and 45 discussed earlier, Trane demonstrates by a preponderance of the evidence that claims 1–3, 5–10, 12–15, 18, 19, 25, 28, 29, 36, 37, 39, 40, 42, 44, 46, 47, and 49 would have been obvious over Meckler and the common knowledge in the art.

III. ORDER

Accordingly, it is

ORDERED that Trane has carried its burden to show that claims 1–15, 18, 19, 25, 28, 29, 36–40, 42, 44–47, and 49 of the ’388 patent are *unpatentable*; and

FURTHER ORDERED that, because this is a Final Written Decision, any party to the proceeding seeking judicial review of the Decision must comply with the notice and service requirements of 37 C.F.R. § 90.2.

IPR2018-00514
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