

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

CHEMCO SYSTEMS, L.P.,
Petitioner,

v.

RDP TECHNOLOGIES, INC.,¹
Patent Owner.

IPR2019-01564
Patent 7,416,673 B2

Before JON B. TORNQUIST, JEFFREY W. ABRAHAM, and
JULIA HEANEY, *Administrative Patent Judges*.

HEANEY, *Administrative Patent Judge*.

JUDGMENT
Final Written Decision
Determining No Challenged Claims Unpatentable
Dismissing Patent Owner's Motion to Amend
35 U.S.C. § 318(a)

¹ The original caption identified RDP Company as the patent owner.
Paper 3. RDP Technologies, Inc., represents that it is now the owner of the
involved patent. Paper 4, 2.

I. INTRODUCTION

We have jurisdiction to conduct this *inter partes* review under 35 U.S.C. § 6, and this Final Written Decision is issued pursuant to 35 U.S.C. § 318(a). For the reasons that follow, we determine that Chemco Systems, L.P. (“Petitioner”) has not shown by a preponderance of the evidence that claims 1 and 2 of U.S. Patent No. 7,416,673 B2 (Ex. 1003, “the ’673 patent”) are unpatentable.

Petitioner filed a Petition to institute an *inter partes* review of claims 1 and 2 of the ’673 patent. Paper 2 (“Petition” or “Pet.”). RDP Technologies, Inc. (“Patent Owner”) filed a Preliminary Response. Paper 7. After institution of trial, Patent Owner filed a Patent Owner Response (“PO Resp.,” Paper 16), Petitioner filed a Reply (“Pet. Reply,” Paper 26), and Patent Owner filed a Sur-Reply (“PO Sur-Reply,” Paper 29).

Patent Owner filed a Contingent Motion to Amend and Request for Preliminary Guidance (Paper 18, “MTA”), to which Petitioner filed a response (Paper 25). On September 18, 2020, we issued Preliminary Guidance with respect to the Motion to Amend. Paper 27. Subsequently, Patent Owner filed a reply to the Motion to Amend (Paper 28) and Petitioner filed a sur-reply (Paper 32).

Petitioner relies on the Declaration of Lewis B. Benson, P.E. (Ex. 1004). Patent Owner relies on the Declarations of David Hokanson, Ph.D. (Ex. 2011) and Vincent Hart (Ex. 2012).

An oral hearing was held on December 1, 2020, and a transcript is included in the record. Paper 36 (“Tr.”).

A. *Related Proceedings*

Petitioner identifies the following pending litigation involving the '673 patent: *RDP Technologies, Inc. v. Chemco Systems, L.P.*, No. 2:18-cv-01161-PJP (W.D. Pa.) (“the District Court litigation”). Pet. 40.

Petitioner indicates that it has concurrently filed additional petitions challenging other patents asserted by Patent Owner in the District Court litigation. *Id.*

B. *The '673 Patent*

The '673 patent is titled “Method and Apparatus for Treating Lime Slurry for Grit Removal.” Ex. 1003, code (54). According to the '673 patent, grit in lime slurry can cause numerous problems, including grit build-up in downstream components, grit plugging or clogging nozzles and orifices, and abrasions caused to equipment due to the abrasive nature of grit particles. *Id.* at 1:42–48. Although various techniques are known for separating grit from lime slurry, problems occur with these techniques, including the inability to effectively remove particles smaller than 100 mesh (140 microns), inconsistent and highly variable amounts of grit removal, and introduction of variations in slurry concentration to the resultant final slurry output. *Id.* at 1:49–2:16. The '673 patent purports to overcome these problems by providing a novel method and apparatus for removing grit particles from lime slurry in which “the slurry is substantially continuously delivered from the slurry tank to a grit separator, with a portion of the slurry being extracted for discharge, while the rest of the slurry is recirculated to the slurry tank after separation of some of the grit from the slurry.” *Id.* at 2:18–24.

An exemplary embodiment of the claimed apparatus is depicted in Figure 6 of the '673 patent, reproduced below.

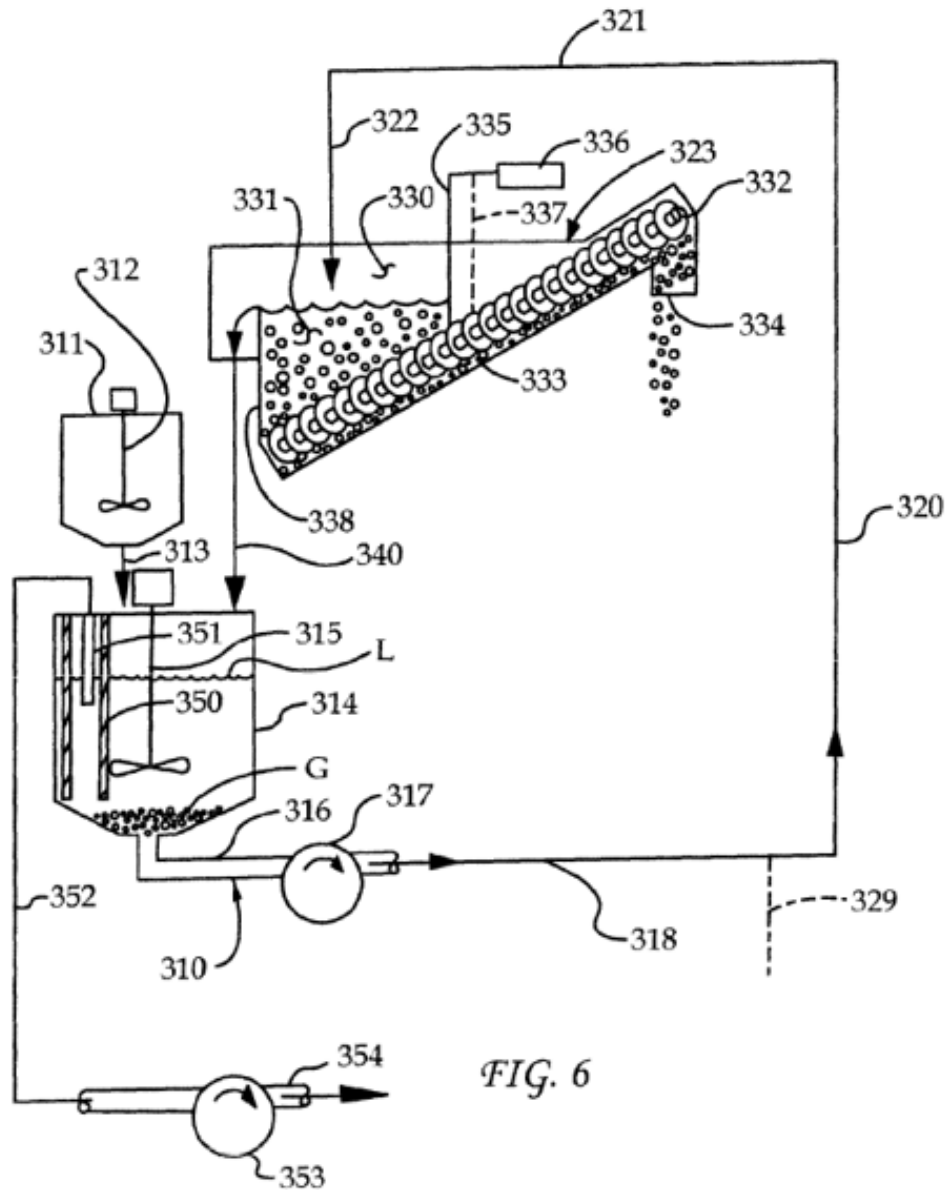


Figure 6 “is an illustration of a flow diagram . . . wherein the slurry is pumped from the slurry tank through a suction line, to discharge, through a stilling well.” Ex. 1003, 3:7–10. In Figure 6, lime slaker 311 has mixer 312 therein and delivers slaked lime via conduit 313 to slurry tank 314. *Id.* at 5:56–58. From slurry tank 314, slurry is pumped through conduit 316 using

pump 317 to lines 318, 320, 321, and 322 to tank 330. *Id.* at 5:58–61. Tank 330 includes sloped auger 332, which engages grit particles and conveys them up sloped surface 333 to point of discharge 334. *Id.* at 5:62–64. Tank 330 and auger 332 define grit separation device 323, which may include movable wall 335 controlled by actuator 336 for leftward and rightward movement between full line position 335 and phantom line position 337, in order to vary the cross-sectional surface area, causing an automatic, continuous or intermittent variation in the volume of liquid 331 retained within grit separation (classifier) device 323. *Id.* at 5:65–6:5. An upper edge of wall 338 of tank 330 enables overflow of lime slurry back into slurry tank 314. *Id.* at 6:5–8.

In the embodiment of Figure 6, extraction can occur by withdrawing slurry through line 351, using suction line 352 from suction pump 353 to discharge line 354. Ex. 1003, 6:20–22. Suction line 351 is in pipe-like stilling well 350; the bottom of stilling well 350 extends lower into the liquid level “L” of slurry in tank 314 than the bottom of suction line 351. *Id.* at 6:23–26. Figure 7, reproduced below, depicts a portion of Figure 6 that is enlarged to show details of stilling well 350.

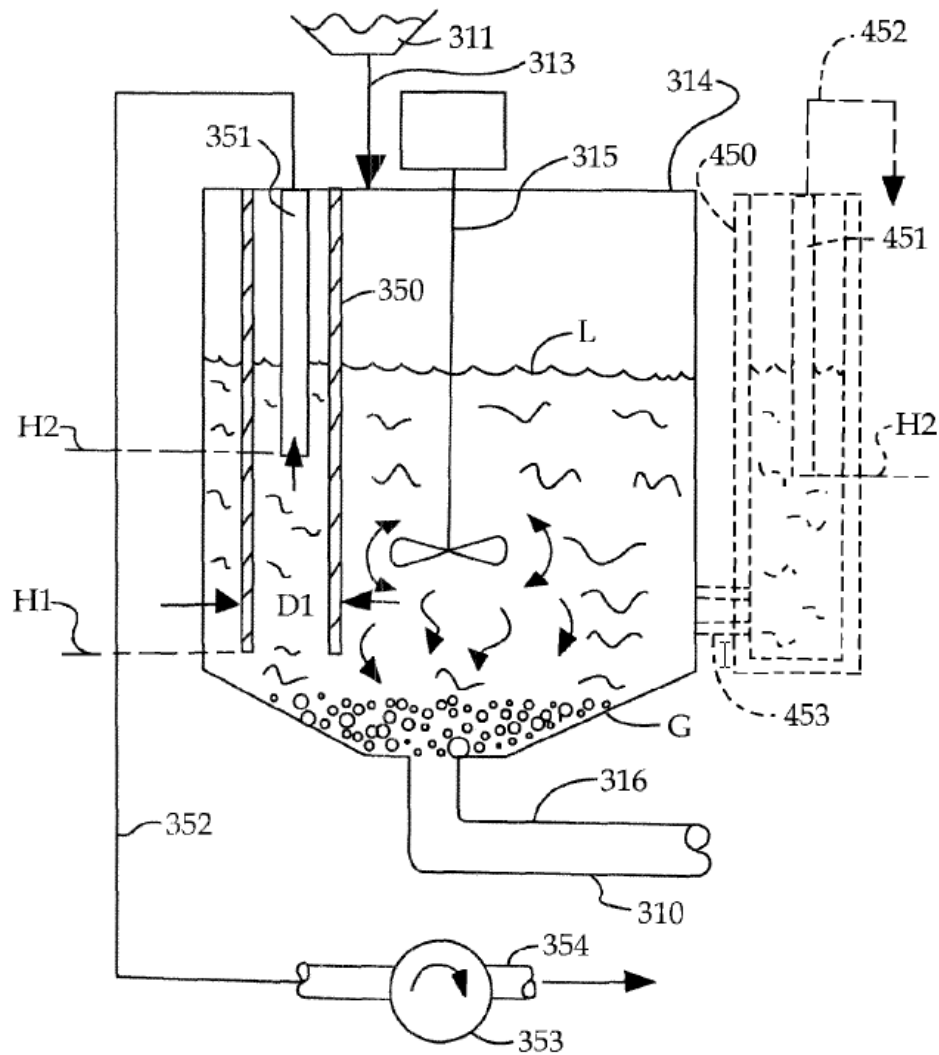


FIG. 7

Figure 7 is an enlarged, detailed view of the stilling well of Figure 6, showing liquid level “L” for the slurry in the slurry tank, grit “G” being separated out of the slurry in the slurry tank, and slurry being discharged from the stilling well. Ex. 1003, 3:11–15. Figure 7 shows stilling well 350 inside the slurry tank in the full line illustration and illustrates in phantom an alternative placement for the stilling well that is outside the slurry tank. *Id.* at 3:15–19. In Figure 7, stilling well 350 has a cross-sectional area having diameter D1, selected to have a predetermined flow velocity responsive to

the suction drawn via pump 353 to provide a sufficient residence time for slurry entering the bottom of stilling well 350, at level H1, to allow for gravity separation of grit “G” from the slurry in tank 314, prior to a portion of that slurry entering the suction line 351. *Id.* at 6:29–36. By determining the suction created via pump 353 and the cross-sectional area of stilling well 350, “the rise rate of slurry in the stilling well is controlled such that a desirable percentage of, or all grit particles do not reach the lower end of the suction line 351.” *Id.* at 6:37–41.

C. The Challenged Claims

Petitioner challenges claims 1 and 2 of the ’673 patent. Pet. 1. Claim 1, reproduced below, is illustrative of the subject matter of the challenged claims:

1. A method of treating lime slurry in a slurry treatment system, comprising the steps of:
 - (a) providing a watery lime slurry having lime particles and grit particles therein, in a slurry tank;
 - (b) delivering slurry from the slurry tank and extracting a portion of the slurry delivered from the slurry tank via a discharge line and discharging said extracted portion of the slurry from said discharge line;
 - (c) substantially continuously delivering the slurry from the slurry tank to a device for separation of some of the grit from the rest of the slurry; and
 - (d) recirculating the rest of the slurry to the slurry tank after separation of some of the grit from the slurry; and
 - (e) wherein the extraction of clause (b) is via a suction line, through a stilling well, that allows gravity separation of grit from slurry.

Ex. 1003, 7:34–8:14.

D. Asserted Grounds of Unpatentability

Petitioner asserts the following grounds of unpatentability:

Claims Challenged	35 U.S.C. § ²	Reference(s)/Basis
1, 2	103(a)	Muzik, ³ Espinoza ⁴
1, 2	103(a)	Muzik, Hanlon ⁵

Pet. 6.

II. ANALYSIS

A. Principles of Law

To prevail in its challenge to claims 1 and 2 of the '673 patent, Petitioner has the burden to establish by a preponderance of the evidence that the challenged claims are unpatentable. 35 U.S.C. § 316(e); 37 C.F.R. § 42.1(d) (2019). This burden never shifts to Patent Owner. *Dynamic Drinkware, LLC v. Nat'l Graphics, Inc.*, 800 F.3d 1375, 1378 (Fed. Cir. 2015).

A claim is unpatentable under 35 U.S.C. § 103 if “the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains.” *KSR Int'l Co. v. Teleflex Inc.*, 550 U.S. 398, 406 (2007). The question of obviousness is resolved on the basis of underlying

² The Leahy-Smith America Invents Act (“AIA”) included revisions to 35 U.S.C. § 103 that became effective on March 16, 2013. Because the '673 patent issued from an application filed before March 16, 2013, we apply the pre-AIA versions of the statutory bases for unpatentability.

³ U.S. Patent No. 5,336,481, issued Aug. 9, 1994 to Muzik et al. (Ex. 1010).

⁴ U.S. Patent No. 6,833,078 B2, issued Dec. 21, 2004 to Espinoza et al. (Ex. 1013).

⁵ U.S. Patent No. 6,197,190 B1, issued Mar. 6, 2001 to Hanlon (Ex. 1014).

factual determinations, including (1) the scope and content of the prior art; (2) any differences between the claimed subject matter and the prior art; (3) the level of ordinary skill in the art; and (4) when available, evidence such as commercial success, long felt but unsolved needs, and failure of others. *Graham v. John Deere Co.*, 383 U.S. 1, 17–18 (1966); see *KSR*, 550 U.S. at 407 (“While the sequence of these questions might be reordered in any particular case, the [*Graham*] factors continue to define the inquiry that controls.”).

The Supreme Court made clear that we apply “an expansive and flexible approach” to the question of obviousness. *KSR*, 550 U.S. at 415. Whether a patent claiming the combination of prior art elements would have been obvious is determined by whether the improvement is more than the predictable use of prior art elements according to their established functions. *Id.* at 417. Reaching this conclusion, however, requires more than merely showing that the prior art includes separate references covering each separate limitation in a challenged claim. *Unigene Labs., Inc. v. Apotex, Inc.*, 655 F.3d 1352, 1360 (Fed. Cir. 2011). Rather, obviousness additionally requires that a person of ordinary skill at the time of the invention “would have selected and combined those prior art elements in the normal course of research and development to yield the claimed invention.” *Id.*

B. Level of Ordinary Skill in the Art

Factors pertinent to a determination of the level of ordinary skill in the art include “(1) educational level of the inventor; (2) type of problems encountered in the art; (3) prior art solutions to those problems; (4) rapidity with which innovations are made; (5) sophistication of the technology; and

(6) educational level of workers active in the field.” *Envtl. Designs, Ltd. v. Union Oil Co.*, 713 F.2d 693, 696–697 (Fed. Cir. 1983) (citing *Orthopedic Equip. Co. v. All Orthopedic Appliances, Inc.*, 707 F.2d 1376, 1381–82 (Fed. Cir. 1983)). Not all such factors may be present in every case, and one or more of these or other factors may predominate in a particular case. *Id.* Moreover, “[t]hese factors are not exhaustive but are merely a guide to determining the level of ordinary skill in the art.” *Daiichi Sankyo Co. v. Apotex, Inc.*, 501 F.3d 1254, 1256 (Fed. Cir. 2007). In determining a level of ordinary skill, we also may look to the prior art, which may reflect an appropriate skill level. *Okajima v. Bourdeau*, 261 F.3d 1350, 1355 (Fed. Cir. 2001). Additionally, the Supreme Court informs us that “[a] person of ordinary skill is also a person of ordinary creativity, not an automaton.” *KSR*, 550 U.S. at 421.

Mr. Benson testifies that a person having ordinary skill in the art would have “at least a bachelor’s degree in civil engineering, chemical engineering, or mechanical engineering with at least two years of industry experience with lime slaking systems (or equivalent degree or experience).” Ex. 1004 ¶ 19. Mr. Benson states that a person of ordinary skill in the art could also qualify by having “some combination of (1) more formal education (such as a master’s of science degree) and less technical experience, or (2) less formal education and more technical or professional experience.” *Id.*

Dr. Hokanson testifies that a person of ordinary skill in the art “would have had a bachelor’s degree in environmental engineering, civil engineering, or environmental science and/or at least two years of hands-on

experience in the water treatment industry with an emphasis on lime slaking technology.” Ex. 2011 ¶ 29.

Upon review of the parties’ arguments and supporting evidence, we adopt Patent Owner’s definition of one of ordinary skill in the art, as it is consistent with the disclosures of the ’673 patent and the prior art of record. We note, however, that neither party contends that any issue in this case turns on the differences between the parties’ definitions of one of ordinary skill in the art. See Ex. 2011 ¶¶ 29–30.

C. Claim Construction

For *inter partes* review proceedings, we apply the same claim construction standard used in the federal courts, in other words, the claim construction standard that would be used to construe the claim in a civil action under 35 U.S.C. § 282(b), which is articulated in *Phillips v. AWH Corp.*, 415 F.3d 1303 (Fed. Cir. 2005) (en banc). 37 C.F.R. § 42.100(b) (2019). Under the *Phillips* standard, the “words of a claim are generally given their ordinary and customary meaning,” which is “the meaning that the term would have to a person of ordinary skill in the art in question at the time of the invention, i.e., as of the effective filing date of the patent application.” *Phillips*, 415 F.3d at 1312–13.

The parties dispute the proper construction of the term “slurry tank.” PO Resp. 10–14; Pet. Reply 3–5; PO Sur-Reply 2–5. Upon review of the parties’ arguments and evidence, we determine that the term “slurry tank” requires analysis, which we provide in our discussion below. No additional claim terms need express construction or discussion for purposes of this decision. See *Nidec Motor Corp. v. Zhongshan Broad Ocean Motor Co.*, 868 F.3d 1013, 1017 (Fed. Cir. 2017) (“[W]e need only construe terms ‘that

are in controversy, and only to the extent necessary to resolve the controversy’” (quoting *Vivid Techs., Inc. v. Am. Sci. & Eng’g, Inc.*, 200 F.3d 795, 803 (Fed. Cir. 1999))).

1. “slurry tank”

Claim 1 of the ’673 patent requires “providing a watery lime slurry having lime particles and grit particles therein, in a slurry tank.” Ex. 1003, 8:1–2. Both parties agree that a “slurry tank” is “a tank for holding slurry produced through a lime slaking process.” PO Resp. 10; Pet. Reply 1–2; PO Sur-Reply 2. Patent Owner asserts, however, that the intrinsic record makes clear that the recited “slurry tank” is distinct from a lime slaker. PO Resp. 10; PO Sur-Reply 3–4.

Neither party asserts that the term “slurry tank” has an established meaning in the art. Tr. 25:20–26:4. Accordingly, we must determine the meaning of this term from the intrinsic evidence of record, including the claims, the written description, and the relevant prosecution history.⁶ See *Phillips*, 415 F.3d at 1321 (“Properly viewed, the ‘ordinary meaning’ of a claim term is its meaning to the ordinary artisan after reading the entire patent.”); *Power Integrations, Inc. v. Fairchild Semiconductor Int’l, Inc.*, 711 F.3d 1348, 1361 (Fed. Cir. 2013) (“If, however, the claim term does not have an ordinary meaning, and its meaning is not clear from a plain reading of the claim, ‘we turn to the remaining intrinsic evidence, including the written description, to aid in our construction of that term.’” (quoting

⁶ The parties have not argued or presented evidence in this record as to how the prosecution history is relevant to our interpretation of the term “slurry tank.”

Telemac Cellular Corp. v. Topp Telecom, Inc., 247 F.3d 1316, 1326 (Fed. Cir. 2001))).

i. Claim Language

Claim 1 recites “providing a watery lime slurry having lime particles and grit particles therein, in a slurry tank” and the ’673 patent explains that lime slurry is produced in a “lime slaking” process. Ex. 1003, 1:22–27, 5:34–35. These disclosures support the parties’ construction of “slurry tank” as “a tank for holding slurry produced through a lime slaking process.” PO Resp. 10; Pet. Reply 2; PO Sur-Reply 2. The language and structure of the claims, however, does not explain the precise difference between a “slurry tank” and a “lime slaking device.”

ii. Written Description

The ’673 patent explains that the process of mixing lime in the form of calcium oxide (CaO) with excess water to form calcium hydroxide is commonly referred to as “lime slaking” and that lime slaking is “accomplished in a device known as a lime slaker.” Ex. 1003, 1:19–26. The ’673 patent also states that the resulting mixture of lime and water is known as a “lime slurry,” and describes slurry being delivered from a “slurry tank.” *Id.* at 1:26–27, 2:17–20. Accordingly, the specification expressly identifies a “lime slaker” as a tank where calcium oxide is mixed with excess water to form a lime slurry and implies that such a tank is different from a “slurry tank.”

The remaining disclosures of the ’673 patent further support Patent Owner’s argument that a “lime slaker” is distinct from a “slurry tank.” For example, Figures 1 and 6 of the ’673 patent identify the device in which lime and water are mixed as “lime slaker 11” and 311, respectively, and the tank

that receives slaked lime from slaker 11/311 via conduit 13/313 as “slurry tank 14” and 314, respectively. Ex. 1003, 3:41–46, 5:53–64, Figs. 1, 6. The ’673 patent also notes that prior art methods of separating grit from a lime slurry “directly after the slaking of lime in a lime slaking device can be problematic.” *Id.* at 1:58–59. The ’673 patent solves these problems, in part, by removing grit particles from a lime slurry that is taken from a slurry tank, as opposed to directly from a lime slaker. *Id.* at 2:17–20, 36–39. The Specification’s references to both a “lime slaker” and a “slurry tank” and description of the distinct functions of these devices support Patent Owner’s argument that a lime slaker is not a “slurry tank.”

iii. Conclusion

The written description of the ’673 patent expressly defines a “lime slaker” as a tank wherein lime and water are mixed to form a lime slurry, and the figures and description of the claimed invention consistently differentiate a “lime slaker” from a “slurry tank.” Thus, for the reasons given in our analysis above, we construe the term “slurry tank” to be “a tank for holding slurry produced through a lime slaking process” and find that a “lime slaker,” into which lime and water are charged, is different from a “slurry tank.”

D. Overview of the Asserted References

1. Muzik (Ex. 1010)

Muzik is titled “Method of Slaking Lime” and relates to “a slaking apparatus for slaking lime, and a method of slaking.” Ex. 1010, code (54), 1:7–8. Muzik describes continuously slaking lime at a relatively low rate in order to remove grit from the slaked lime prior to additional slaking, which

reduces wear on the slaker components, prevents clogging, and alleviates other problems associated with conventional slakers. *Id.* at 1:39–56.

Muzik's Figure 1 is reproduced below.

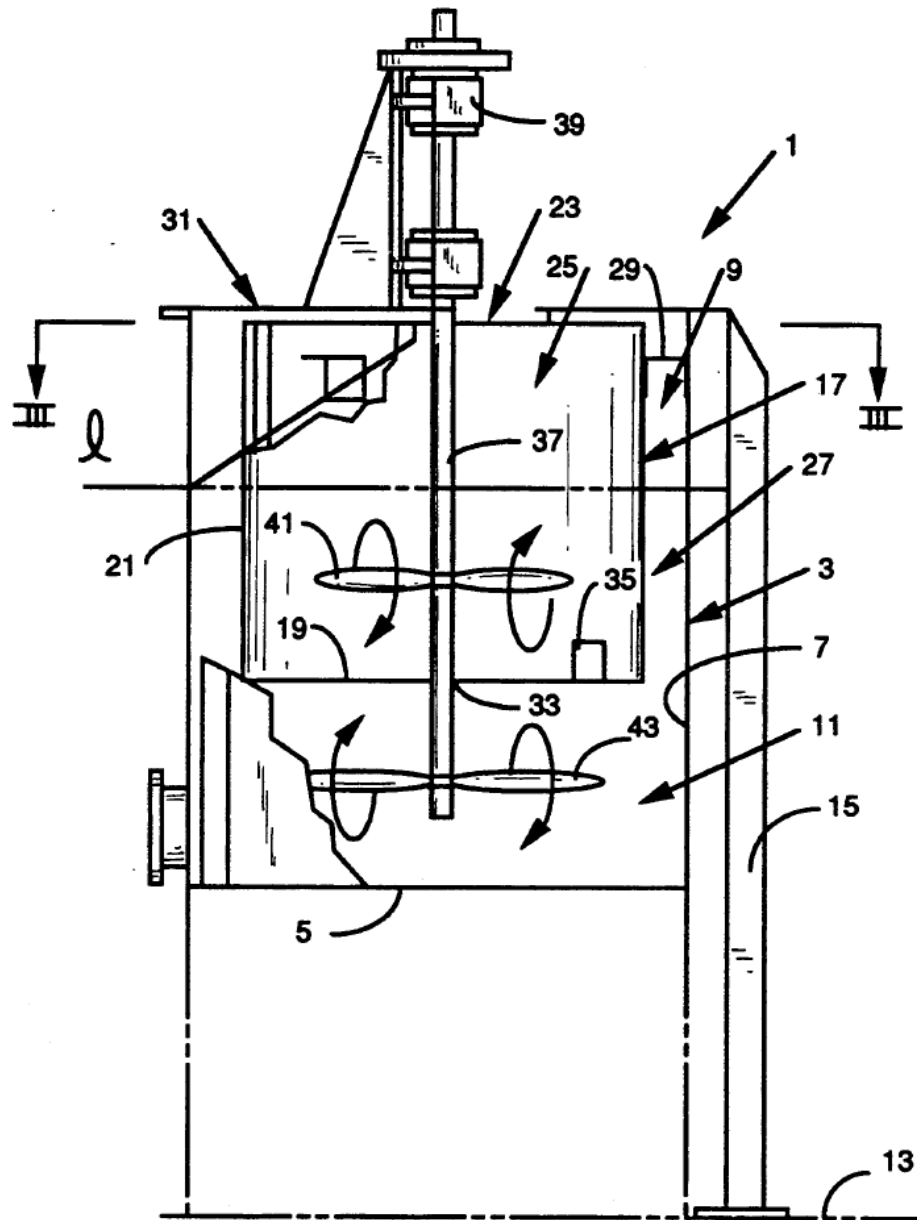


FIG. 1

Muzik's Figure 1 "is a side elevational view, with portions cut away, of inner and outer vessels for the slaking of lime and water." Ex. 1010 2:52–

54. Slaking apparatus 1 has outer vessel 3 with bottom wall 5, upwardly extending side wall 7, and open top 9. *Id.* at 3:10–15. Inner vessel 17 constitutes initial slaking chamber 25, and outer vessel 3 constitutes final slaking chamber 11. *Id.* at 3:11–21. Slaked lime is further processed in a collection trough, as seen in Muzik’s Figures 2, 5 and 6. Muzik’s Figure 2 is reproduced below.

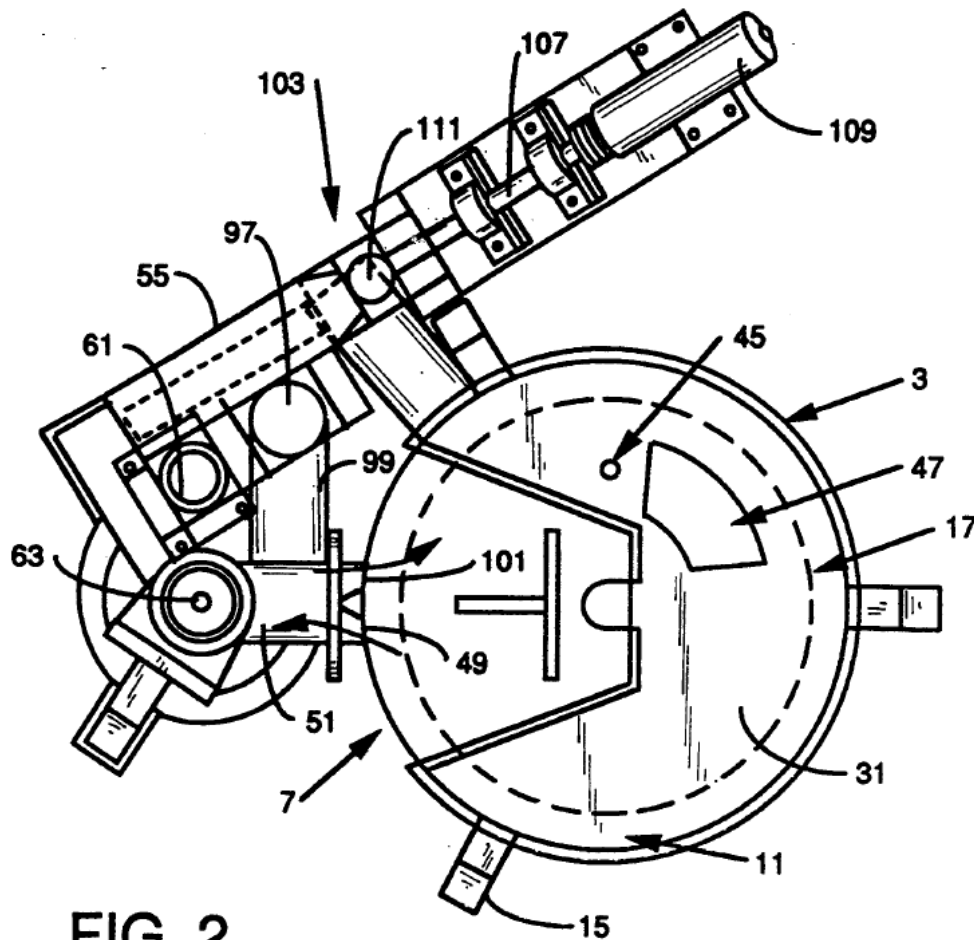
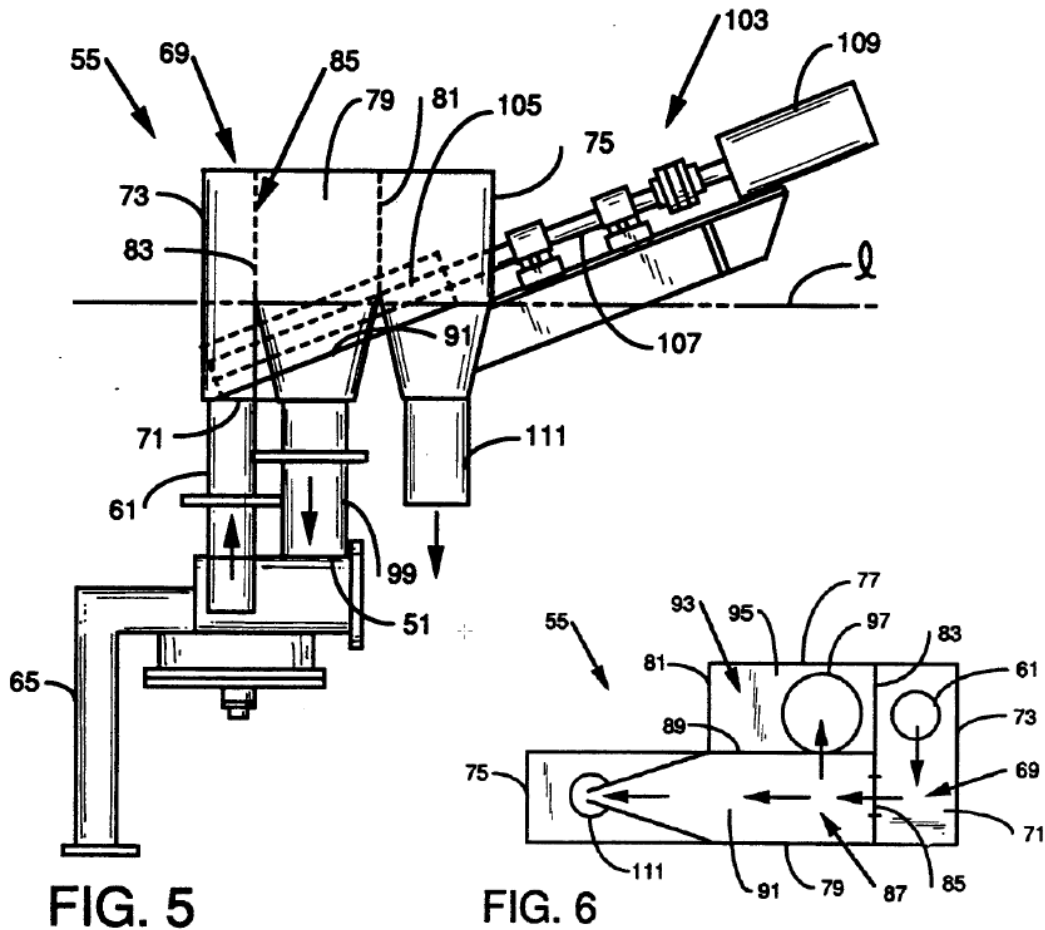


FIG. 2

Muzik's Figure 2 is a top plan view of the slaking apparatus. *Id.* at 2:55–56. As seen in Figure 2, a pump having motor 63 circulates final slurry through flow passageway 49, in side wall 7 of outer vessel 3, to outlet conduit 51 adjacent bottom wall 5, and then from outlet conduit 51 to collection trough 55. *Id.* at 3:51–55.

Muzik's Figures 5 and 6 are reproduced below.



Muzik's Figure 5 "is a side elevational view of the collection trough, and grit removal device preferably used in the compact lime slaker," and Figure 6 "is a diagrammatical top-plan view of the collection trough shown in Figure 5 with the grit removal device removed for clarity." Ex. 1010, 2:62–67. Collection trough 55 accepts lime slurry from outer vessel 3, removes grit from the slurry, returns a major portion of slurry with grit removed back to outer vessel 3, and discharges lime slurry that contains grit from the slaking apparatus. *Id.* at 4:3–8. Collection trough 55 has inlet compartment 69 having bottom 71 through which lime slurry from final slaking chamber 11 is fed by pump 53. *Id.* at 4:9–12. Opening 85 formed in

compartmental wall 83 permits discharge of slaked lime from inlet compartment 69 to settling and separation compartment 87. *Id.* at 4:16–19. Lime slurry containing grit that is discharged from inlet compartment 69 through opening 85 is directed downwardly into settling and separation compartment 87, so that the grit tends to sink to the bottom of settling and separation compartment 87, while lime slurry with at least a portion of the grit removed will overflow wall 89 into return compartment 93. *Id.* at 4:23–30. Return compartment 93 has discharge 97 that leads to return conduit 99, which communicates with final slaking chamber 11 to return slaked lime back to final slaking chamber 11. *Id.* at 4:30–36.

2. *Espinoza (Ex. 1013)*

Espinoza is titled “Solid-Liquid Separation System” and relates to “methods and apparatus for separating liquid products from a slurry comprising solid particles and liquids.” Ex. 1013, code (54), 1:14–16. Specifically, Espinoza teaches separation in a Fischer-Tropsch slurry bubble column reactor. *Id.* at 17–19. Figure 1 of Espinoza is reproduced below.

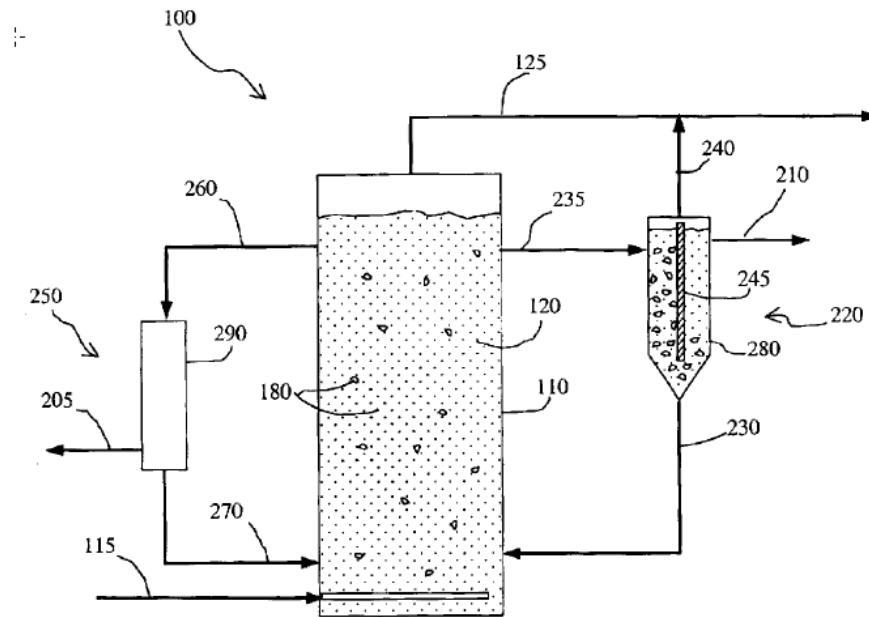


Fig.1

Espinoza's Figure 1 "is one embodiment of a slurry bubble column reactor system." *Id.* at 3:42–43. Slurry bubble column reactor system 100 includes slurry reactor 110 and settling system 220. *Id.* at 4:59–61. "Reactor 110 includes a reactor chamber 120 containing a catalyst 180 suspended in a slurry. Settling system 220 includes settling chamber 280, lines 230 and 235 connecting the settling chamber to reactor 110, sub-particle rich stream outlet 210, and gas outlet 240." *Id.* at 4:61–66. Settling system 220 also includes internal plate 245, or other internal structure, to improve the settling characteristics of chamber 280. *Id.* at 5:1–3. Settling system 220 controls accumulation of catalyst fines in the reactor slurry that enter settling chamber 280 from reactor 110 via line 235 by moving reactor slurry through chamber 280 at a velocity that allows solid catalyst particles having at least a predetermined size to settle towards the bottom of chamber 280 to be returned to reactor chamber 120 via line 230. *Id.* at 6:9–17. Catalyst

particles smaller than the predetermined size will remain suspended and be removed by outlet line 210, which “is specifically sized, placed, and operated so as to remove a minimum amount of catalyst particles having at least the predetermined size,” so that only catalyst sub-particles (fines) that are detrimental to the system are removed. *Id.* at 6:17–25.

3. Hanlon (Ex. 1014)

Hanlon is titled “Tapered Flocculation Water Treatment” and relates to “a system and method for removing contaminants, both colloidal and suspended particles, from raw water at a high rate of treatment.” Ex. 1014, code (54), 1:5–7. Hanlon’s Figure 1 is reproduced below.

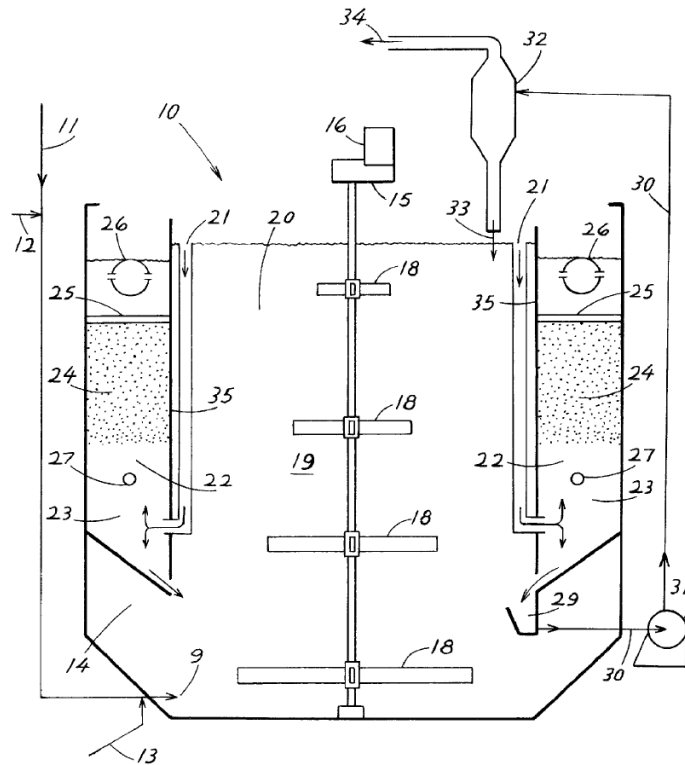


FIG. 1

Hanlon’s Figure 1 is a schematic depiction of a system and process for clarifying raw water by tapered flocculation. *Id.* at 2:51–53. Raw water

containing colloidal and particulate contaminants to be clarified by system 10 flows through pipe 11, is injected with a flocculant at point 13, and is discharged through influent portal 9 into mixing area 20 of tank 14. *Id.* at 3:1–3, 11–16, 32. Channels 21 direct water from the lower-energy mixing area of mixing zone 20 into the lower-quadrant of baffled area 22. *Id.* at 4:3–5. Baffles 35 in baffle area 22 separate water from the lower-energy mixing of mixing zone 20 from a quiescent settling/clarification zone 23, in which “heavy, sand laden particles will settle and fall back into the mixing zone 20, and any unflocculated light contaminants will flow upward to be trapped by a buoyant clarifying medium 24.” *Id.* at 3:65–4:11. Water refined by clarifying medium 24 is removed by collecting pipe 26 for ultimate use or further processing. *Id.* at 4:11–13.

E. Obviousness Based on Muzik and Espinoza

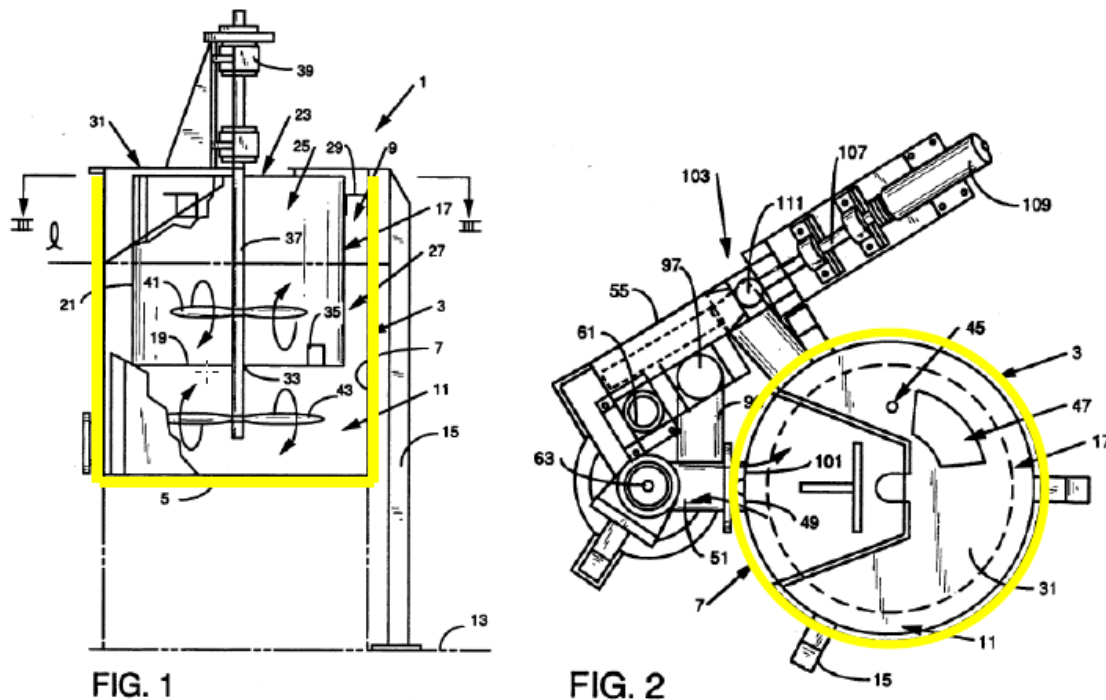
Petitioner argues that claims 1 and 2 would have been obvious over the combined teachings of Muzik and Espinoza. Pet. 14–32. We first discuss claim 1’s limitations relating to a slurry tank, then turn to the “suction line” recited in step (e) of claim 1, as to which we determine that Petitioner fails to demonstrate the combination of Muzik and Espinoza discloses or suggests.

1. Claim 1
“slurry tank”

Petitioner contends that Muzik discloses a slurry tank, as recited in steps (a)–(d) of claim 1, by introducing water and lime particles “into a slaking chamber of Muzik’s lime slaking apparatus via liquid feed inlet 45 and solids feed inlet 47,” and that by “the slaking reaction, the watery lime

slurry within the slaking chamber contains grit particles.” Pet. 15–16 (citing Ex. 1010, 3:5–9, 3:48–50, 4:23–26, 4:60–5:3, 5:20–30).

Petitioner provides an annotated version of Muzik’s Figures 1 and 2, reproduced below.



The annotated version of Muzik’s Figures 1 and 2 adds yellow highlighting around outer vessel 3. According to Petitioner, outer vessel 3 includes “final slaking chamber 11[, which] is a ‘slurry tank’ that holds watery lime slurry with lime particles and grit particles therein.” *Id.* at 16.

Patent Owner contends that Muzik does not teach a slurry tank, and that a person of ordinary skill in the art would have understood that Muzik’s final slaking chamber 11 “does not hold slurry to feed a slurry treatment system from which slurry can be extracted for use and from which grit removal can be done, as the entirety of the method recited in claim 1 requires.” PO Resp. 22–23 (citing Ex. 2011 ¶¶ 88–93, 95). Patent Owner further contends that Petitioner has not met its burden to show that Muzik

discloses steps (a) through (d) of claim 1 (PO Resp. 21–27) because Muzik is a continuous slaker, unlike the slurry treatment process of “the ’673 patented method which permits useable slurry to be delivered through an extraction line, while the grit separation is done elsewhere on the loop and the grit is removed from the loop.” *Id.* at 21. Patent Owner asserts that the ’673 method “divorces the slurry treatment process from the slaking process . . . through the use of a slurry tank, which receives the slaked lime from the slaker” (*id.*), and that in contrast, “the discharge from Muzik includes both the removed grit and the slurry” such that grit must be removed “before the slurry can be used for its intended purpose.” *Id.* Similarly, Patent Owner asserts that Muzik does not teach treatment of lime slurry because its process “does not separate the grit from the lime slurry prior to discharge; instead, Muzik discharges grit and slurry together for further processing” (PO Sur-Reply 8 (citing Ex. 1010, 2:38–46; Ex. 2011 ¶¶ 84–85; Ex. 2006, 296:6–10)), and this “is a fundamental difference between Muzik and the ’673 patent,” which removes grit as part of processing lime slurry in a slurry recirculation loop, separately from extraction of useable slurry from the loop (*Id.* at 8–9 (citing Ex. 2011 ¶ 83)).

Upon reviewing the record as a whole, we find that Muzik discloses a “slurry tank” as we have construed the term above. The slaking apparatus of Muzik contains two chambers or tanks. Ex. 1010, 2:30–37, 3:10–26. In the first chamber, lime and water are mixed together and agitated “to slake the lime with a resulting exotherm.” *Id.* at 2:30–32. “The slaked lime” (past tense) is then “passed from the initial slaking chamber to a final slaking chamber that surrounds the initial slaking chamber, so that hot slaked lime” (past tense) “insulates the contents of the initial slaking chamber.” *Id.* at

2:32–37. “Slaked lime” is then pumped from the final slaking chamber to a collection trough, from which “slaked lime” is either discharged for use or “returned to the final slaking chamber.” *Id.* at 2:38–43. Because it is “slaked lime” that is transferred to, and held for a period of time in, final slaking chamber 11, and because calcium oxide and water are not mixed into final slaking chamber 11, we agree with Petitioner that outer vessel 3 including final slaking chamber 11 is a “slurry tank.” Ex. 1004 ¶ 81; Ex. 1021, 107:22–108:8, 114:14–20; Ex. 1010, 3:10–15, 4:26–36, Figs. 1, 2, 5.

We disagree with Patent Owner’s argument that Muzik does not teach treatment of lime slurry because it uses a continuous slaker. Final slaking chamber 11 of Muzik and slurry tank 14 of the ’673 patent both receive “slaked lime” from a lime slaker, both hold this slaked lime for a period of time, and both are the initiation point of a slurry recirculation loop. Ex. 1003, 3:44–46; Ex. 1010, 2:33–35. We do not discern, and Patent Owner does not explain, why tanks that function in essentially the same manner would constitute a “lime slaker” in Muzik but a “slurry tank” in the ’673 patent.

(b) delivering slurry from the slurry tank and extracting a portion of the slurry delivered from the slurry tank via a discharge line and discharging said extracted portion of the slurry from said discharge line;

(e) wherein the extraction of clause (b) is via a suction line, through a stilling well, that allows gravity separation of grit from slurry.

Petitioner contends that Muzik discloses step (b), and in support of its contention provides annotations of Muzik’s Figures 1, 2, and 5, reproduced below. Pet. 17.

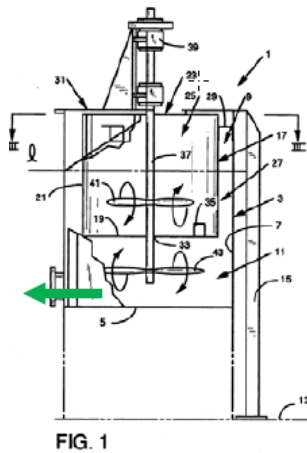


FIG. 1

FIG. 1 – Side view of slaking chambers without connected collection trough pictured.

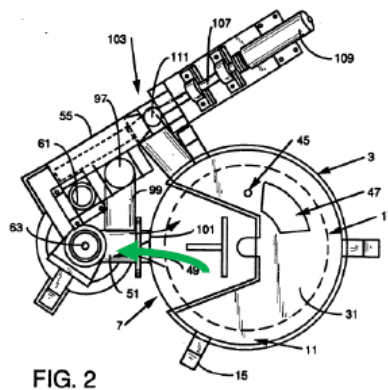


FIG. 2

FIG. 2 – Top view of slaking apparatus including slaking chambers and collection trough.

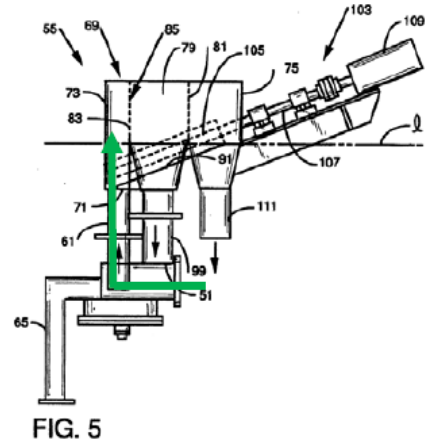


FIG. 5

FIG. 5 – Side view of collection trough without connected slaking chambers pictured.

The annotated versions of Muzik’s Figures 1, 2, and 5 include the addition of green arrows that, according to Petitioner, depict “outlet conduit 51 and column 61 . . . ‘delivering slurry from the slurry tank’ (e.g., outer vessel 3), as required by claim 1.” Pet. 17. Petitioner contends that because Muzik discloses circulating slurry from outlet conduit 51 to collection trough 55, “Muzik discloses delivering slurry from the slurry tank (i.e., delivering slurry from outer vessel 3 via outlet conduit 51 to column 61).” *Id.* at 17–18.

Petitioner further contends that “Muzik also discloses the extraction and discharge of a portion of the slurry delivered from the slurry tank via a discharge line,” because slaked lime product delivered from outer vessel 3 is directed through collection trough 55 and screw conveyor 103 to product discharge conduit 111 and removed from slaking apparatus 1, as depicted in annotated Figure 5 of Muzik, reproduced below. *Id.* at 18 (citing Ex. 1010, 4:45–51).

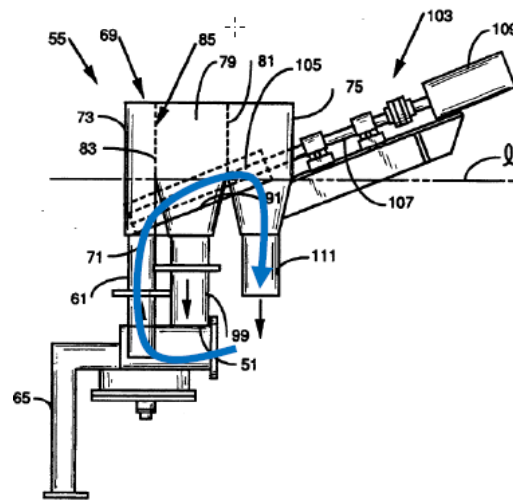


FIG. 5

The annotated version of Muzik's Figure 5 includes the addition of a blue arrow that, according to Petitioner, depicts extraction via conduit 111 from collection trough 55. *Id.*

With respect to step (e) of claim 1, Petitioner also contends that a person of ordinary skill in the art would understand that Espinoza's settling system "could be used to extract slurry directly from Muzik's slurry tank, like the '673 patent" and "would be motivated to extract such partially de-gritted slurry straight from the slurry tank, followed by an additional separation step (like through Espinoza's stilling well) to more fully separate the grit from the slurry." Pet. 30 (citing Ex. 1003, Fig. 6; Ex. 1004 ¶ 304; Ex. 1013, 8:18–28, Fig. 1); Pet. Reply 6–7. Petitioner contends that according to this arrangement of Muzik and Espinoza, a first slurry treatment loop delivers slurry from outer vessel 3, through grit classifier 87, and back to outer vessel 3, with grit being discharged from the top of classifier 87 at product discharge conduit 111, as depicted in annotated Figures 5 and 6 of Muzik, reproduced below. Pet. Reply 7; *see* Pet. 29.

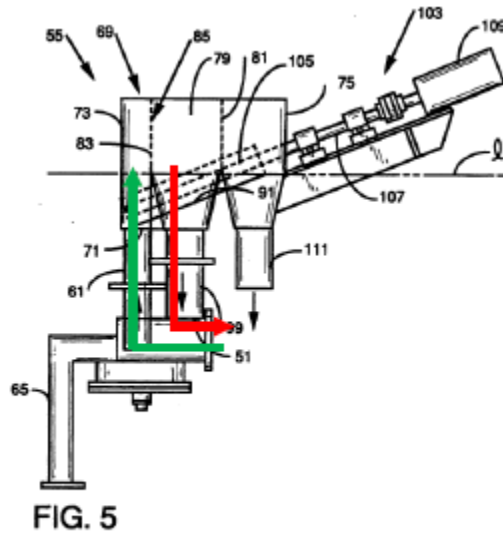


FIG. 5 – Side view of collection trough without connected slaking chambers pictured.

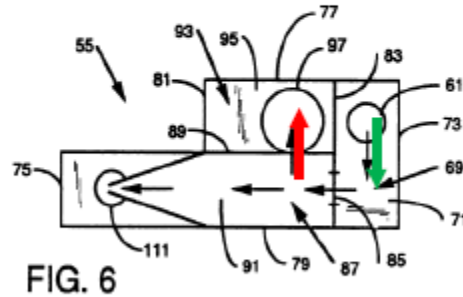


FIG. 6 – Top view of collection trough.

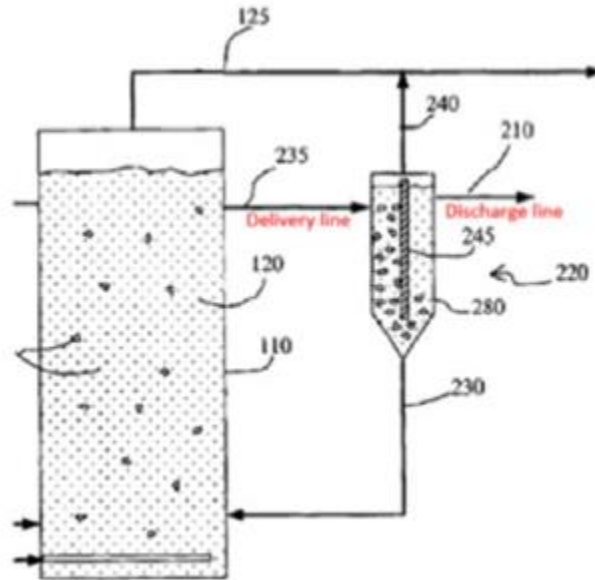
The annotated versions of Muzik’s Figures 5 and 6 include the addition of red and green arrows that, according to Petitioner, depict the flow of “lime slurry from the final slaking chamber . . . via column 61 into an inlet compartment 69 of the collection trough 55, as evidenced by the green arrows.” Pet. 22 (citing Ex. 1010, 4:9–12). Petitioner also contends that collection trough 55 includes “settling and separation compartment 87” that separates grit from slurry by gravity, and that the grit is transported to product discharge conduit 111 and removed from the slaking apparatus, while

the rest of the lime slurry with at least a portion of the grit removed will overflow the overflow wall 89 into a return compartment 93 . . . which has a discharge 97 therein that leads to a return conduit 99, the return conduit 99 communicating with the final slaking chamber 11 and returning slaked lime back to the final slaking chamber.

Id. (citing Ex. 1010, 4:25–36, 4:45–51).

The second slurry treatment loop of Petitioner’s Muzik-Espinoza arrangement uses Espinoza’s settling system 220 to extract slurry directly

from Muzik's slurry tank, as depicted in Petitioner's annotated excerpt of Figure 1 of Espinoza, reproduced below. Pet. Reply 8–9; Pet. 30.



The annotated version of an excerpt of Espinoza's Figure 1 includes the addition of labels "delivery line" on line 235 from chamber 120 to settling chamber 280 and "discharge line" on line 210 exiting settling chamber 280. Pet. Reply 9; Ex. 1013, 4:59–66.

Petitioner contends that a person of ordinary skill in the art would have understood that line 235 draws off slurry into Espinoza's settling system 220 and outlet 210 draws off slurry from settling system 220 by means of suction because

a line extracting from the top of a vessel must be pressurized in order to draw off fluid because there is no liquid above the extraction line (*i.e.*, pressure head) to push liquid out of that line. And a well known method of creating sufficient pressure in a line is by suction provided via a pump. Because there is not head liquid in Espinoza's stilling well, a POSA would understand that line 235 to outlet 210 is a suction line through the settling system 220.

Pet. 27 (citing Ex. 1004 ¶ 298; Ex. 1013, 6:18–20, 7:57–59, 8:5–9); Pet. Reply 8–9. Petitioner further contends that settling system 220 includes settling chamber 280 containing slurry that moves at a velocity that causes larger particles to “settle towards the bottom of the chamber and be recycled into reactor chamber 120 via line 230,” while “[p]articles smaller than the predetermined size will remain suspended ... [to be] drawn off through outlet 210” Pet. 26 (alterations other than the first in original) (citing Ex. 1013, 6:13–25). According to Petitioner, Espinoza’s settling system 220 shares a similar purpose to the ’673 patent’s stilling well—namely, “to ensure that large, settled particles are not withdrawn during extraction.” *Id.* at 28. Petitioner further contends that a person of ordinary skill in the art would have recognized gravity separation of grit from lime slurry as well known in the art, and thus would have been motivated to use Espinoza’s separation system 220 to separate grit from the portion of lime slurry extracted from Muzik’s slurry loop, because Muzik also contemplates an additional separation step during extraction, after discharge through conduit 111. *Id.* at 29–30 (citing Ex. 1010, 4:48–55).

Patent Owner contends that Petitioner’s combination of Muzik and Espinoza fails with respect to step (e) of claim 1 because (1) Petitioner does not sufficiently explain why a person of ordinary skill would have been motivated to combine Muzik with Espinoza, (2) Petitioner does not explain how a person of ordinary skill would have connected Espinoza’s stilling well to Muzik’s outer vessel 3, and (3) Espinoza does not teach a suction line or a pump to create suction. PO Sur-Reply 10–14.

As to Espinoza’s teaching of a suction line, Patent Owner contends that Espinoza does not teach extraction via a suction line, that Mr. Benson

conceded Espinoza does not teach suction, and that Petitioner has not provided any evidence that a person of ordinary skill would have understood Espinoza line 235 to outlet 210 to work via suction. PO Resp. 29 (citing Ex. 1013; Ex. 2011 ¶ 114).

In response, Petitioner argues “extraction using suction is at least implicitly, if not explicitly, disclosed and obvious based on Espinoza’s disclosure of ‘drawing off’ the sub-particle rich stream from as close to the top of settling chamber 280 as possible” (Pet. Reply 14–15 (citing Ex. 1021, 65:24–66:3)), and asserts that “Espinoza’s ‘draw off’ terminology is the same language used in the ’673 patent when discussing suction from the top of the stilling well” (*id.* at 14 (citing Ex. 1003, 6:29–36, 6:48–54, Fig. 7)). Petitioner contends that Dr. Hokanson “admits that ‘when the terms drawn and drawn off are used in the context of a stilling well, it’s talking about using suction to induce fluid flow.” *Id.* (citing Ex. 1021, 51:1–4).

Having considered the record as a whole, we are not persuaded by Petitioner’s argument that a person of ordinary skill in the art would have understood that Espinoza discloses the “suction line” recited in step (e). Petitioner does not direct us to any express disclosure of suction in Espinoza or explain sufficiently why the sub-particle rich stream could not be removed by gravity flow through outlet 210, which is below the fluid line in chamber 280. During his deposition, Mr. Benson acknowledged that Espinoza does not teach suction, does not refer to line 235 as a suction line, and does not have a pump to create suction. Ex. 2006, 301:11–15, 303:16–304:5, 301:8–10. And, although Petitioner relies on Mr. Benson’s testimony that a person of ordinary skill would “understand that line 235 to outlet 210 is a suction line through the settling system 220” (Pet. 27; Pet. Reply 13

(citing Ex. 1004 ¶ 298, Ex. 1013, 6:18–20)), Espinoza’s Figure 1 in fact shows that there is liquid above lines 235 and 210. By Mr. Benson’s reasoning, this would allow liquid to be pushed out of the line, rather than necessitating suction.

As to Petitioner’s argument that Espinoza inherently discloses a suction line, Petitioner and Mr. Benson rely on the use of the term “draw off” in Espinoza. Pet. 27; Ex. 1004 ¶ 298 (citing Ex. 1013, 6:18–20, 7:57–59, 8:5–9). We, however, are not persuaded that Espinoza’s “draw off” terminology is necessarily the same as the language used in the ’673 patent. First, the portions of the ’673 patent cited by Petitioner that use the term “drawn” expressly refer to suction and a pump. Ex. 1003, 6:20–22, 29–32. As noted above, those terms do not appear in Espinoza. Second, Dr. Hokanson’s testimony does not support Petitioner’s argument that the terminology is the same in Espinoza and the ’673 patent. It is clear from the questions before and after the portion of testimony that Petitioner quotes that Dr. Hokanson was being asked about the disclosure in the ’673 patent, and was specifically referring to the language in the ’673 patent (Ex. 1003, 6:27–43) — not in Espinoza. Petitioner, however, attempts to expand the alleged “admission” in Dr. Hokanson’s deposition testimony concerning the terms “drawn and drawn off” to apply to Espinoza, or more broadly, to stilling wells in general. Petitioner fails to direct us to evidence demonstrating sufficiently that the use of the term “drawn” in the ’673 patent’s description of the operation of its stilling well is probative of how a person of ordinary skill in the art would have understood Espinoza. Further, although Mr. Benson’s Declaration states that a person of ordinary skill in the art would have understood that Espinoza’s settling system would require pressure,

such as a suction pump, to remove liquid from the top (Ex. 1004 ¶ 298), Mr. Benson's deposition testimony admitting that Espinoza does not teach suction (e.g., Ex. 2006, 301:11–15) supports Patent Owner's position. For these reasons, we do not find that a preponderance of the evidence supports Petitioner's contention that the Muzik-Espinoza arrangement discloses step (e) of claim 1.

Conclusion as to Claim 1

Petitioner fails to adequately demonstrate that the combination of Muzik and Espinoza discloses or suggests step (e) of claim 1 of the '673 patent. Accordingly, Petitioner has not demonstrated by a preponderance of the evidence that claim 1 would have been unpatentable as obvious over the combination of Muzik and Espinoza.

2. Claim 2

Claim 2 depends from claim 1 and further requires use of a “gravity-operative grit classifier.” Ex. 1003, 8:15–19. Petitioner's argument with respect to claim 2 does not remedy the deficiency discussed above with respect to claim 1. See Pet. 31–32. Accordingly, Petitioner has not demonstrated by a preponderance of the evidence that claim 2 would have been unpatentable as obvious over the combination of Muzik and Espinoza.

A. Obviousness Based on Muzik and Hanlon

Petitioner argues that claims 1 and 2 would have been obvious over the combined teachings of Muzik and Hanlon. Pet. 33–40.

1. Claim 1

Petitioner asserts that Muzik discloses steps (a)–(d) of claim 1 for the same reasons as discussed above. Pet. 33 (citing Ex. 1004 ¶ 313). As to step (e), Petitioner asserts that Hanlon's “quiescent settling/clarification zone

23” has the same purpose as the stilling well in the ’673 patent and discloses step “(e) wherein the extraction of clause (b) is via a suction line, through a stilling well, that allows gravity separation of grit from slurry.” *Id.*

Specifically, Petitioner asserts that water clarified by gravity separation from heavy particles in Hanlon’s quiescent settling/clarification zone 23 is removed by collecting pipe 26 located at the top of the tank. Pet. 34–35 (citing Ex. 1014, 3:61–67, 4:3–14). Petitioner contends that a person of ordinary skill in the art would have understood that the rise rate of heavy particles within Hanlon’s quiescent settling/clarification zone could be controlled by adjusting output flow. Pet. 36. According to Petitioner, a person of ordinary skill in the art would have understood based on Hanlon’s disclosure of the cross-sectional area of its clarifying section, suction could be used to control the rise rate of fluid because

it would be obvious to a POSA—using knowledge of Stoke’s law which determines particle settling velocity based on particle size and density—that varying the output flow would in turn affect the settling of particles within the zone. Thus, a POSA would find it advantageous to extract slurry from a settling zone in a controlled fashion, such as via suction created by a pump, which is well known in the art.

Id. at 36 (citing Ex. 1004 ¶ 319); Pet. Reply 19.

Petitioner further contends that a person of ordinary skill in the art would have recognized gravity separation of grit from lime slurry as well known in the art, and thus would have been motivated to use Hanlon’s quiescent settling/clarification zone to separate grit from the portion of lime slurry extracted from Muzik’s slurry loop, because Muzik also contemplates an additional separation step during extraction, after discharge through

conduit 111, or directly from Muzik's slurry tank. *Id.* at 37–38 (citing Ex. 1003, Fig. 6; Ex. 1004 ¶¶ 313–325; Ex. 1010, 4:48–55).

Patent Owner contends that Petitioner's combination of Muzik and Hanlon fails with respect to step (e) of claim 1 for three reasons similar to those Patent Owner argues against Petitioner's combination of Muzik and Espinoza, including that Hanlon does not teach a suction line or a pump to create suction. PO Sur-Reply 15–18. Patent Owner relies on Dr. Hokanson's Declaration, and also asserts that Mr. Benson conceded Hanlon does not teach suction. PO Resp. 32 (citing Ex. 2011 ¶ 123; Ex. 2005, 309:12–14).

In response, Petitioner argues

extraction using suction is at least implicitly, if not explicitly, disclosed and obvious based on Hanlon's disclosure of controlling rise rate of fluid within its stilling well (Ex. 1014, 5:10–11) and a POSA's understanding that rise rate in a stilling well being controlled by the cross section of the stilling well and the outflow rate of fluid at the top of the stilling well controlled by suction.

Pet. Reply 19. Petitioner also argues that Dr. Hokanson admits that Hanlon's extraction point at the top of its stilling well results in very little, if any, pressure head at that extraction point. *Id.* at 19 n.4 (citing Ex. 1021, 101:17–23). In addition, Petitioner points to the '673 patent's description that “rise rate of slurry in the stilling well is controlled” by suction and the cross-sectional area of the stilling well. *Id.* at 18 (citing Ex. 1003, 6:37–41).

Having considered the record as a whole, we are not persuaded by Petitioner's argument that a person of ordinary skill in the art would have understood that Hanlon discloses the recited “suction line.” Although Mr. Benson's explanation of the application of Stoke's Law in Hanlon's

quiescent settling/clarification zone 23 explains how a person of ordinary skill in the art would have understood Hanlon's operation with respect to the relationship between output flow and settling of particles within the zone, it does not support finding that a person of ordinary skill in the art would have understood Hanlon's collecting pipe 26 is a suction line, or that Hanlon suggests the use of a suction line for removing liquid or slurry from the zone. Similarly, Petitioner's argument that a person of ordinary skill would have understood that the rise rate in a stilling well is controlled by the cross section of the stilling well and outflow rate at the top of the well (*e.g.*, Pet. Reply 19–20 (citing Ex. 1004 ¶ 319)) does not adequately support a finding that Hanlon extracts slurry via a suction line. Specifically, in the absence of any disclosure in Hanlon of slurry extraction via suction, Petitioner does not explain sufficiently why a person of ordinary skill would have chosen suction over collecting pipe 26 that Hanlon discloses for discharge of clarified water. Petitioner does not explain any benefit that suction would have in Hanlon, nor point to any evidence in Hanlon suggesting modification of collection pipe 26. Further, Mr. Benson admitted that Hanlon does not mention suction, or teach or disclose extracting slurry via suction. Ex. 2005, 309:12–19, 311:19–312:7. And, the '673 patent's description of the operation of its stilling well is not probative of how a person of ordinary skill in the art would have understood Hanlon. For these reasons, we find that a preponderance of the evidence does not support Petitioner's contention that the combination of Muzik and Hanlon discloses step (e) of claim 1.

Conclusion as to Claim 1

Petitioner fails to adequately demonstrate that the combination of Muzik and Hanlon discloses or suggests step (e) of claim 1 of the '673 patent. Accordingly, Petitioner has not demonstrated by a preponderance of the evidence that claim 1 would have been unpatentable as obvious over the combination of Muzik and Hanlon.

2. Claim 2

Claim 2 depends from claim 1, and Petitioner's argument with respect to dependent claim 2 does not remedy the deficiency discussed above with respect to claim 1. *See* Pet. 38–40. Accordingly, Petitioner has not demonstrated by a preponderance of the evidence that claim 2 would have been unpatentable as obvious over the combination of Muzik and Espinoza.

III. MOTION TO AMEND

“[S]hould the Board find any of the challenged claims to be unpatentable,” Patent Owner's contingent motion to amend requests substitution of proposed substitute claims 7–12 for original claims 1–6. MTA 1–2. Because we do not find any challenged claims to be unpatentable, Patent Owner's contingent motion to amend is dismissed as moot.

IV. CONCLUSION

Based on the evidence and arguments, Petitioner has not shown by a preponderance of the evidence that the challenged claims of the '673 patent are unpatentable.

In summary:

Claims	35 U.S.C. §	Reference(s)/Basis	Claims Shown Unpatentable	Claims Not Shown Unpatentable
1, 2	103(a)	Muzik, Espinoza		1, 2
1, 2	103(a)	Muzik, Hanlon		1, 2
Overall Outcome				1, 2

V. ORDER

In consideration of the foregoing, it is hereby:

ORDERED that Petitioner has not shown by a preponderance of the evidence that claims 1–2 are unpatentable;

FURTHER ORDERED that Patent Owner’s contingent motion to amend is dismissed as moot; and

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

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For PETITIONER:

Matthew Johnson
Marlee Hartenstein
David Cochran
JONES DAY
mwjohnson@jonesday.com
mhartenstein@jonesday.com
dcochran@jonesday.com

For PATENT OWNER:

Thomas Fisher
Keri Schaubert
COZEN O'CONNOR
tfisher@cozen.com
kschaubert@cozen.com