The opinion in support of the decision being entered today was *not* written for publication and is *not* binding precedent of the Board.

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE BOARD OF PATENT APPEALS
AND INTERFERENCES

Ex parte GEORGE STEPHENS, MARK E. BURY,
and GAUTAM GAUBA

Appeal 2006-1768
Application 10/389,327
Technology Center 3700

Decided: November 14, 2006

Before GARRIS, PAK, and KIMLIN, *Administrative Patent Judges*.

GARRIS, *Administrative Patent Judge*.

DECISION ON APPEAL

This appeal involves claims 1-25, the only claims pending in this application. We have jurisdiction over the appeal pursuant to 35 U.S.C. § 134.

We AFFIRM.

INTRODUCTION

The claims are directed to a burner for the combustion of fuel in a furnace and a method of combustion (Specification ¶ [0002]). Claim 1 is illustrative:

> 1. A burner for the combustion of fuel in a furnace, said burner comprising:
>
> (a) a burner tube having a downstream end and an upstream end;
>
> (b) a fuel orifice located adjacent the upstream end of said burner tube, for introducing fuel into said burner tube;
>
> (c) a burner tip mounted on the downstream end of said burner tube and adjacent a first opening in the furnace, said burner tip having a plurality of main ports in an external surface thereof so that combustion of the fuel takes place at said external surface of said burner tip, the number and dimensions of said main ports in said external surface being such that the total area of the main ports in said external surface is at least 1 square inch per million (MM) Btu/hr burner capacity; and
>
> (d) means for drawing flue gas from said furnace or air from a source of air or mixtures thereof in response to an inspirating effect of uncombusted fuel flowing through said burner tube from its upstream end towards its downstream end.

The Examiner relies on the following prior art references as evidence of unpatentability:

Ferguson	US 2,813,578	Nov. 19, 1957
Fischer	EP 374,423 A3	Jun. 27, 1990
Dinicolantonio	US 5,092,761	Mar. 3, 1992
Johnson	US 5,688,115	Nov. 18, 1997
Newby	US 5,813,846	Sep. 29, 1998

The rejections as presented by the Examiner are as follows:

1. Claims 1-12 and 16-25 are rejected under 35 U.S.C. § 103(a) as being unpatentable over Fischer.
2. Claims 1, 2, 4-10, 14-20, 24 and 25 are rejected under 35 U.S.C. § 103(a) as being unpatentable over Dinicolantonio.
3. Claims 3 and 11 are rejected under 35 U.S.C § 103(a) as unpatentable over Dinicolantonio in view of Newby.
4. Claims 11-13 and 21-23 are rejected under 35 U.S.C. § 103(a) as being unpatentable over Dinicolantonio in view of Johnson.
5. Claims 11-13 and 21-23 are rejected under 35 U.S.C. § 103(a) as being unpatentable over Dinicolantonio in view of Ferguson.

Rather than reiterate the respective positions advocated by the Appellants and by the Examiner concerning these rejections, we refer to the Brief and Reply Brief and to the Answer respectively for a complete exposition thereof.

OPINION

Appellants do not argue the burner and the method of combusting claims separately. Rather, Appellants focus on the structural limitations that are commonly recited in each set of claims. Accordingly, we choose burner claim 1 as a representative claim on which to render our decision.

SECTION_ 103(a) REJECTION OVER FISCHER

The feature of claim 1 that is the point of contention between the Examiner and Appellants is “a burner tip mounted on the downstream end of said burner tube and adjacent a first opening in the furnace,” the burner tip

having a plurality of main ports in an external surface of said burner tip such that "the number and dimensions of said main ports in said external surface being such that the total area of the main ports in said external surface is at least 1 square inch per million (MM) Btu/hr burner capacity."

The Examiner rejected claim 1 under § 103(a) over Fischer. The Examiner indicated that Fischer discloses a "method and apparatus for a burner" having all the limitations in claim 1, except for the "claimed total area of the main ports." (Answer 5). However, the Examiner, citing to *In re Aller*, 220 F.2d 454, 456, 105 USPQ 233, 235 (CCPA 1955), concluded that it would have been obvious to have incorporated the claimed area into Fischer's burner because "it has been held that where the general conditions of a claim are disclosed in the prior art, discovering the optimum or workable ranges involves only routine skill in the art." (Answer 5).

Appellants argue that for the *Aller* holding to be applicable, Fischer would be required to provide some teaching of the relevant parameters used in burner tip design (Br. 9). Appellants allege that absent a teaching of burner tip parameters, Appellants' claims cannot merely represent an adjustment of the relevant parameters as was found to exist in *Aller* (Br. 9). Appellants cite to *Ex parte Sullivan*, 2003 WL 23014513 (Bd. Pat. App. & Interf.), a non-precedential Board decision, for support that *Aller* is not applicable to the facts of the present appeal (Br. 9-10).

Citing to paragraph 33 of their Specification, Appellants further argue unexpected results. Appellants allege that rather than the tip velocity "intuitively" decreasing upon increasing the burner tip area, unexpectedly the velocity drop is mitigated "by the fact that raising tip flow area raises FGR [Flue Gas Recirculation]" (Br. 10). Appellants argue that this allegedly

unexpected result is "different in kind not merely different in degree" such that the discovery of an optimum or workable range imparts patentability to the claims (Br. 10).

Appellants also argue that there is no motivation to increase the burner tip area because doing so would be expected to decrease the tip velocity and result in operational instability of the burner (Br. 11). Appellants argue that using their claimed burner tip area results in a burner with no decrease in burner tip velocity due to the unexpected increase in Flue Gas Recirculation (FGR) (Br. 11). Appellants contend that any modification of the prior art to include Appellants' claimed burner tip area would require impermissible hindsight (Br. 11).

Appellants argue further that "[w]hen the prior art has not recognized the result effective capability of a particular invention parameter, no expectation would exist that optimizing that parameter would be successful" (Br. 11).

The Examiner responds that the facts of *Aller* may be reconciled with the factual scenario of the present appeal (Answer 8). As temperature and concentration are factors that affect the chemical process in *Aller*, nozzle shape and area similarly are factors that affect fluid flow in burner design (Answer 8). The Examiner concludes that "to provide the most effective nozzle and ports [for a burner] a skilled artisan needs to discover the optimum shape and area to attain the desired effect" (Answer 8).

The Examiner further contends that the main focus of Appellants' invention is the drawing of flue gases such that varying the shape and area of the nozzle and ports to affect flow naturally follows (Answer 8). The Examiner finds that Appellants merely adhere to a basic principle of fluid

dynamics: "varying velocity or volume of flow will affect the fluid's ability to draw other fluids" (Answer 9).

Regarding Appellants' allegation of unexpected results, the Examiner finds that Appellants failed to provide any evidence to support their allegation (Answer 9). The Examiner finds that the single sentence in paragraph 33 of the Specification is "simply insufficient to satisfy [A]ppellants' burden of proof" (Answer 9).

Moreover, the Examiner finds Appellants' statement in the Specification (i.e., "intuitively" tip velocity would decrease with an increase in burner port area) is incorrect (Answer 9). The Examiner states that many variables affect burner design and Appellants' statement regarding the relationship of tip area-to-tip velocity is an unsupported conclusion (Answer 9). The Examiner further determines that well known fluid dynamic principles indicate that increasing the volume of fluid flowing through a cross-sectional area in response to an increase in the cross-sectional area maintains a constant velocity and increases the induction capability of the fluid (i.e., the ability to draw other fluids) (Answer 10).

Regarding the reasonable expectation of success arguments, the Examiner contends that Fischer shows variation in both nozzles and ports in Figures 4-7 and venturi throat length in Figures 5, 7, and 8 (Answer 10). Moreover, the Examiner states that modification of various factors affecting fluid flow is "well known if not inherent in the art" (Answer 10). Based on this, the Examiner concludes that the variables affecting fluid flow would be known and thereby readily optimizable in accordance with the *Aller* decision (Answer 10).

Appellants counter that the *Manual of Patent Examining Procedure* (*MPEP*) § 2144.05 (Rev. 3 August 2005) regarding the optimization of ranges states that only result-effective variables may be optimized (Reply Br. 6). Appellants argue that because the prior art used in the rejection does not recognize burner tip area as a result-effective variable, the Examiner's contention regarding the obviousness of optimizing burner tip area is based on impermissible hindsight (Reply Br. 7).

Appellants further counter that their discovery that burner tip area may be increased without decreasing tip velocity is an unexpected result that is different in kind, not merely different in degree (Reply Br. 7-8). Appellants allege that surprisingly the expected decrease in tip velocity may be mitigated by increasing the Flue Gas Recirculation effect (Reply Br. 8).

Appellants further argue that the Examiner oversimplifies the combustion system in his application of fluid dynamic principles (Reply Br. 8). Appellants argue the Examiner fails to address how the volume would be increased in response to an increase in burner port area so as to maintain a constant tip velocity (Reply Br. 8). Appellants additionally reiterate the aforenoted arguments made in their Brief.

We agree with the Examiner's ultimate conclusion that claim 1 is unpatentable over Fischer.

Appellants argue that the prior art did not recognize burner port area as a result-effective variable. However, Fischer discloses that different size burner ports are used to guarantee "desired flame form" and to provide satisfactory control of the burner (Fischer 11). Thus, Fischer's teaching indicates a general desire in this art to manipulate burner port size, for

example, to control flame form and thereby evinces that burner port size is a result-effective variable.

Generally, it would have been obvious for an artisan with ordinary skill to develop workable or even optimum ranges for such art-recognized, result-effective parameters. *In re Woodruff*, 919 F.2d 1575, 1578, 16 USPQ2d 1934, 1936-1937 (Fed. Cir. 1990); *In re Boesch*, 617 F.2d 272, 276, 205 USPQ 215, 219 (CCPA 1980); *Aller*, 220 F.2d at 456, 105 USPQ at 235.

From the foregoing case law and based upon Fischer's recognition that burner port size is a result-effective variable, it would have been obvious to optimize or achieve a workable range of burner port areas to control, for example, flame form.

We note that Appellants' claim requires that the "total area of the main ports" in the external surface of the burner is "at least 1 square inch per million (MM) Btu/hr burner capacity." In this regard, Appellants disclose in paragraph [0032] of their Specification that a conventional burner port area is 5.8 in^2 for a burner capacity of 6.0 million Btu/hr. Dividing the burner port area by the burner capacity, we calculate a burner port area of .966 in^2 per (MM) Btu/hr. Therefore, Appellants implicitly admit that about .97 in^2 per (MM) Btu/hr is a conventional burner port area.

Generally, to establish a prima facie case of obviousness under § 103, there must be some teaching, suggestion, and/or motivation in the applied prior art taken as a whole and/or knowledge generally available to a person having ordinary skill in the art, which would have led that person to the claimed invention, without any recourse to the teachings in an applicant's disclosure. *See e.g.*, *Pro-Mold & Tool Co. v. Great Lakes Plastics, Inc.*, 75

F.3d 1568, 1573, 37 USPQ2d 1626, 1629-1630 (Fed. Cir. 1996). The knowledge generally available to a person having ordinary skill in the art includes facts admittedly well known in the art. *In re Nomiya*, 509 F.2d 566, 570-71, 184 USPQ 607, 611-12 (CCPA 1975) (The admitted prior art in the Appellants' Specification may be used in determining the patentability of a claimed invention.); *See also*, *In re Davis*, 305 F.2d 501, 503, 134 USPQ 256, 258 (CCPA 1962).

Based upon the foregoing case law, it is appropriate to use Appellants' admission that a conventional burner port area is about .97 in^2 per (MM) Btu/hr in assessing the patentability of the claims. *Nomiya* 509 F.2d at 570-71, 184 USPQ at 611-12. That is, Appellants' admission of conventional burner port area is knowledge that would have been generally available to a person having ordinary skill in the art. *Pro-Mold*, 75 F.3d at 1573, 37 USPQ2d at 1629-30.

The closeness of Appellants' claimed burner port area of 1.0 in^2 per (MM) Btu/hr to the conventional burner port area of about .97 in^2 per (MM) Btu/hr supports a conclusion that the conventional about .97 in^2 per (MM) Btu/hr area would have suggested a 1.0 in^2 per (MM) Btu/hr area based on a reasonable expectation that the desired results (e.g., control of flame form) provided by the former also would be provided by the latter. *See*, *Titanium Metals Corp. v. Banner*, 778 F.2d 775, 783, 227 USPQ 773, 779 (Fed. Cir. 1985) (explaining that a claimed alloy having 0.3% Mo and 0.8% Ni was prima facie obvious over a Russian reference disclosing two examples having 0.25% Mo and 0.75% Ni, and 0.31% Mo and 0.94% Ni, respectively, because the claimed values were "so close" to the reference values the claimed alloy could reasonably be expected to have the same characteristics

as the reference alloy). Stated differently, it would have been obvious to develop a workable range for the art-recognized, result-effective variable of burner port area, and the Appellants' admission that about .97 in^2 per (MM) Btu/hr is a conventional burner port area reasonably supports the proposition that a similar area of 1.0 in^2 per (MM) Btu/hr would be within the aforementioned workable range.

We are not persuaded by Appellants' argument regarding lack of motivation to increase burner port size because of the alleged burner instability that would accompany the increase. As we discussed above, there are a number of reasons for manipulating the burner port size (e.g., flame form, flame size, etc.). An artisan would have recognized that any adjustment (i.e., increase or decrease) in burner port area would obviously require manipulation of the various other features of the burner to maintain a stable burner operation. Regardless of the reason for increasing the burner port area, the motivation for doing so need not be the same as Appellants' motivation (i.e., to increase FGR). *In re Kemps*, 97 F.3d 1427, 1430, 40 USPQ2d 1309, 1311 (Fed. Cir. 1996) (Although the motivation to combine here differs from that of the applicant, the motivation in the prior art to combine the references does not have to be identical to that of the applicant to establish obviousness.); *see also*, *In re Beattie*, 974 F.2d 1309, 1312, 24 USPQ2d 1040, 1042 (Fed. Cir. 1992).

Moreover, we are not persuaded by Appellants' argument that there would have been no reasonable expectation of success with respect to increasing Fischer's burner port area because the art has not recognized burner port area as a result-effective variable. As we found above, Fischer demonstrates that burner port area is a result-effective variable in this art.

Because burner port area is a result effective variable, it is reasonable to expect success in developing workable or optimized burner port areas.

Appellants cite to a non-precedential Board decision, *Ex parte Sullivan* 2003 WL 23014513 (Bd. Pat. App. & Interf.), to support their argument that *Aller* is not applicable to the facts of the present appeal. The *Sullivan* decision does not support the Appellants' position in the present appeal for two reasons. First, it is a non-precedential decision that is not binding on the Board.[1] Second, the facts in *Sullivan* are inapposite to the facts of the present appeal. As we determined above, burner port size is an art recognized, result-effective variable. As such, it would have been prima facie obvious to develop workable values for this variable. *Woodruff*, 919 F.2d at 1578, 16 USPQ2d at 1936-1937; *Boesch*, 617 F.2d at 276, 205 USPQ at 219; *Aller*, 220 F.2d at 456, 105 USPQ at 235.

Appellants allege the following statement shows unexpected results: "Intuitively, it would be expected that raising the tip flow area would proportionally reduce tip velocity, but instead, it is found that the drop in velocity can be mitigated by the fact that raising tip flow area raises FGR" (Specification, ¶ [0033]). Regarding this allegation, we agree with the Examiner's analysis in the Answer.

Under the circumstances of this appeal, Appellants' single sentence statement in the Specification, without more, is not sufficient to prove unexpected results. Appellants' quoted statement above provides no express statement of unexpected results and fails to explain why the increase in FGR in response to an increase in burner port area is unexpected. Additionally,

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[1] *See*, Board of Patent Appeals and Interferences Standard Operating Procedure 2: Publication of Opinions and Binding Precedent § VII(F) (August 10, 2005, Rev. 6).

Appellants provide no indication of why the results are different than what would be expected. Rather, as the Examiner explained in his Answer, Appellants' allegedly unexpected result appears to be nothing more than the application of basic fluid dynamic principles.

Furthermore the allegation of unexpected results is not commensurate with the scope of the claims. The claims require a minimum burner port area (i.e., at least 1.0 in^2 per (MM) Btu/hr), whereas the quoted sentence does not include such a minimum area. Accordingly, we are not convinced that Appellants' "unexpected results" overcome the prima facie case of obviousness set forth by the Examiner.

We affirm the § 103(a) rejection over Fischer.

§ 103(a) REJECTION OVER DINICOLANTONIO

The Examiner also rejected claim 1 over Dinicolantonio. The Examiner stated that Dinicolantonio teaches all aspects of claim 1, except for the "claimed total area of the main ports" (Answer 5). Citing to *In re Aller*, 220 F.2d 454, 456, 105 USPQ 233, 235 (CCPA 1955), the Examiner concluded that it would have been obvious to combine the claimed total area of the main ports with Dinicolantonio "since it has been held that where the general conditions of a claim are disclosed in the prior art, discovering the optimum or workable ranges involves only routine skill in the art" (Answer 5-6).

The Appellants make the same arguments with regard to the rejection over Dinicolantonio that they made with regard to the rejection over Fischer. Since we have determined that burner port size is a result-effective variable

in the burner art, we are similarly unpersuaded by Appellants' arguments for the reasons discussed above.

We affirm the § 103(a) rejection over Dinicolantonio.

§ 103(a) REJECTION OVER DINICOLANTONIO IN VIEW OF NEWBY

The Examiner rejected claims 3 and 11 over Dinicolantonio in view of Newby (Answer 6). The Examiner stated that Dinicolantonio fails to teach a flat flame burner (Answer 6). Newby was cited to teach a flat flame burner to reduce NOx emissions (Answer 6). The Examiner concluded that it would have been obvious to combine Newby's flat flame burner with Dinicolantonio's burner in order to reduce NOx emissions (Answer 6).

Appellants argue that Newby does not cure the deficiencies (i.e., the total main port area being at least 1.0 in^2 per (MM) Btu/hr) of the Dinicolantonio reference (Br. 15). Appellants also argue that "there is nothing to suggest that it would be desirable to modify the teachings of Dinicolantonio by the teachings of Newby" (i.e., lack of motivation to combine) (Br. 15).

The Examiner responds that Dinicolantonio does not have the deficiency (i.e., total main port area) that would require Newby to remedy such deficiency (Answer 10). Moreover, the Examiner states that motivation for the combination is clearly delineated in the Newby reference (i.e., reduce NOx emissions) (Answer 11).

We agree with the Examiner's ultimate determination that claims 3 and 11 are unpatentable over Dinicolantonio in view of Newby.

Newby is applied by the Examiner for his teaching of using a flat-flame burner (Answer 6), not for using burner port holes having the claimed

area. Moreover, motivation for the combination of Newby's flat flame burner with Dinicolantonio's burner assembly is provided by Newby, that is, to reduce NOx emissions (Newby col. 1, ll. 48-51).

We affirm the § 103(a) rejection over Dinicolantonio in view of Newby.

§ 103(a) REJECTION OVER DINICOLANTONIO IN VIEW OF JOHNSON

The Examiner rejected claims 11-13 and 21-23 over Dinicolantonio in view of Johnson. The Examiner stated that Dinicolantonio teaches "substantially all of the claimed limitations, but fail[ed] to specifically require adding steam to the burner" (Answer 6). The Examiner found that Johnson teaches adding steam to a burner to dilute the oxygen concentration in the burner thereby reducing NOx emissions (Answer 7). The Examiner concluded that it would have been obvious to have combined Johnson's steam injection into Dinicolantonio burner in order to "reduce NOx emissions" (Answer 7).

Appellants argue that Johnson does not cure the deficiencies (i.e., the total main port area being at least 1.0 in^2 per (MM) Btu/hr) of the Dinicolantonio reference (Br. 17). Appellants also argue lack of motivation for combining Johnson's steam injection with Dinicolantonio's burner assembly (Br. 17).

The Examiner responds that Dinicolantonio does not have the deficiency (i.e., total main port area) that would require Johnson to remedy such deficiency (Answer 10). Moreover, the Examiner states that

motivation for the combination is clearly delineated in the Johnson reference (i.e., reduction in NOx emissions) (Answer 11).

We agree with the Examiner's ultimate determination that claims 11-13 and 21-23 are unpatentable over Dinicolantonio in view of Johnson.

Johnson is applied by the Examiner for his teaching of using steam injection in a burner (Answer 6-7), not for using burner port holes having the claimed area. Moreover, motivation of the combination of Johnson's steam injection with Dinicolantonio's burner assembly is provided by Johnson, that is, to reduce NOx emissions (Johnson col. 1, ll. 53-58).

We affirm the § 103(a) rejection over Dinicolantonio in view of Johnson.

§ 103(a) REJECTION OVER DINICOLANTONIO IN VIEW OF FERGUSON

The Examiner rejected claims 11-13 and 21-23 over Dinicolantonio in view of Ferguson. The Examiner stated that Dinicolantonio teaches "substantially all of the claimed limitations, but fails to specifically require adding steam to the burner" (Answer 7). The Examiner found that Ferguson teaches adding steam to a burner to facilitate the drawing of flue gases through an opening and the flue gas recirculation passageway (Answer 7). The Examiner concluded that it would have been obvious to have combined Ferguson's steam injection into Dinicolantonio burner in order to "provide for heating and atomizing fuel" (Answer 7).

Appellants argue that Ferguson does not cure the deficiencies (i.e., the total main port area being at least 1.0 in^2 per (MM) Btu/hr) of the

Dinicolantonio reference (Br. 19). Appellants also argue that Ferguson's steam injection point is in the flue gas recirculation duct which is "inconsistent with Appellant's claimed invention" (Br. 18). Appellants further argue lack of motivation for combining Ferguson's steam injection with Dinicolantonio's burner assembly (Br. 17).

The Examiner responds that Dinicolantonio does not have the deficiency (i.e., total main port area) that would require Ferguson to remedy such deficiency (Answer 10). Moreover, the Examiner states that motivation for the combination is clearly delineated in the Ferguson reference (i.e., to heat and atomize the fuel) (Answer 11).

We agree with the Examiner's ultimate determination that claims 11-13 and 21-23 are unpatentable over Dinicolantonio in view of Ferguson.

Ferguson is applied by the Examiner for his teaching of using steam injection in a burner (Answer 7), not for using burner port holes having the claimed area. Moreover, motivation for the combination of Ferguson's steam injection with Dinicolantonio's burner assembly is provided by Ferguson, that is, to atomize the fuel and drawing gases into the burner (Ferguson col. 1, ll. 41-47).

We are not persuaded by Appellants' argument that Ferguson's steam injection location is inconsistent with the claims. Claims 11-13 require that the "steam tubes" terminate "adjacent the upstream end of said burner tube for introducing steam into said burner tube." In examining Ferguson's Figure 2, we find that steam jet 48 is "adjacent" to the burner head 39. Moreover, we find that in order for the steam to perform its atomizing function for the fuel, the steam jet 48 would need to be located in relative proximity (i.e., "adjacent") to the burner port 39.

Claims 21-22 require a "step of injecting steam into the burner tube to mix with the fuel and air, flue gas or mixtures thereof upstream of said zone of combustion." Claim 23, which depends on claim 17, only requires that the furnace be a "steam-cracking" furnace. These method claims are silent regarding the positioning of the steam injection port in the burner. The recited step of "injecting steam into the burner" does not require that the steam be "directly" injected into the burner. Indirect injection of the steam, as in Ferguson, would suffice to meet claims 21-23.

We affirm the § 103(a) rejection over Dinicolantonio in view of Ferguson.

CONCLUSION

We have affirmed the § 103(a) rejection of claims 1-12 and 16-25 over Fischer.

We have affirmed the § 103(a) rejection of claims 1, 2, 4-10, 14-20, 24 and 25 over Dinicolantonio.

We have affirmed the § 103(a) rejection of claims 3 and 11 over Dinicolantonio in view of Newby.

We have affirmed the § 103(a) rejection of claims 11-13 and 21-23 over Dinicolantonio in view of Johnson.

We have affirmed the § 103(a) rejection of claims 11-13 and 21-23 over Dinicolantonio in view of Ferguson.

The decision of the Examiner 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).

AFFIRMED

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