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UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

Ex parte MICHAEL D. DAVIS, DAREL R. CLARK,
JOHN W. VAN BERGEN, and ANTHONY PUGH

Appeal 2011-011549
Application 11/159,924
Technology Center 3600

Before PHILLIP J. KAUFFMAN, BARRY L. GROSSMAN, and
BART A. GERSTENBLITH, *Administrative Patent Judges*.

GERSTENBLITH, *Administrative Patent Judge*.

DECISION ON APPEAL

STATEMENT OF THE CASE

Michael D. Davis et al. ("Appellants") appeal under 35 U.S.C. § 134 from the Examiner's decision rejecting claims 4, 5, and 7-26.[1] We have jurisdiction under 35 U.S.C. § 6(b).

Claimed Subject Matter

Claims 4, 10, and 13 are the independent claims on appeal. Claim 4 is illustrative of the claimed subject matter and is reproduced below.

> 4. A method to calculate shape deviations of a fuel channel of a boiling water reactor with a device that has a structure for supporting a fuel channel and imparting acoustic energy from an array of transducers supported by the structure, the device further having a pulse generator to send a pulse to the transducers and a computer to calculate a total time of flight of acoustic energy and distances of the pulses, the channel surrounded by a fluid with a temperature and a salinity, the method comprising:
>
> providing the structure for supporting the fuel channel, the structure disposed around all sides of the fuel channel and extending the length of the channel, the array of transducers positioned along the length of the structure at a plurality of elevations, transducers at each elevation positioned on each side of the structure;
>
> stabilizing the fuel channel at a plurality of positions along the length of the structure, thereby maintaining the fuel channel in a constant position in the structure;
>
> generating a pulse with the pulse generator and simultaneously sending the pulse to the array of transducers, each transducer:
>
> converting the pulse to acoustic energy,
>
> imparting acoustic energy onto the fuel channel,
>
> receiving acoustic energy echoing from the fuel channel,
>
> converting the echoing acoustic energy into an electrical signal, and sending the electrical signal to the computer;

[1] Claims 1-3 and 6 were cancelled. App. Br. 2.

calculating the total time of flight of the acoustic energy with the computer;

calculating a total distance between each transducer and the fuel channel based on the calculated total time of flight of the acoustic energy with the computer; and

comparing the calculated total distance for each transducer to a standard fuel channel, wherein the shape deviations over the length of the channel are determined.

App. Br., Claims App'x 1.

References

The Examiner relies upon the following prior art references:

Scharpenberg	US 4,847,037	Jul. 11, 1989
McClelland	US 5,661,766	Aug. 26, 1997
Beier	US 6,549,600 B1	Apr. 15, 2003
Nakayasu[2]	Doc. No. S60-195412	Oct. 3, 1985

Rejection

Appellants seek review of the following rejection:

I. Claims 4, 5, and 7-26 are rejected under 35 U.S.C. § 103(a) as unpatentable over Beier, McClelland, Nakayasu, and Scharpenberg.

SUMMARY OF DECISION

We AFFIRM.

[2] Nakayasu refers to the English translation, PTO 06-3834, of Japanese Patent Document, Document Number S60-195412, titled "Contour Dimension Measurement Method for a Vacillating Channel Box" translated by Schreiber Translations, Inc. (dated Apr. 2006). *See* Ans. 3.

OPINION

The Examiner concluded that the combination of Beier, McClelland, Nakayasu, and Scharpenberg would have rendered the subject matter of claims 4, 5, and 7-26 obvious to one of ordinary skill in the art at the time of invention. Ans. 3-22. The entirety of the Examiner's findings are not repeated here, but with respect to Appellants' main contentions, the Examiner found that Beier substantially discloses the claimed invention, but does not disclose transducers located on each side of the structure supporting the fuel channel. *Id.* at 5. The Examiner found that McClelland discloses a method and device for ultrasonic inspecting of a fuel element in a nuclear reactor, including positioning transducers on each side of the fuel channel. *Id.* (citing McClelland, figs. 1, 2). The Examiner determined that it would have been obvious to one of ordinary skill in the art to

> include the teaching of McClelland to improve a detection system such as that of Beier et al as an application of a general rule of the desirability to increase spatial resolution of measurement; in the instant case so as to locate a similar array of transducers-detectors around and opposite sides of said fuel channel for the production of reflected signals from other sides of the fuel channel and to recalculate a panoramic image of [the] channel with good spatial resolution.

Id. at 5-6. The Examiner also determined that Beier motivates including transducers on each side of the fuel channel because Beier "teach[es] that it is possible and that it is their aim to measure at least the maximum width of the spacer with a measuring error of less than 20 micrometer[s]." *Id.* at 6 (citing Beier, Abstract). Thus, the Examiner found that "[f]or fast production of such high accuracy [it] is useful to have a parallel operation of [a] plurality of transducers receivers around the fuel channel." *Id.*

Additionally, the Examiner found that "to supplement the transducers US with additional transducers only a minor variation of relative distances of calibration rods to the fuel channel would at most be required," and thus concluded that the "combination of Beier et al with the teaching by McClelland et al is straightforward and has reasonable expectation of success." *Id.*

Appellants do not separately argue claims 4, 5, and 7-26. *See* App. Br. 7-20; Reply Br. 1-11. We select claim 4 as representative. Accordingly, claims 5 and 7-26 stand or fall with claim 4. *See* 37 C.F.R. § 41.37(c)(1)(vii) (2011); *see also In re Lovin*, 652 F.3d 1349, 1351 (Fed. Cir. 2011).

Appellants raise four arguments in response to this rejection: (1) modifying Beier will impermissibly change its principle of operation (App. Br. 7-17; Reply Br. 3-10); (2) Beier does not disclose a method to calculate shape deviations of a fuel channel (App. Br. 10; Reply Br. 1-3); (3) Beier's combination with Scharpenberg will prevent Beier from functioning in the manner intended (App. Br. 18-19); and (4) the cited references fail to provide any reason to combine or modify the teachings of the references to obtain the claimed invention and fail to provide a reasonable expectation of success (*id.* at 19). We address each.

Beier's Principle of Operation

Appellants' main argument is premised upon two contentions: (1) modifying Beier to provide additional ultrasonic probes (transducers) at the same elevation as probes US1, US2, US3, US1B, US2B, and US3B is not possible without the removal of the calibration rods, and (2) such modification is impermissible because removal of the calibration rods would

change the principle of operation of Beier's device. *See* App. Br. 7-16; *see also id.* at 17 (indicating that changing the position of the calibration rods such that transducers are either behind the rods or between the rods and the fuel channel will not allow Beier's device to function properly).

A change in the principle of operation of the primary reference can, in some circumstances, render a modification nonobvious. For example, a modification suggested by an examiner was considered to be nonobvious where the modification (1) necessitated a substantial reconstruction of the primary reference, and (2) changed the basic principles under which the primary reference was designed to operate. *In re Ratti*, 270 F.2d 810, 811-13 (CCPA 1959) ("This suggested combination of references would require a substantial reconstruction and redesign of the elements shown in [the primary reference] as well as a change in the *basic principles* under which the [primary reference] construction was designed to operate." (emphasis added)).

Beier is directed to a method and device for inspecting a fuel element in a nuclear reactor. Beier, col. 1, ll. 8-9. Beier explains:

> Such a fuel element includes a bundle of fuel rods. At one end of the fuel rods is a head part, and at the other end a foot part. Situated between the head and foot parts are spacers disposed above another at axial spacings. Fuel elements in boiling water reactors are usually further surrounded by boxes.

Id. at col. 1, ll. 9-14. Because "[w]ear phenomena and damage to the fuel elements can occur during operation of the reactor" (*id.* at col. 1, ll. 23-24), Beier desires to provide a method and device to detect changes in a fuel element in a simple way (*id.* at col. 1, ll. 66-67). Beier further explains:

> The invention is based on the finding that changes which are caused by the growth in the individual components of the

> fuel element, and other dimensional changes, for example bowing, bending and twisting of fuel element structural parts (such as spacers and fuel element boxes), impair the functionality and are therefore to be detected during inspection and measured.

Id. at col. 4, ll. 31-37.

Beier employs "ultrasonic probes US" that are "directed partly toward the left-hand or right-hand outer surface of the spacer, and partly also toward the end faces of a calibration rod CS of known length d_o." *Id.* at col. 9, ll. 5-8; figs. 1, 2. The ultrasonic probes "emit ultrasonic pulses which are reflected at the outer surfaces of the spacer or the end faces of the calibration rod CS." *Id.* at col. 9, ll. 8-10. Beier describes the following with respect to Figure 2:

> it may be seen that the three ultrasonic probes US1, US2, and US3 at three measuring points on the left-hand outer surface FSA of the spacer FS measure the spacing of this spacer from the corresponding, left-hand measuring arm MA. The outer ultrasonic probes US4 and US5, by contrast, measure the spacing of the end faces CA or CA' of the corresponding calibration rod CS or CS' extending from left to right. The spacings between these end faces CA and CA', on the one hand, and the measuring probes US4 and US5 differ, but are known, and so these two probes US4 and US5 supply two calibration points for the relationship between the propagation time of the ultrasonic echo and the arc covered.

Id. at col. 9, ll. 24-37. "Corresponding probes US1B to US5B are situated opposite the probes US1 to US5 on the right-hand arm MB," and function in the same way as probes US1 to US5 for measuring three points on the opposite outer face FSB of the spacer and two calibration points on the corresponding end faces of CB, CB' of the calibration rods. *Id.* at col. 9, ll. 28-43. Beier also discloses that "[i]n the same way, in the plane lying

therebelow, in which the ultrasonic probes US' shown in FIG.1 are situated, three measuring points and two calibration points are formed in each case for the two other mutually opposite sides of the spacer." *Id.* at col. 9, ll. 49-53.

As noted above, Appellants' main argument is premised on the notion that the Examiner's proposed combination requires removal of Beier's calibration rods. *See* App. Br. 7-17; Reply Br. 3-10. The Examiner's proposed combination, however, does not require removal of the calibration rods. Although the Examiner provided several counterarguments in response to Appellants' position, the following finding by the Examiner is particularly persuasive: "(b) the function of the calibration rods CS only involves their measurement through said additional ultrasonic probes US4 through US5B, for which the coordinate of the longitudinal axis of said calibration rods in the lateral direction perpendicular to their longitudinal axes is entirely irrelevant." Ans. 24-25. Appellants interpret this statement as "the Examiner tak[ing] the position that the control rods, CS, disclosed by Beier and the disclosed calibration measurements using those control rods is immaterial and irrelevant to the method of inspecting a fuel assembly disclosed by Beier." Reply Br. 3.

We disagree. This particular finding by the Examiner does not suggest that the calibration rods and calibration are immaterial or irrelevant to Beier's method; rather, the Examiner explained that it is the coordinate of the longitudinal axes of the calibration rods in the lateral direction perpendicular to their longitudinal axes that is irrelevant. In other words, the distance between the calibration rods and the outer surface of the spacer is not disclosed as being so sacrosanct in Beier that the calibration rods cannot

be repositioned further away from the outer surface of the spacer and still perform their calibration function. Of course, the ultrasonic probes US4, US5, US4B, and US5B would also be repositioned to align with the repositioned calibration rods. And, Appellants have not convincingly asserted that such repositioning is beyond the level of skill of one of ordinary skill in the art.[3]

Further, Appellants have not persuasively explained why such modification would change Beier's principal of operation when Beier discloses that "[t]he most important variables for assessing the relevant spacer (here: the third spacer, 'spacer **3**') is the maximum spacing Δmax between opposite outer surfaces." Beier, col. 10, ll. 4-6; *see also id.* at col. 10, ll. 20-23 (explaining that the x-coordinate C(x) or y-coordinate C(y) of the center point C is another interesting variable). In other words Appellants have not explained why repositioning the calibration rods as proposed by the Examiner's combination would render Beier unable to calculate these variables and hence change its principle of operation. Nor have we been able to find any importance attributed by Beier to the distance between the calibration rods and the outer surface of the spacer such that an alteration of that distance would result in changing Beier's principle of operation. Thus, altering the distance between the rods and the outer surface of the spacer is not changing a "basic principle" under which Beier was designed to operate such that the Examiner's proposed modification would

[3] Nor do we see why adding means to calibrate the additional probes added by the Examiner's combination, such as adding calibration rods, is beyond the level of one of ordinary skill in the art or why additional calibration rods would alter Beier's principle of operation. *Contra* Reply Br. 11.

not have been obvious to one of ordinary skill in the art at the time of invention. *See Ratti*, 270 F.2d at 813.

Appellants also contend that McClelland, Nakayasu, and Scharpenberg do not teach how to modify Beier to obtain the presently claimed invention without removing the calibration rods, which Appellants assert are an essential element of Beier's device. *See* App. Br. 17 (discussing McClelland), 17-18 (discussing Nakayasu), 19 (discussing Scharpenberg in this context). As we explained above, however, the Examiner's proposed combination does not require removal of the calibration rods. Accordingly, Appellants' arguments that McClelland, Nakayasu, and Scharpenberg do not teach how to modify Beier in this regard are not persuasive.

Method to Calculate Shape Deviations of a Fuel Channel

Appellants also contend that while their claims are directed to calculating shape deviations of a "fuel channel," Beier discloses a method and apparatus for inspecting a "fuel element." Reply Br. 1; *see* App. Br. 10. Appellants assert that a "fuel channel encloses a fuel element in a boiling water reactor, and directs coolant up through the fuel assembly." Reply Br. 3. Appellants explain that Beier discloses removing the fuel channel (which Appellants correctly note that Beier refers to as a "box" or "lateral box") prior to inspection of the fuel element and thus "substantially teaches away from using the disclosed method to perform any type of inspection or measurement of a fuel channel." *Id.* Thus, Appellants contend that Beier does not disclose a method to calculate shape deviations of a fuel channel of a boiling water reactor as claimed. *Id.*

We agree with Appellants that Beier is *generally* directed to inspecting a fuel element of a boiling water reactor. *See, e.g.*, Beier, col. 8, ll. 29-31 ("Referring now to the figures of the drawings in detail and first, particularly, to FIG. 1 thereof, there is shown how a fuel element FA of a boiling-water reactor is inspected."). Beier's method of inspection, however, is not limited to fuel elements; rather, Beier explicitly states that the disclosed measuring device "can be used, for example, to measure the *boxes* and the spacers in the case of boiling-water fuel elements." Beier, col. 11, ll. 49-51 (emphasis added). Further, Beier explains that it is not only changes in the fuel element, but also changes in the boxes that impair the functionality of boiling water reactors and thus should be detected during inspection and measured. *Id.* at col. 4, ll. 31-37 ("The invention is based on the finding that changes which are caused by the growth in the individual components of the fuel element, *and other dimensional changes, for example bowing, bending and twisting of fuel element structural parts (such as* spacers and *fuel element boxes*), impair the functionality and are therefore to be detected during inspection and measured." (emphases added)).

Accordingly, Appellants' argument—that Beier does not disclose a method to calculate shape deviations of a fuel channel of a boiling water reactor—is not persuasive.

Beier's Combination with Scharpenberg

Appellants also assert that the Examiner's reliance upon combining Scharpenberg's disclosure of supports using bars 25 at each level of inspection 16, 17, and 18, with Beier is improper. App. Br. 18-19; *see* Ans. 7-8. Specifically, Appellants contend that such combination would also require the use of Scharpenberg's support shafts 19 at each inspection

level. *Id.* at 18. Appellants assert that Scharpenberg's support shaft and bars would prevent movement of Beier's positioning device and thus "prevent the device from functioning in the manner intended by Beier." *Id.* at 19.

Appellants' argument assumes a finding by the Examiner that is not specifically stated in the rejection as forming the basis for the combination of the teachings of the references and is not commensurate in scope with the claim language. Claim 4 does not require stabilizing the fuel channels at the positions of inspection; rather, it broadly recites "stabilizing the fuel channel at a plurality of positions *along the length of the structure.*" App. Br., Claims App'x 1 (emphasis added). Nor was the rejection premised upon using bars 25 at each level of inspection. Rather, the Examiner found that Scharpenberg's use of bars 25 at each level of inspection, discloses "locat[ing] the support systems in different elevation positions of said fuel channel for the fuel channel position stabilization and improving an accuracy of measurements." Ans. 8; *see also id.* at 28 (noting that it is not necessary to provide support shafts 19 exactly at the inspection levels because nothing in the claim language so requires).

Accordingly, Appellants' argument is not persuasive.

Reason to Combine/Reasonable Expectation of Success

Appellants assert that the cited prior art references "fail to provide any reason for one of ordinary skill in the art to combine and/or modify the teachings of the cited prior art references to obtain the claimed invention." App. Br. 19. Appellants similarly contend that the cited references "also fail to provide one of ordinary skill in the art with a reasonable expectation of

success without resort to a hindsight reconstruction of the presently claimed method." *Id.*

First, motivation need not be based on an explicit teaching in a particular prior art reference. *See, e.g.*, *KSR Int'l Co. v. Teleflex Inc.*, 550 U.S. 398, 418 (2007) (noting that "the analysis need not seek out precise teachings directed to the specific subject matter of the challenged claims, for a court can take account of the inferences and creative steps that a person of ordinary skill would employ"); *see also DyStar Textilfarben GmbH & Co. Deutschland KG v. C.H. Patrick Co.*, 464 F.3d 1356, 1365-66 (Fed. Cir. 2006) (noting that an explicit teaching to combine "need *not* be found in the prior art references themselves"); *Alza Corp. v. Mylan Labs., Inc.*, 464 F.3d 1286, 1291 (Fed. Cir. 2006) ("There is flexibility in our obviousness jurisprudence because a motivation may be found *implicitly* in the prior art. We do not have a rigid test that requires an actual teaching to combine . . . ."). Second, contrary to Appellants' argument, the Examiner explained why one of ordinary skill in the art would have combined the references relied upon and provided reasons with rational underpinnings for each combination. *See* Ans. 5-8. Appellants have not attempted to explain why those reasons are insufficient or why one of ordinary skill in the art would not have a reasonable expectation of success in light of the Examiner's detailed explanation and analysis.

Accordingly, we do not find Appellants' bare assertions persuasive.

DECISION

We AFFIRM the Examiner's decision rejecting claims 4, 5, and 7-26.

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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