

Appeal No. 1997-1551
Application No. 08/235,597

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THIS OPINION WAS NOT WRITTEN FOR PUBLICATION

The opinion in support of the decision being entered today (1) was not written for publication in a law journal and (2) is not binding precedent of the Board.

Paper No. 19

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE BOARD OF PATENT APPEALS
AND INTERFERENCES

Ex parte DENNIS W. JOHNSON, PERVAJI A. BHAT and THOMAS R. GOOTS

Appeal No. 1997-1551
Application no. 08/235,597¹

ON BRIEF

Before DOWNEY, WILLIAM F. SMITH and LORIN, Administrative Patent Judges,

DOWNEY, Administrative Patent Judge.

DECISION ON APPEAL

This is an appeal under 35 U.S.C. ' 134 from the final rejection of claims 1-6.²

¹ US appl. no. 08/448,060 is a divisional continuation of the instant application. The claims of 08/448,060 also are the subject of appeal no. 97-2914, which is being decided concurrently with the instant appeal.

² The February 21, 1996 Final Rejection involved claims 1-8. On April 25, 1996, however, the appellants filed an Amendment after Final Rejection which amended claim 1 and cancelled claims 7 and 8. The examiner

Claim 1, the only independent claim, is illustrative of the subject matter on appeal and reads as follows:

A method for removing SO₃ and SO₂ from a flue gas produced by the burning of a fossil fuel, comprising:

providing flue gas to particulate collection means for collecting particles from the flue gas to produce partially cleaned flue gas;

injecting into the partially cleaned flue gas, after particles have been removed therefrom by the particulate collection means, an amount of dry sorbent having a particle size range larger than approximately 1.0 B 2.0 microns sufficient to react with and remove substantially all of the SO₃ from the partially cleaned flue gas to produce a substantially SO₃-free flue gas containing reacted dry sorbent and unreacted dry sorbent;

conveying the substantially SO₃-free flue gas, reacted dry sorbent, and unreacted dry sorbent to wet scrubber means to wet and remove both the reacted and unreacted dry sorbent in the substantially SO₃-free flue gas, thereby making the unreacted dry sorbent available as a reagent for SO₂ removal; and

approved the after-final amendment for entry upon the filing of an appeal, per the May 6, 1996 Advisory Action.

reacting the wet reagent with the SO₂ in the wet scrubber means to remove SO₂ from the substantially SO₃-free flue gas conveyed to the wet scrubber means.³

The references relied upon the examiner are:

Peterson et al. (Peterson), A Pilot-Scale Evaluation of Sorbent Injection to Remove SO₃ and HCl, Proceedings: 1991 SO₂ Control Symposium (December 2-3, 1991), pp. 6A-1 to 6A-22.

Kohl et al. (Kohl), Gas Purification, 4th ed., Gulf Publishing Company (1985), pp. 302, 303, and 306-320.

British Patent (Steag) 1,589,999 May 28, 1981

Rejections

Claims 1-6 stand rejected under 35 U.S.C. § 103. With respect to claim 1, the examiner relies upon Kohl, Steag, and appellants' admission as evidence of obviousness.

With respect to claims 1-6, the examiner relies upon Kohl, Steag, appellants' admission, and Peterson as evidence of obviousness.¹ We reverse both grounds of rejection and institute new grounds of rejection under 37 C.F.R. § 1.196(b).

The claims at issue

Claim 1, representative of the claims on appeal, is directed to a method of removing SO₃ and SO₃ from a flue gas produced by burning fossil fuel comprising the steps summarized as follows:

providing flue gas containing SO₃ and SO₃ produced by burning fossil fuel;

sending the flue gas to particulate collection means for collecting and removing particles from the flue gas to produce a partially cleaned flue gas;

injecting dry sorbent into the partially cleaned flue gas, wherein

³ Claim 1 is reproduced here as it appears in the April 25, 1996 Amendment After Final Rejection, which was approved by the examiner in the May 6, 1996 Advisory Action.

the dry sorbent has a particle size range larger than approximately 1.0 microns²,

the amount of dry sorbent is sufficient to react with and remove substantially all of the
SO₃ in the flue gas, and

the substantially SO₃-free flue gas contains both reacted and unreacted sorbent;

conveying the substantially SO₃-free flue gas, reacted sorbent, and unreacted sorbent to a wet
scrubber means;

wetting and removing the reacted sorbent and unreacted sorbent from the substantially

SO₃-free flue gas with the wet scrubber means,

making a wet reagent⁴ with the unreacted dry sorbent;

reacting the wet reagent with the SO₂ in the wet scrubber means to remove SO₂ from
the substantially SO₃-free flue gas.

Prior art cited by the examiner as evidence of obviousness

The examiner relies upon Kohl as the primary reference.

Kohl teaches providing flue gas containing SO₃ and SO₃ produced by burning fossil fuel (pp. 302 and 303). The SO₃ can be highly corrosive, especially when the SO₃ reacts with water to form sulfuric acid (paragraph bridging pp. 302 and 303).

Kohl describes sending the flue gas to particulate collection means for collecting and removing

⁴ As noted below, claim 1 as presently drafted fails to provide antecedent basis for "the wet reagent@".

particles from the flue gas to produce a partially cleaned flue gas (p. 309, Fig. 7-2, Ash Collector)

Kohl discloses conveying the partially cleaned flue gas to a wet scrubber means;

making a wet reagent with materials such as lime (CaO), limestone (CaCO₃), and magnesium oxide (MgO) (p. 308, Table 7-7). Compare, present claim 3, and p. 7, lines 20-24, of the present specification.

reacting the wet reagent with the SO₂ in the wet scrubber means to remove SO₂ from the flue gas (p. 306, Figure 7-1; and pp. 307-320).

There are differences between the teachings of Kohl and the claimed invention.

Kohl does not disclose removing substantially all the SO₃ from the flue gas.

Kohl discusses SO₃ formation at pp. 302 and 303, but its formation is attributed to process condition variables such as air/fuel ratios, fuel composition, temperature, etc.

Kohl addresses SO₂ removal elsewhere and the examiner points to no teaching in Kohl on the actual removal of SO₃ in particular from a flue gas.

Kohl does not describe injecting dry sorbent particles into the flue gas after particulate collection and before wet scrubbing, so that some of the dry sorbent particles react with and remove substantially all the SO₃ in the flue gas, and so that the unreacted dry sorbent particles form a wet reagent to remove SO₂ from the substantially SO₃-free flue gas during wet scrubbing.

Kohl describes a "dry plus wet" process at p. 307, para. 4, but that process involves

the in-situ injection of limestone (CaCO_3) directly into the furnace. Contrary to that description, the presently claimed invention includes a particulate collection means which would work against the process described in Kohl by intercepting the lime particles after they leave the furnace and before they enter the wet scrubber. Kohl also discounts the in-situ process because of A numerous operational problems@ in the same paragraph.

Kohl discloses the A concept of combining fly ash particulate removal with the SO_2 removal scrubber@ as offering A a very large potential for cost savings by eliminating the need for an electrostatic precipitator or baghouse@, but Kohl also lists several drawbacks to that concept (para. Bridging pp. 307 and 309). In any case, the presently claimed invention captures the fly ash in

the particulate collection means before it reaches the dry sorbent and wet scrubber stages.

Kohl does not teach that the dry sorbent particles are larger than 1.0 micron.

The Examiner cites appellants= A admission@, Steag, and Peterson as secondary references to account for the differences between Kohl and the claimed invention.

The examiner addresses the claimed removal of substantially all the SO_3 from the flue gas with the A admission@ of appellants and the teachings of Peterson.

The examiner relies upon appellants= A admission@ as suggesting the desirability of

removing substantially all the SO_3 from the flue gas.

The examiner points to appellants' Admission at p. 5, lines 3 and 4, of the specification that A(i)t is well-known in the pollution control field that a wet scrubber does not effectively remove SO_3 from flue gas.

The examiner further notes that Kohl teaches that SO_3 is highly corrosive.

In light of the Admission and the Kohl teaching, the examiner concludes that there would have been expected advantages of being able to remove highly corrosive SO_3 out

of the flue gas before it can damage any equipment or the environment and also because it is known that wet-scrubbers are not efficient at removing SO_3 out of a gas.

The examiner points to Peterson, p. 6A-3, as showing that $\text{Ca}(\text{OH})_2$ and NaHCO_3 can remove not only SO_3 out of a gas but SO_2 as well. The examiner further notes that claim 2 would encompass both $\text{Ca}(\text{OH})_2$ and NaHCO_3 .³

The examiner argues in the paragraph bridging pp. 5 and 6 of his September 27, 1996 Answer that Peterson suggests both SO_2 and SO_3 may be removed by $\text{Ca}(\text{OH})_2$ and NaHCO_3 in a wet scrubber.

It should be noted, however, that the sorbents taught in Peterson are dry. See p. 6A-2, para. 2; p. 6A-6, para. 2; and p. 6A-18, Table 1.

The examiner cites Steag for its teaching on the dry cleaning of flue gas after the particulate collection step.

The examiner indicates that Steag at p. 2, lines 4-13 sets forth a process for removing SO_2/SO_3 out of a flue gas by initially passing the contaminated gas through a dust collector followed by a dry cleaning of the gas to remove SO_2/SO_3 .

After the dry cleaning, however, Steag captures the particles in a cloth filter (p. 2, lines 75-83).

Steag does not teach the actual injection of dry sorbent particles into the flue gas stream after the particulate collection step.

Instead, the reference teaches a multiple stage filtration in which the dust content is reduced from 10-15 g/m^3 to 600 mg/m^3 in the first filtration, to 100-200 mg/m^3 after the dry gas cleaning stage, and to 10 mg/m^3 in the final filtration (p. 2, lines 55-83 and 105-115).⁵

The reference does not explicitly discuss the dry gas cleaning process itself but only indicates that such processes are known per se at p. 2, line 15.

Steag does not teach wet scrubbing in particular but only acknowledges the existence of such processes in the prior art at p. 1, lines 60-65.

The examiner relies upon Peterson at p. 6A-9 to show dry sorbent particles of 10 microns in size, which meets the greater than 1.0 micron limitation presently claimed.

Although not specifically addressed in the Examiner's Answer, Peterson shows the actual step of Sorbent Injection into the flue gas stream for the purpose of removing SO_3 . See p. 6A-16, para. 1. The dry sorbent is

⁵ The 10 to 15 mg/m^3 reported at p. 2, line 57, of Steag is an obvious typographical error.

subsequently removed by an Electrostatic Precipitator. See p. 6A-20, Figure 1.

Opinion

We reverse the rejection of claim 1 under 35 U.S.C. § 103 as being unpatentable over Kohl in view of Steag and appellants' admission, as set forth at pp. 3-5 of September 27, 1996 Examiner's Answer. None of the references cited by the examiner teaches or suggests a dry sorbent with a particle size range larger than approximately 1.0 micron, nor has the examiner made any attempt to account for that limitation.⁴

We also reverse the rejection of claims 1-6 under 35 U.S.C. § 103 as being unpatentable over Kohl in view of Steag and appellants' admission, further in view of Peterson, as set forth at pp. 5 and 6 of the September 27, 1996 Examiner's Answer.⁶

The examiner essentially argues it would have been obvious to one of ordinary skill in the art at the time the invention was made to remove SO₃ from a flue gas with a dry sorbent step and then remove SO₂ in a wet scrubber step because:

Flue gas is known to have SO₃ and SO₂, both of which are pollutants to be removed from flue gas.

The dry sorbent step is known for removing SO₃ and the wet scrubber is known for removing SO₂.

The use of both the dry sorbent step and the wet scrubber step on the same flue gas would have been expected to remove both SO₃ and SO₂.

The SO₃ removal step would have to proceed first because B

⁶ The examiner refers to claims 1-8, but as discussed above, claims 7 and 8 have been cancelled in an after-final

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amendment.

the wet scrubbing step is not efficient at removing SO₃; and

the same gas would have damaged other equipment downstream.

The fact remains, however, that none of the prior art references or Admission^o cited by the examiner, individually or in combination, teach or suggest the step of injecting dry sorbent particles into the flue gas after particulate collection and before wet scrubbing, so that some of the dry sorbent particles react with and remove substantially all the SO₃ in the flue gas, followed by conveying the substantially SO₃-free gas, reacted dry sorbent, and unreacted dry sorbent particles to a wet scrubber means in which the unreacted dry sorbent is available as a wet reagent to remove SO₂ from the substantially SO₃-free flue gas during wet scrubbing.

Both Steag and Peterson teach a dry cleaning or sorbent process, but both also teach removal of the particles downstream with a filter or electrostatic precipitator. The examiner argues that the present claims have the term Acomprising^o which does not exclude the filter of Steag. Nevertheless, the presence of a filter or electrostatic precipitator would undermine the requirement in the claimed invention that the unreacted dry sorbent particles are conveyed into the wet scrubber means to produce a wet reagent for removing SO₂. The examiner has provided no other evidence in the prior art or in the general knowledge in the relevant art suggesting to one of ordinary

skill in the art a modification of the prior art so that the dry sorbent passes into the wet scrubber means as required in the presently claimed process. Without such evidence, the prima facie determination of obviousness for the claimed invention as a whole cannot stand. See In re Dembiczak, 175 F.3d 994, 1000, 50 USPQ 2d 1614, 1618 (Fed. Cir. 1999). No suggestion has been shown in the prior art as to the desirability of making such a modification to the presently claimed process as a whole. See In re Brouwer, 77 F.2d 422, 425, 37 USPQ 2d 1663, 1666 (Fed. Cir. 1995).

The prior art cited by the examiner can be seen as teaching away from the presently claimed invention on this point. As discussed above, both Steag and Peterson teach the interception of particles downstream from the dry cleaning or sorbent step with either a filter or electrostatic precipitator. Interception suggests that the sorbent particles have no other use, which teaches away from the downstream use of those particles. As also discussed above, Kohl lists several drawbacks to the in situ calcination of limestone and the concept of combining fly ash particulate removal with the SO₂ removal scrubber (p. 307, para. 4, through p. 309). Those drawbacks would further teach away from the downstream use of particles. Prior art references must be considered in their entirety, i.e., as a whole, including portions that would lead away from the claimed invention. See W.L. Gore & Associates, Inc. v. Garlock, 721 F. 2d 1540, 1550, 220 USPQ 303, 311 (Fed. Cir. 1983), cert. den., 469 U.S. 851 (1984).

NEW GROUND OF REJECTION UNDER 37 C.F.R. ' 1.196(b)

Pursuant to the provisions of 37 C.F.R. ' 1.196(b), we make the following new grounds of rejection.

Claims 1-6 are rejected under 35 U.S.C. ' 112, second paragraph, as being indefinite.

Claim 1, lines 8 and 9, recite "A particle size range larger than approximately 1.0-2.0 microns", but it is unclear whether the particles are larger than 1.0 micron or 2.0 micron.⁷ Clarification is needed. For example, are particles having a size of 1.5 microns within or without the claims?

Claim 1 does not have antecedent basis for "the wet reagent" found at line 16. The claim recites "A reagent" at line 14, but clarification is needed as to whether "the wet reagent" of line 16 is the same as the "reagent" of line 14.

CONCLUSION

The rejections of claims 1-6 are reversed.

This decision contains a new ground of rejection pursuant to 37 C.F.R. ' 1.196(b)(amended effective Dec. 1, 1997, by final rule notice, 62 Fed. Reg. 53, 131, 53, 197 (Oct. 10, 1997), 1203 Off. Gaz. Pat. & Trademark Office 63, 122 (Oct. 21, 1997)). 37 CFR ' 1.196(b) provides that, "A new ground of rejection shall not be considered final for purposes of judicial review."

37 C.F.R. ' 1.196(b) also provides that the appellant, WITHIN TWO MONTHS FROM THE DATE OF THE DECISION, must exercise one of the following two options

⁷ Reference is made to lines 8 and 9 of claim 1 in the April 25, 1996 Amendment after Final Rejection.

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with respect to the new ground of rejection to avoid termination of proceedings ('

1.197(c)) as to the rejected claims:

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Submit an appropriate amendment of the claims so rejected or a showing of facts relating to the claims so rejected, or both, and have the matter reconsidered by the examiner, in which event the application will be remanded to the examiner. . . .

Request that the application be reheard under ' 1.197(b) by the Board of Patent Appeals and Interferences upon the same record. . . .

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

Reversed B 37 C.F.R. ' 1.196(b)

MARY F. DOWNEY)	
Administrative Patent Judge)	
)	
)	
)	BOARD OF PATENT
WILLIAM F. SMITH)	
Administrative Patent Judge)	APPEALS AND
)	
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The examiner refers to claims 1-8 at p. 5 of his September 27, 1996 Answer, but as noted above, claims 7 and 8 have been cancelled.

Claim 1 provides for a particle range larger than approximately 1.0-2.0 microns, but as noted below, that limitation is indefinite. For the purpose of considering the rejections under 35 U.S.C. § 103, claim 1 is interpreted in a manner which renders it definite. See Ex parte scu, 222 USPQ 537, 540 (BPAI 1984).

See also, the specification at p. 9, lines 1 and 2, for hydrated lime ($\text{Ca}(\text{OH})_2$); and p. 7, line 21, for sodium bicarbonate (NaHCO_3).

The February 21, 1996 Final Office Action included a rejection of claim 1 under 35 U.S.C. § 103 as unpatentable over Kohl in view of Steag and Plants = admission, but at that time claim 1 did not include any limitation as to particle sizes greater than 1.0 micron. Claims 7 and 8, which did include sizes, were not rejected over the same two references and admission. The April 25, 1996 Amendment after Final Rejection, approved for entry by the examiner, inserts particle size limitations into claim 1 and cancels claims 7 and 8. In light of the record, therefore, this rejection of claim 1 should have been withdrawn as no longer applicable.