UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE BOARD OF PATENT APPEALS
AND INTERFERENCES

Ex parte CHRISTOPH NOVER and HELMUT DILLENBURG

Appeal 2007-2776
Application 10/093,827
Technology Center 1700

Decided: January 23, 2008

Before SALLY G. LANE, MICHAEL P. TIERNEY and JAMES T. MOORE, *Administrative Patent Judges*.

MOORE, *Administrative Patent Judge*.

DECISION ON APPEAL

1

2 STATEMENT OF CASE

3 The Appellants appeal under 35 U.S.C. § 134 (2002) from a final
4 rejection of claims 1-7 and 9.[1] We have jurisdiction under 35 U.S.C. § 6(b)
5 (2002).

6 The Appellants' claims are directed to a process for continuously
7 producing precipitated calcium carbonate having a controllable particle size.

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[1] Claim 8 has been canceled.

The Appellants assert that claims 1-7 and 9 "stand or fall together" in this appeal. (App. Br. 4, ll. 1-2.) We select independent claim 1 to decide the appeal. 37 C.F.R. § 41.37 (c)(1)(vii)(2006). Accordingly, the remaining claims stand or fall with claim 1.

Claim 1 reads as follows:

> 1. A process for continuously producing precipitated calcium carbonate having a controllable particle size, comprising
>
> introducing into a stirred reactor a flow of CO_2-containing gas that is blown into a flow of calcium hydroxide suspension in a nucleation phase in which predominantly calcium carbonate nuclei are formed and in a separate crystal growth phase in which predominantly the nuclei formed in the nucleation phase grow in accordance with the calcium hydroxide and the CO_2 availability, wherein fresh calcium hydroxide suspension is only added during the nucleation phase, and wherein said crystal growth phase takes place in at least one separate second reactor, and
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> controlling the particle size of the precipitated calcium carbonate through the concentration of the calcium carbonate nuclei formed in the nucleation phase, by adjusting only the volume ratio of the CO_2 flow introduced into the calcium hydroxide flow in said nucleation phase by
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> (a) regulating the calcium hydroxide flow volume at a constant reactor volume and a constant CO_2 flow volume, or
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> (b) regulating the CO_2 flow volume at a constant calcium hydroxide flow volume and a constant reactor volume.

THE REJECTION

Claims 1-6 and 9 stand rejected under 35 U.S.C. § 103(a) (2004) over Shibazaki (US Patent 4,133,894). Dependent claim 7 stands rejected under 35 U.S.C. § 103(a) (2004) over the combination of Shibazaki and "Wyatt Technology Theory" (http://www.wyatt.com/theory/index/cfm).

We AFFIRM.

ISSUE

Did the Examiner err in determining that it would have been obvious to one of ordinary skill in the art at the time the invention was made to adjust known reaction conditions in a known process to reach a predictable result?

BRIEF SUMMARY OF THE ART AND GENERIC FINDINGS OF FACT

Precipitated calcium carbonate is a well-known material used as fillers and pigments in papermaking, paint and other compositions. (Specification, p. 2.)

It was known to those of ordinary skill in the art at the time the invention was made that precipitated calcium carbonate can be produced by several methods. The most cost-effective process is by carbonation of calcium hydroxide.[2] In the carbonation process, carbon dioxide gas is reacted with calcium hydroxide in a carbonator reactor.

Reaction conditions determine the type of crystal, the size of particles, and the size distribution produced. Process variables include starting temperature, temperature during carbonation, rate of mixing, pH, concentration of reactants, and the presence or absence of chemical additives. K-O, 428.

The reaction may be conducted in a mixing reactor to produce shear forces which form fine particles (Specification, p. 1-2). It was known to perform the reaction in a set of continuous separate nucleation and growth

[2] See Kirk-Othmer, Encyclopedia of Chemical Technology, Third Edition, Volume 4, 1978, pages 427-431, attached hereto and referenced herein as "K-O", which is representative of the level of ordinary skill in the art at the time the invention was made.

cells. (*Id*.) Grain size and carbonization are affected by, inter alia, concentration of hydrate suspension, throughflow rate, and amount of excess of CO_2. (Specification, p. 2.)

One of ordinary skill in the art would be aware of these process variables and how to control them to arrive at a desired size of precipitated calcium carbonate, and how to optimize the process as needed. (Shibazaki, 1:24-31) .

SPECIFIC FINDINGS OF FACT

The record supports the following findings of fact by a preponderance of the evidence.

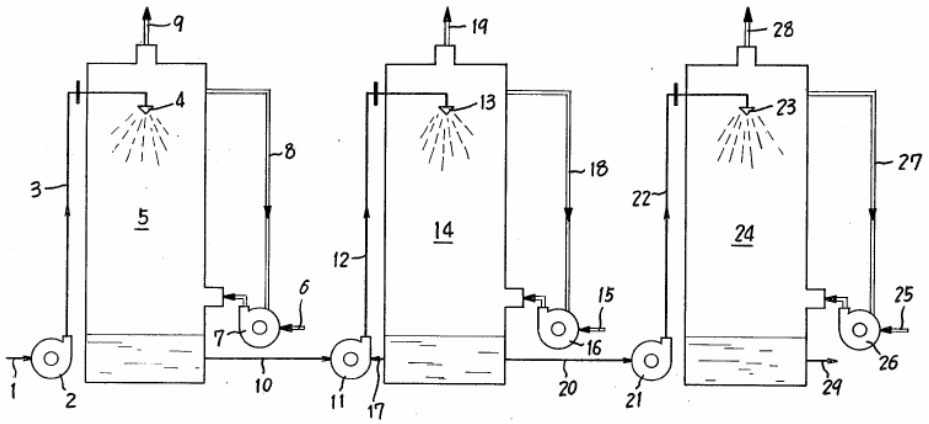
1. Shibazaki describes a process for continuously producing precipitated calcium carbonate of a uniform size by repeating the step of carbonation reaction in which calcium hydroxide suspension having a specified droplet diameter is sprayed into a carbon dioxide-containing gas having a specified superficial velocity in a column. (1:18-24).

2. Shibazaki also describes that this process can produce precipitated calcium carbonate in an "optionally selected average size" of about 0.02 to about 3μm by "suitably adjust[ing]" reaction conditions. (1:25-31).

3. Shibazaki describes that the reaction conditions adjusted to produce an "optionally selected…size" of precipitated calcium carbonate are "the droplet diameter, solids concentration and temperature of the calcium hydroxide suspension, the superficial velocity of the carbon dioxide-containing gas, etc." (1:25-31).

4. Shibazaki's figure 1, reproduced below, is a flow chart illustrating one embodiment of the described invention. (Fig. 1; 4:54-55).

Fig. 1



5. Shibazaki describes a "first process" suited to produce superfine particles of calcium carbonate less than 0.1µm in average particle size. (1:33-36) (Fig. 1; 1:44-45).

6. Shibazaki describes that the first step of the first process requires uniformly producing a suitable amount of nuclei of calcium carbonate crystals. (1:47-50).

7. Shibazaki describes that uniformly producing a suitable amount of nuclei of calcium carbonate crystal is necessary so that the final third step of the process will give superfine calcium carbonate particles of the desired particle size. (1:47-53).

8. Shibazaki describes that the first step of the first process is accomplished by spraying a suspension of calcium hydroxide having a solids concentration of up 10 wt.% and a temperature of up to 30º C, in the form of droplets having a diameter of about 0.2 to about 1.0 mm, against a gas containing 10 to 40 vol.% of carbon dioxide. (1:53-59).

9. Shibazaki describes that in the second step of the first process, the suspension resulting from the first step is sprayed in the form of droplets of about 1.0 to about 2.0 mm in diameter in countercurrent contact with a gas containing 10 to 40 vol.% of carbon dioxide. (2:31-35).

10. Shibazaki describes that in the third step of the first process, the suspension from the second step, in the form of droplets sized about 1.5 to about 2.0 mm in diameter, is sprayed at a temperature of up to 30º C against a gas containing 10 to 40 vol.% of carbon dioxide. (2:52-59).

11. Shibazaki next describes a "second process" to produce fine particles of calcium carbonate about 0.1 to about 3.0μm in average particle size. (1:37-40; 3:19-21; 8:7-11).

12. Shibazaki describes that the first process and second process differ in the particle size of the resulting product and "invariably differ from each other in the reaction conditions involved." (1:40-43).

13. Shibazaki describes that in the first step of the second process, the calcium hydroxide suspension has a solids concentration of 10 to 15 wt.%, a temperature of 30 to 80º C, and a droplet diameter of about 0.2 to 1.0 mm. (3:19-27), the gas contains 10 to 40 vol.% of carbon dioxide and is passed upward through a column with a superficial velocity of about 0.02 to about 0.5 m/sec. (3:26-31).

14. Shibazaki describes that in the second step of the second process, the suspension has a temperature of 30 to 80ºC, with a droplet diameter of 1.0 to about 2.0 mm. (4:2-4).

15. Shibazaki describes that in the third step of the second process,

calcium carbonate crystals grow to an average size of about 1.0 to about 3μm. (4:22-25).

16. Shibazaki describes,

> The feed rate of the carbon dioxide-containing gas from the line **6**, the concentration of the carbon dioxide, the rate of circulation of the gas through the line **8**, the rate and timing of discharge of the gas from the line **9** are determined in accordance with the concentration and temperature of the calcium hydroxide suspension, the degree of progress of the reaction, etc.

(4:66-5:5).

PRINCIPLES OF LAW

The factual inquiry to determine whether an invention is obvious under 35 U.S.C. § 103 requires consideration of: (1) the scope of and content of the prior art; (2) the differences between the claimed subject matter and the prior art; (3) the level of ordinary skill in the art; and (4) secondary considerations, such as unexpected results. *Graham v. John Deere Co.*, 383 U.S. 1, 17 (1966).

"Section 103 forbids issuance of a patent when '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 International Co. v. Teleflex Inc.,* 127 S. Ct. 1727, 1734, (2007).

"If a person of ordinary skill can implement a predictable variation, § 103 likely bars its patentability." *Id.* at 1740. For example, "where the general conditions of a claim are disclosed in the prior art, it is not inventive

to discover the optimum or workable ranges by routine experimentation." *In re Aller*, 220 F.2d 454, 456 (1955).

ANALYSIS

I. The Rejection of Claims 1-6 and 9 under 35 U.S.C. § 103(a) over Shibazaki (US Patent 4,133,894).

Claims 1-6 and 9 stand rejected under 35 U.S.C. § 103(a) over Shibazaki. Specifically, the Examiner found that Shibazaki describes a continuous process for the production of precipitated calcium carbonate of a uniform and controlled size. (Non-Final Rejection, Jul. 13, 2005, p. 3, incorporated by reference in Final Rejection, Mar. 31, 2006, p. 2). Shibazaki forms precipitated calcium carbonate by reacting calcium hydroxide solution with carbon dioxide gas. (*Id.*) The process has a nucleation phase during which crystal nuclei are uniformly formed and a growth phase wherein complete carbonation takes place. (*Id.*)

The Examiner also found that Shibazaki controls particle size by adjusting reaction conditions such as the flow of carbon dioxide and the corresponding volume ratio of the reactants. (*Id.*) The Examiner found that Shibazaki does not explicitly teach control of the particle size by varying the ratio of reactants in the nucleation stage only and holding the conditions of the other stages constant. (*Id.*) The Examiner determined, however, that this manner of control would have been obvious to one of ordinary skill in the art at the time of the invention because this represents one of many ways in which the various reaction parameters may be varied to control particle size. (*Id.*)

The Examiner found that Shibazaki teaches an acceptable range for droplet size to prevent larger drops from producing an uneven reaction rate and smaller drops from being carried away as vapor in the carbon dioxide-containing gas. (Final Rejection, Mar. 31, 2006, p. 4). The Examiner further found that the ranges of droplet size for the first and second processes in Shibazaki are the same even though the resulting particle sizes are different. (*Id.*) Consequently, the Examiner found that Shibazaki teaches droplet size does not control particle size. (*Id.*)

The Examiner found that Shibazaki does not emphasize the control of the process temperature to control particle size. (Final Rejection, Mar. 31, 2006, p. 3). The Examiner determined that all processes have temperature limits and Shibazaki teaches the temperature limits of the patented processes. (*Id.*)

The Examiner found that "[i]t is an old and obvious technique in the art of process control to reduce [the] amount of variables one needs to adjust in a chemical process." (Final Rejection, Mar. 31, 2006, p. 5). The Examiner determined that the applicant's disclosure simply chooses one process parameter to *adjust* during operation. The Applicants' claim permits the control (if not adjustment) of the same parameters controlled in Shibazaki, i.e., temperature, CO_2 flow rate, CO_2 concentration, calcium hydroxide flow rate, and calcium hydroxide concentration.

The Examiner found that holding a parameter value constant "is in and of itself control." (*Id.*) The Examiner found that insofar as the Appellants assert that their process can more effectively tolerate fluctuations

in its so-called uncontrolled parameters than Shibazaki, such assertions are unsupported by the specification. (*Id.*)

Turning now to the arguments presented for our review, the Appellants assert that it would not have been obvious to one of ordinary skill in the art who reviewed Shibazaki to control the particle size of precipitated calcium carbonate by adjusting only the CO_2 to the calcium hydroxide volume ratio in the nucleation phase. The Appellants urge that this is so because Shibazaki does not teach controlling calcium carbonate particle size by "varying a *single* process parameter." (App. Br. p. 4)(emphasis in original). The Appellants assert that Shibazaki instead teaches "varying both the temperature and the concentration of a calcium hydroxide suspension" to control particle size. (*Id.* pp. 4-5).

This argument is unpersuasive.

First, it fails to distinguish the reference from the claimed subject matter. The instant claim, written in open-term "comprising language" states that the process includes:

> … controlling the particle size of the precipitated calcium carbonate through the concentration of the calcium carbonate nuclei formed in the nucleation phase, by adjusting only the volume ratio of the CO_2 flow introduced into the calcium hydroxide flow in said nucleation phase by
>
> (a) regulating the calcium hydroxide flow volume at a constant reactor volume and a constant CO_2 flow volume, or
>
> (b) regulating the CO_2 flow volume at a constant calcium hydroxide flow volume and a constant reactor volume.

This claim as written does not exclude "controlling" any other parameter for any other reason. The claim is limited to "adjusting" "only" the volume ratio of the CO_2 flow to affect particle size in the nucleation

stage. Shibazaki teaches a process having a constant temperature. Consequently, we find no error in the Examiner's position that the claim reads on standard process control which would allow for "control" of temperature.

Second, even were we to accept the Appellants' assertions that the claim really limits its scope to the "control" of a single process variable, we note that this argument is unpersuasive.

Initially in this regard, we find that the person of ordinary skill in the art would be familiar with process control and design, as evidenced by the disclosures of the evidence of record which discuss process control and design (e.g. Shibazaki). An integral part of process control and design is optimization. Optimization of a process requires the adjustment of one or more variables to yield optimized results. The process of optimization principally involves adjusting one variable in order to determine the effect of that adjustment. The Appellants' claims therefore read on the well-known science and practice of process optimization, which would have been obvious to one of ordinary skill in the art at the time the invention was made.

Additionally in this regard, Shibazaki describes two separate carbonation processes, each of which independently produces precipitated calcium carbonate particles of a controlled size. Shibazaki then describes that the reaction conditions involved in this process can be "suitably adjusted" to produce "optionally selected" particle sizes. (1:25-31).

Shibazaki expressly encourages adjustment to yield the particles which are desired. One of ordinary skill in the art is led to adjust the

parameters as needed. Adjustment of a single parameter out of the known parameters would have been obvious to one of ordinary skill in the art.

The Appellants next argue that the claimed invention is not obvious because Shibazaki "makes no mention of regulating the volume ratio of carbon dioxide and milk of lime flows [to control particle size] as in the claimed invention." (App. Br. p. 5). The Appellants assert that Shibazaki instead teaches controlling particle size by adjusting "the droplet diameter, solids concentration and temperature of the calcium hydroxide suspension, the superficial velocity of the carbon dioxide-containing gas, etc. " (*Id.* quoting Col. 1, ll. 25-31).

This argument is also not persuasive. First, it references a quote from Shibazaki that describes adjustments made *between* the two separate processes. Review of Shibazaki's description of the reaction parameters *within or during* the process reveals that the solids concentration and temperature of the calcium hydroxide suspension remain constant.

Shibazaki further describes that the flow rate and concentration of carbon dioxide are determined in accordance with the concentration and temperature of the calcium hydroxide. Specifically, Shibazaki describes,

> The feed rate of the carbon dioxide-containing gas from the line **6**, the concentration of the carbon dioxide, the rate of circulation of the gas through the line **8**, the rate and timing of discharge of the gas from the line **9** are determined in accordance with the concentration and temperature of the calcium hydroxide suspension, the degree of progress of the reaction, etc.

(4:66-5:5; Figure 1). This description refers to the first step of the process, which Shibazaki describes is necessary to uniformly produce a suitable amount of nuclei of calcium carbonate crystals so that the final step of the process will produce the calcium carbonate particles of the desired uniform size. (1:47-53).

Shibazaki also controls, and does not vary, the concentration and temperature of the calcium hydroxide to avoid a rigorous non-uniform reaction. Therefore, we find that Shibazaki describes adjusting the flow volume of carbon dioxide in relation to a constant concentration and temperature of calcium hydroxide to control particle size.

Controlling particle size by "regulating the carbon dioxide flow volume at a constant calcium hydroxide flow volume and a constant reactor volume," as described in alternative b) of the claimed invention, would have been obvious to one of ordinary skill in the art at the time of the invention. Regulating the volume ratio of the two reactants in this manner represents a simple selection of one of the known ways in which the reaction parameters may be varied to control particle size. Shibazaki described these parameters and their effects on the reaction result.

The Appellants also argue that one with ordinary skill in the art would not have a reasonable expectation of successfully being able to control particle size by adjusting only the volume of the reactants because Shibazaki teaches that both the temperature and calcium hydroxide suspension concentration must be in the specified range to obtain the desired size particles. (App. Br. pp. 5-6).

This argument is not persuasive. First, it is merely attorney argument as Appellants did not submit any evidence in support of the Appeal Brief. Second, it is internally inconsistent. Shibazaki describes the process limits for the temperature of the calcium hydroxide. As stated by the Examiner, "All processes have temperature limits- low, high, or both." (Final Rejection, Mar. 31, 2006, p. 3). The Appellants acknowledge that the claimed invention also has process limits by asserting in their Reply Brief that process parameters, other than those reflected in claim 1, "are allowed to vary freely *within natural limits*." (Reply Br. pp. 1-2)(emphasis added). The difference between Shibazaki and the claimed invention is not that the temperature is maintained within certain limits, but that Shibazaki describes the limits of the temperature and the claimed invention does not. The Appellants cannot on the one hand argue both that claimed invention does not require monitoring temperature, App. Br. p. 8, and then acknowledge that the temperature is allowed to vary freely but only "within normal limits," Reply Br. pp. 1-2. To ensure that the temperature is maintained "within normal limits" the temperature must be monitored.

The Appellants next urge that the claimed invention is not obvious because Shibazaki controls the concentration of the calcium hydroxide suspension, which is urged to be contrary to the claims at issue. As with the temperature, Shibazaki describes the upper limit for the weight percent of the solids concentration of the calcium hydroxide suspension. Similarly, the invention at issue controls this parameter. The Applicants' specification describes, "According to the invention, a calcium hydroxide suspension having a concentration of up to 250 grams/liter was used." (Specification, p.

3). Consequently, the Appellants have not established that Shibazaki's express control of this parameter renders the Examiner's obviousness rejection erroneous.

Finally, the Appellants assert that the claimed invention is not obvious because of differences between Shibazaki and the process of their claims. The Appellants assert that Shibazaki sprays droplets of a milk of lime slurry into a stream of carbon dioxide gas rather than introducing the gas into a "flowing suspension of milk of lime." This argument, again, is attorney argument and not supported with evidence. One of ordinary skill in the art would have been aware of conventional methods of intermingling and reacting the instant reactants. The Appellants have provided no persuasive evidence that this would not have been obvious to one of ordinary skill in the art,

The Appellants assert that Shibazaki describes a three-step process, while the claimed invention only requires two steps.

We also find this argument unavailing. First, the instant claims are not limited to a two step process. Second, Appellants have not directed our attention to credible evidence that the number of steps is a meaningful difference between the two processes such that one of ordinary skill in the art would not have found the difference to be obvious.

II. The Rejection of Claim 7 under 35 U.S.C. § 103(a) over the combination of Shibazaki and "Wyatt Technology Theory"

Claim 7 stands rejected under 35 U.S.C. § 103(a) (2004) over the combination of Shibazaki and "Wyatt Technology Theory."

The Appellant has offered no separate argument for this rejection, stating that this claim stands or falls with claim 1. (App. Br. 4, ll. 1-2). Accordingly, we affirm it for the reasons stated above.

Accordingly, we affirm the Examiner's rejections.

CONCLUSION OF LAW

On the record before us, the Appellants have not shown error on the part of the Examiner. It would have been obvious to one of ordinary skill in the art at the time the invention was made to control only the volume ratio of the reactants to control particle size.

DECISION

The Rejection of claims 1-6 and 9 under 35 U.S.C. §103(a) as being unpatentable over Shibazaki is AFFIRMED.

The Rejection of claim 7 under 35 U.S.C. §103(a) as being unpatentable over Shibazaki in view of "Wyatt Technology Theory" (http://www.wyatt.com/theory/index/cfm) is AFFIRMED.

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) (2006).

AFFIRMED

MAT

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