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UNITED STATES PATENT AND TRADEMARK OFFICE

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BEFORE THE PATENT TRIAL AND APPEAL BOARD

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*Ex parte* MICHAEL CHARLIES BALFE and PETER KNIESBURGES

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Appeal 2019-001246  
Application 14/150,005  
Technology Center 1700

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Before LINDA M. GAUDETTE, MONTÉ T. SQUIRE, and  
JANE E. INGLESE, *Administrative Patent Judges*.

INGLESE, *Administrative Patent Judge*.

DECISION ON APPEAL

Appellant<sup>1</sup> requests our review under 35 U.S.C. § 134(a) of the Examiner's decision to finally reject claims 1–4, 7–11, 13–15, 17, and 18<sup>2</sup>. We have jurisdiction over this appeal under 35 U.S.C. § 6(b).

We AFFIRM.

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<sup>1</sup> We use the word “Appellant” to refer to “applicant” as defined in 37 C.F.R. § 1.42. Appellant identifies the real party in interest as General Electric Technology GmbH. Appeal Brief filed June 5, 2018 (“Br.”), 2.

<sup>2</sup> Although the Final Office Action entered November 3, 2017 (“Final Act.”) indicates that claims 6 and 12 stand rejected (Final Act. 1, 2, 4–5), Appellant cancelled claims 6 and 12 in an amendment filed January 3, 2018, and the Examiner confirmed entry of the amendments in an Advisory Action entered February 1, 2018.

### CLAIMED SUBJECT MATTER

Appellant claims a method and system for cleaning a process gas containing carbon dioxide and contaminants. Br. 5–6. Claim 1 illustrates the subject matter on appeal, and is reproduced below with contested language italicized:

1. A method of cleaning a process gas containing carbon dioxide and contaminants, the method comprising:
  - bringing the process gas into direct contact with an alkaline solution or slurry, and *capturing in the alkaline solution or slurry at least a part of the contaminants of the process gas*;
  - bringing the process gas depleted of the contaminants, after capturing at least the part of the contaminants of the process gas in the alkaline solution or slurry into direct contact with a cooling liquid, separate from the alkaline solution or slurry, to form a cooled process gas,
    - wherein *the contaminants comprise sulfur dioxide, heavy metals, and particulate material*; and
  - recirculating the alkaline solution or slurry, after the direct contact of the process gas with the alkaline solution or slurry, to the process of bringing the process gas into direct contact with the alkaline solution or slurry.

Claims Appendix filed June 21, 2018, 2 (emphasis and spacing added).

### REJECTIONS

The Examiner maintains the following rejections in the Examiner's Answer entered September 19, 2018 ("Ans."):

- I. Claims 1, 3, 10, and 17 under 35 U.S.C. § 103(a) as unpatentable over Dube<sup>3</sup> in view of Gal<sup>4</sup>;

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<sup>3</sup> US 2011/0150733 A1, published June 23, 2011.

<sup>4</sup> US 2008/0072762 A1, published March 27, 2008.

II. Claim 2 under 35 U.S.C. § 103(a) as unpatentable over Dube in view of Gal and Gal 831<sup>5</sup>;

III. Claim 4 under 35 U.S.C. § 103(a) as unpatentable over Dube in view of Gal as evidenced by Bates<sup>6</sup>; and

IV. Claims 7–9 under 35 U.S.C. § 103(a) as unpatentable over Dube in view of Gal and Emmer<sup>7</sup>;

V. Claim 11 under 35 U.S.C. § 103(a) as unpatentable over Dube in view of Gal, Kobayashi<sup>8</sup>, and Gal 831;

VI. Claims 13–15 under 35 U.S.C. § 103(a) as unpatentable over Dube in view of Gal, Kobayashi, and Emmer; and

VII. Claim 18 under 35 U.S.C. § 103(a) as unpatentable over Dube in view of Gal, Kobayashi, Gal 831, and Gal 733<sup>9</sup>.

#### FACTUAL FINDINGS AND ANALYSIS

Upon consideration of the evidence relied upon in this appeal and each of Appellant’s contentions, we affirm the Examiner’s rejections of claims 1–4, 7–11, 13–15, 17, and 18 under 35 U.S.C. § 103(a), for the reasons set forth in the Final Action, the Answer, and below.

We review appealed rejections for reversible error based on the arguments and evidence the appellant provides for each issue the appellant identifies. 37 C.F.R. § 41.37(c)(1)(iv); *Ex parte Frye*, 94 USPQ2d 1072, 1075 (BPAI 2010) (precedential) (cited with approval in *In re Jung*, 637

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<sup>5</sup> US 2010/0083831 A1, published April 8, 2010.

<sup>6</sup> Roger G. Bates, *et al.*, *Calcium Hydroxide as a Highly Alkaline pH Standard*, 56 J. of Research of the National Bureau of Standards 305 (1956).

<sup>7</sup> US 5,512,097, issued April 30, 1996.

<sup>8</sup> US 2010/0074817 A1, published March 25, 2010.

<sup>9</sup> US 2008/0178733 A1, published July 31, 2008.

F.3d 1356, 1365 (Fed. Cir. 2011) (explaining that even if the Examiner had failed to make a prima facie case, “it has long been the Board’s practice to require an applicant to identify the alleged error in the examiner’s rejections”).

Rejection I: Claims 1, 3, 10, and 17 under 35 U.S.C. § 103(a)  
as Unpatentable over Dube in view of Gal

*Claims 1 and 10*

Appellant argues claims 1 and 10 together on the basis of claim 1, to which we accordingly limit our discussion. Br. 9–15; 37 C.F.R. § 41.37(c)(1)(iv).

Dube discloses a system and method for removing sulfur dioxide and carbon dioxide from flue gas produced by combustion of fossil fuels, such as oil or coal. Dube ¶¶ 2, 3, 8, 40. Dube discloses that the method comprises contacting the flue gas with a scrubbing liquor comprising an alkaline compound to remove sulfur dioxide from the flue gas, cooling the sulfur dioxide-depleted flue gas to a temperature preferably below 20°C, and contacting the cooled, sulfur dioxide-depleted flue gas with an absorption liquid comprising ammonia to remove carbon dioxide from the gas. *Id.* ¶¶ 9, 10, 21, 61.

The Examiner finds that although Dube discloses cooling the sulfur dioxide-depleted flue gas before removing carbon dioxide from the gas, Dube does not explicitly teach cooling the gas by bringing it into direct contact with a cooling liquid, and the Examiner relies on Gal for suggesting such a cooling process. Final Act. 3–4.

Gal discloses a system and method for removing carbon dioxide, sulfur dioxide, particulate matter, and mercury contaminants from flue gas

generated by combustion of coal and oil. Gal ¶¶ 1, 2 32. Gal discloses that the method comprises cooling the combustion gas to a temperature of 0–20°C by directly contacting the gas with cold water, and reacting the cooled gas with an ammoniated solution. *Id.* ¶¶ 21, 24, 32. Gal discloses that cooling the combustion gas before reacting it with ammonia results in “high removal efficiency of the contaminants,” including efficient capture of CO<sub>2</sub>. *Id.* ¶¶ 21, 23, 32.

In view of these disclosures in Gal, the Examiner concludes that it would have been obvious to one of ordinary skill in the art at the time of Appellant’s invention to cool the sulfur dioxide-depleted flue gas produced during Dube’s method by directly contacting the gas with cold water, as disclosed in Gal, to achieve efficient capture of CO<sub>2</sub> and other contaminants when subsequently contacting the gas with an ammonia-containing absorption liquid. Final Act. 4.

Appellant argues that the methods for removing contaminants disclosed in Dube and Gal “require different processes” because Dube’s method uses “a *fresh scrubbing liquor for desulfurization*” and Gal’s method cools combustion gas to condense water from the gas, and uses the condensed water to capture and remove contaminants. Br. 12–13.

Appellant argues that the Examiner “fails to demonstrate how any teaching from Gal (i.e., condensing/cooling) would lead one to modify Dube (counter-current chemical-based process) to arrive at the Appellant’s method of using an alkaline solution or slurry to remove contaminants.” Br. 13–14.

The Examiner, however, provides a thorough, reasoned explanation, grounded in sound factual findings, for why one of ordinary skill in the art would have combined the relied-upon disclosures of Dube and Gal to arrive

at the method recited in claim 1. Final Act. 3–4. Specifically, as discussed above, Dube and Gal both disclose methods of removing contaminants, including sulfur dioxide and carbon dioxide, from flue gas generated by combustion of oil or coal. As also discussed above, Dube discloses contacting flue gas with a scrubbing liquor comprising an alkaline compound to remove sulfur dioxide from the gas, cooling the sulfur dioxide-depleted flue gas to a temperature below 20°C, and contacting the cooled, sulfur dioxide-depleted flue gas with an absorption liquid comprising ammonia to remove carbon dioxide from the gas.

As the Examiner determines (Final Act. 4), in view of Gal’s disclosure that cooling combustion gas to a temperature of 0–20°C by directly contacting the gas with cold water before reacting the cooled gas with an ammoniated solution results in “high removal efficiency of the contaminants,” including efficient capture of carbon dioxide, particulate matter, and mercury, it would have been obvious to one of ordinary skill in the art at the time of Appellant’s invention to cool the sulfur dioxide-depleted flue gas produced during Dube’s method by directly contacting the gas with cold water, as recited in claim 1, before contacting the cooled, sulfur dioxide-depleted flue gas with an ammoniated solution, to efficiently remove contaminants from the gas, as disclosed in Gal.

Appellant’s conclusory arguments fail to identify any specific error in the Examiner’s factual findings, or the Examiner’s rationale for the proposed combination of the relied-upon disclosures of Dube and Gal, and Appellant’s arguments, are, therefore, unpersuasive of reversible error in the Examiner’s rejection.

Appellant argues that although Dube discloses removing sulfur

dioxide from flue gas, Dube and Gal, alone or in combination, do not teach or suggest removing heavy metal and particulate material contaminants from flue gas as recited in claim 1. Br. 12–13.

As discussed above, however, Gal discloses that flue gas generated by combustion of coal and oil includes carbon dioxide, sulfur dioxide, particulate matter, and mercury (a heavy metal) contaminants. Gal ¶¶ 1, 2 32. Gal further discloses that cooling the combustion gas to a temperature of 0–20°C by directly contacting the gas with cold water, and then reacting the cooled gas with an ammoniated solution to remove the carbon dioxide, particulate matter, and mercury contaminants with high efficiency. *Id.* ¶¶ 21, 23, 32. In view of this disclosure, one of ordinary skill in the art would have understood that cooling the sulfur dioxide-depleted flue gas produced during Dube’s method by directly contacting the gas with cold water, as disclosed in Gal, would result in efficient capture of carbon dioxide, particulate matter, and mercury, as recited in claim 1, when subsequently contacting the gas with an ammonia-containing absorption liquid, as disclosed in both Dube and Gal.

Appellant’s arguments are, therefore, unpersuasive of reversible error in the Examiner’s rejection of claims 1 and 10 under 35 U.S.C. § 103(a), which we accordingly sustain.

### *Claim 3*

Claim 3 depends from claim 1 and recites that the alkaline solution or slurry comprises NaOH or Ca(OH)<sub>2</sub>.

As the Examiner finds, Dube discloses that the alkaline compound of the scrubbing liquor described in the reference may be Ca(OH)<sub>2</sub>. Final Act. 4 (citing Dube ¶ 14).

Although Appellant argues that Dube does not disclose NaOH (Br. 14), as the Examiner explains in the Answer, claim 3 requires the alkaline solution or slurry to comprise *either* NaOH *or* Ca(OH)<sub>2</sub>. Ans. 8. Consequently, we are not persuaded of error in the Examiner's determination that the combination of Dube and Gal renders claim 3 obvious. We, accordingly, sustain the Examiner's rejection of claim 3 under 35 U.S.C. § 103(a).

*Claim 17*

Independent claim 10 recites a gas cleaning system for cleaning a process gas containing carbon dioxide and contaminants. Claim 17 depends from claim 10 and recites that the process gas entering the alkaline cleaning system is at a temperature of between 40°C and 80°C.

The Examiner finds that claim 17 is directed to “the manner in which the system is operated and does not impart any structural limitations to the system.” Final Act. 8.

Appellant argues that the Examiner's rejection is conclusory and “fails to state what modifications would be needed to the Dube/Gal system ‘such that the process gas entering the alkaline cleaning system is at a temperature ranging between 40°C and 80°C.’” Br. 15–16.

Claim 10 recites a system for cleaning a process gas, and claim 17 recites the temperature of the process gas entering the system of claim 10. Claim 17, therefore, recites the temperature of the material worked upon by the system of claim 10. It is well-established that “[i]nclusion of the material or article worked upon by a structure being claimed does not impart patentability to the claims.” *In re Otto*, 312 F.2d 937, 940 (CCPA 1963); *see also In re Casey*, 370 F.2d 576, 580–81 (CCPA 1967). The recitation in

claim 17 of the temperature of the process gas entering the gas cleaning system of claim 10, therefore, does not impart patentability to claim 17. We, accordingly, sustain the Examiner's rejection of claim 17 under 35 U.S.C. § 103(a).

Rejection II: Claim 2 under 35 U.S.C. § 103(a) as Unpatentable over Dube in view of Gal and Gal 831 and Rejection III: Claim 4 under 35 U.S.C. § 103(a) as Unpatentable over Dube in view of Gal as evidenced by Bates

To address these rejections, Appellant asserts that each of claims 2 and 4 is patentable “at least by virtue of its dependency on independent Claim 1,” because the additional references applied in these rejections (Gal 831 and Bates) are “not relied upon to remedy the deficiencies in the rejection of independent Claim 1.” Br. 16–17. Because we are unpersuaded of reversible error in the Examiner's rejection of claim 1 for reasons discussed above, Appellant's position as to these rejections is also unpersuasive of reversible error.

Rejection IV: Claims 7–9 under 35 U.S.C. § 103(a) as Unpatentable over Dube in view of Gal and Emmer

Appellant argues claims 7–9 together on the basis of claim 7, to which we accordingly limit our discussion. Br. 18–19; 37 C.F.R. § 41.37(c)(1)(iv).

Claim 7 depends from claim 1 and recites that the process gas is generated by a cement production facility or a steel production facility.

The Examiner finds that although Dube discloses removing contaminants from flue gas produced by combustion of fossil fuels, Dube does not explicitly disclose that the flue gas is generated by a cement production facility or a steel production facility. Final Act. 10. The Examiner, however, relies on Emmer's disclosure that waste gases produced

during industrial processes that involve combustion of fossil fuels, such as cement manufacturing, include sulfur oxide contaminants. Final Act. 10 (citing Emmer Abstr.); *see also* Emmer col. 1, ll. 15–22.

In view of this disclosure in Emmer, Appellant does not convince us of error in the Examiner's determination that it would have been obvious to one of ordinary skill in the art at the time of Appellant's invention to utilize Dube's method (as modified by Gal) of removing sulfur dioxide contaminants from flue gas produced by combustion of fossil fuels to remove sulfur dioxide contaminants from flue gas generated combustion of fossil fuels during cement manufacturing, as recited in claim 7. We, accordingly, sustain the Examiner's rejection of claims 7–9 under 35 U.S.C. § 103(a).

Rejection V: Claim 11 under 35 U.S.C. § 103(a) as Unpatentable over Dube in view of Gal, Kobayashi and Gal 831

Claim 11 depends from claim 10 and recites that the claimed gas cleaning system comprises, in part, an ammonia removal system comprising a gas-liquid contacting device operative for removing, at least partly, ammonia from process gas that has been treated in a CO<sub>2</sub>-absorber and comprises ammonia, by bringing the process gas containing the ammonia into direct contact with a wash liquid.

The Examiner finds that Dube does not explicitly disclose an ammonia removal system as recited in claim 11, and the Examiner relies on Gal 831 for suggesting inclusion of such an ammonia removal system in Dube's system. Final Act. 13–14. Specifically, Gal 831 discloses that ammonia efficiently removes CO<sub>2</sub> and other contaminants from flue gas, but explains that ammonia must be removed from treated gas to comply with

emission standards. ¶ 5. Gal 831 discloses a system and method for removing ammonia from a flue gas stream by washing the gas stream with a liquid that absorbs ammonia from the gas. *Id.* ¶¶ 2, 6, 7. Gal 831 discloses that flue gas so treated complies with emission standards, and may be released to the environment due to the reduction or substantial elimination of ammonia from the gas. *Id.* ¶¶ 30, 48.

In view of these disclosures in Gal 831, the Examiner concludes that it would have been obvious to one of ordinary skill in the art at the time of Appellant's invention to include an ammonia removal system as disclosed in Gal 831 in Dube's system, to permit Dube's system to use ammonia to efficiently remove CO<sub>2</sub> from flue gas, and to subsequently reduce the concentration of ammonia in the treated flue gas, so that the gas complies with emission standards, and can be released to the environment. Final Act. 14; Ans. 11–12.

Appellant argues that the Examiner does not explain “what modifications [of Dube's system] would be needed” in view of the relied-upon disclosures in Gal 831 to achieve the goals of complying with emission standards and ensuring the efficiency of Dube's system. Br. 20.

As discussed above, however, Gal 831 discloses that ammonia efficiently removes CO<sub>2</sub> and other contaminants from flue gas, and indicates that removing ammonia from the treated flue gas ensures compliance with emission standards. Gal 831 ¶ 5. In view of these disclosures in Gal 831, one of ordinary skill in the art reasonably would have been led to modify Dube's system to include an ammonia removal system as disclosed in Gal 831, to reduce the concentration of ammonia in flue gas following ammonia treatment to remove CO<sub>2</sub>, so that the treated gas can be released to the

environment, while ensuring compliance with emission standards.

To the extent that Appellant asserts that one of ordinary skill in the art would not have had sufficient skill to appropriately adapt Dube's system to successfully incorporate an ammonia removal system as disclosed in Gal 831, Appellant's arguments do not demonstrate that such modification would have been "uniquely challenging or difficult for one of ordinary skill in the art." *Leapfrog Enters., Inc. v. Fisher-Price, Inc.*, 485 F.3d 1157, 1162 (Fed. Cir. 2007) (citing *KSR Int'l Co. v. Teleflex Inc.*, 550 U.S. 398, 418–419 (2007)); *In re Sovish*, 769 F.2d 738, 743 (Fed. Cir. 1985) (In an obviousness assessment, skill is presumed on the part of the artisan, rather than the lack thereof.).

We, accordingly, sustain the Examiner's rejection of claim 11 under 35 U.S.C. § 103(a).

Rejection VI: Claims 13–15 under 35 U.S.C. § 103(a) as Unpatentable over Dube in view of Gal, Kobayashi, and Emmer

Claims 13–15 depend from independent claim 10. Appellant argues that the additional references applied in the rejection of claims 13–15, Kobayashi and Emmer, do not remedy the deficiencies of Dube and Gal with respect to the Examiner's rejection of claim 10. Br. 22. Appellant further argues that although the Examiner appears to rely on Kobayashi in rejecting claims 13–15, the Examiner does not indicate which part of Kobayashi the Examiner relies upon. *Id.* Appellant argues that the rejection is therefore improper for failing to state "the relevant teachings of the prior art relied upon." *Id.* (citing MPEP § 706.02(j)).

The Examiner explains in the Answer, however, that Kobayashi "is cited as a cumulative reference." Ans. 11. Appellant does not substantively

challenge the Examiner's reliance on Kobayashi as a cumulative reference. Therefore, because we are unpersuaded of reversible error in the Examiner's rejection of claim 10 for the reasons discussed above, Appellant's position as to the rejection of claims 13–15 is also unpersuasive of reversible error.

Rejection VII: Claim 18 under 35 U.S.C. § 103(a) as Unpatentable over Dube in view of Gal, Kobayashi, Gal 831, and Gal 733

Appellant argues that the Examiner's rejection of claim 18 is improper because the Examiner does not state the relevant teachings of the prior art relied upon, based on the Examiner statement in the Final Action that "Dube/Gal/Kobayashi/Gal '831 do not explicitly teach the cooling system and the ammonia removal system are arranged in liquid connection." Br. 23 (citing Final Act. 17 and MPEP § 706.02(j)).

Appellant's argument, however, does not take into consideration the entirety of the Examiner's rejection of claim 18 as set forth in the Final Action. Specifically, the Examiner finds that Gal 733 discloses using direct contact cooler 50 to cool flue gas with cooling water before removing CO<sub>2</sub> from the gas in absorber 22. Final Act. 18 (citing Gal 733 ¶ 48, and Figs. 1 and 3). The Examiner finds that Gal 733 discloses using the cooling water following its exit from the direct contact cooler to remove ammonia from the flue gas. Final Act. 18 (citing Gal 733 ¶ 52). In view of these disclosures in Gal 733, the Examiner concludes that it would have been obvious to one of ordinary skill in the art at the time of Appellant's invention to arrange Dube's cooling system (as modified by Gal) and ammonia removal system (as suggested by Gal 831) in liquid connection to allow the water from the direct contact cooler to be used in the ammonia removal system. Final Act. 18.

Because Appellant does not substantively challenge the Examiner’s factual findings and conclusion of obviousness for claim 18 (Br. 23), Appellant’s arguments are unpersuasive of reversible error in the Examiner’s rejection of this claim under 35 U.S.C. § 103(a), which we accordingly sustain.

CONCLUSION

| <b>Claims Rejected</b> | <b>Basis</b>   | <b>Affirmed</b>              | <b>Reversed</b> |
|------------------------|--|------------------------------|-----------------|
| 1, 3, 10, and 17       | § 103(a)<br>Dube and Gal                               | 1, 3, 10, and 17             |                 |
| 2                      | § 103(a)<br>Dube, Gal, and Gal 831                     | 2                            |                 |
| 4                      | § 103(a)<br>Dube and Gal as evidenced by Bates         | 4                            |                 |
| 7–9                    | § 103(a)<br>Dube, Gal, and Emmer                       | 7–9                          |                 |
| 11                     | § 103(a)<br>Dube, Gal, Kobayashi, and Gal 831          | 11                           |                 |
| 13–15                  | § 103(a)<br>Dube, Gal, Kobayashi, and Emmer            | 13–15                        |                 |
| 18                     | § 103(a)<br>Dube, Gal, Kobayashi, Gal 831, and Gal 733 | 18                           |                 |
| <b>Overall Outcome</b> |  | 1–4, 7–11, 13–15, 17, and 18 |                 |

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Application 14/150,005

No time period for taking any subsequent action in connection with this appeal may be extended under 37 C.F.R. § 1.136(a)(1)(iv).

AFFIRMED