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UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

Ex parte ALASTAIR SIMPSON

Appeal 2020-000541
Application 15/592,721
Technology Center 3900

Before MICHELLE R. OSINSKI, JILL D. HILL, and CYNTHIA L. MURPHY, *Administrative Patent Judges.*

HILL, *Administrative Patent Judge.*

DECISION ON APPEAL

STATEMENT OF THE CASE

Pursuant to 35 U.S.C. § 134(a), Appellant[1] appeals from the Examiner's decision to reject claims 1, 2, 4, 18–20, 22, 24, 25, and 35. We have jurisdiction under 35 U.S.C. § 6(b).

We REVERSE.

[1] We use the word Appellant to refer to "applicant" as defined in 37 C.F.R. § 1.42. Appellant identifies the real party in interest as HiVis Pump AS. Appeal Br. 2.

BACKGROUND

Independent claims 1 (apparatus) and 35 (method) are pending. Claim 1, reproduced below with certain limitations italicized, represents the claimed subject matter:

> 1. A pump assembly for use with a high viscosity or multiphase hydrocarbon fluid comprising:
>
> a stator having an internal surface of constant diameter and one or more stator vanes extending from the internal surface to a constant stator vane radial height along a length of the stator; and
>
> a rotor having an external surface of constant diameter and one or more rotor vanes extending from the external surface to a constant rotor vane radial height along a length of the rotor,
>
> wherein the one or more stator vanes have an opposite handed thread with respect to a thread of the one or more rotor vanes, wherein the stator and rotor cooperate to, on rotation of the rotor, move the high viscosity or multiphase hydrocarbon fluid longitudinally between the stator and the rotor, wherein a radial gap, having a gap width in the range of greater than 0.254 mm to 10 mm, is located between the constant stator vane radial height and the constant rotor vane radial height along a length of the pump assembly, wherein *the constant rotor vane radial height is greater than the constant stator vane radial height, and a ratio of the constant rotor vane radial height to the constant stator vane radial height has a constant value in the range of 3.5 to 4.5 along the length of the pump assembly*,
>
> a helix formed by the one or more rotor vanes has a mean lead angle (α) that is greater than 60° but less than 90°, and a helix formed by the one or more stator vanes has a mean lead angle (β) that is greater than 60° but less than 90°,
>
> the one or more stator vanes further comprises a stator vane thickness, and the one or more rotor vane further comprises a rotor vane thickness, and the stator vane thickness is greater than the rotor vane thickness along the length of the pump assembly.

Support for Appellant's rotor vane height ratio limitation can be found in Appellant's Specification, as follows:

> Most preferably a height of the one or more rotor vanes is greater than a height of the one or more stator vanes. A ratio of the rotor vane height to stator vane height may be in the range of 1.1 to 20. Preferably the ratio of the rotor vane height to the stator vane height is in the range 3.5 to 4.5. In a preferred embodiment the ratio of the rotor vane height to the 25 stator vane height is 4.2.

Spec. 4:19–25.

> FIG. 9(c) presents the performance curve for a rotor vane height 24 to stator vane height 26 ratio equal to 4.2. Surprisingly, the gradient of the water curve and the 5,000 cp viscosity fluid are equal. With such an arrangement the performance of the pump assembly 1 is effectively independent of the viscosity of the fluid being pumped. Extensive testing has confirmed that this effect is provided when the rotor vane height 24 to stator vane height 26 ratio is 3.5 to 4.5 and it is anticipated that this effect will be maintained for even greater ratio values.

Spec. 11:39–48.

REFERENCES

The prior art relied upon by the Examiner is:

Name	Reference	Date
Desgoffe	US 551,852	Dec. 24, 1895
McCoskey	US 589,532	Sept. 7, 1897
Zalis	US 3,841,805	Oct. 15, 1974
Cameron	US 5,275,238	Jan. 4, 1994
Simpson	WO 99/27256 A1	June 3, 1999
Nistor	US 6,041,855	Mar. 28, 2000

REJECTIONS

I. Claims 1, 2, 4, 19, 20, 22, and 35 stand rejected under 35 U.S.C. 103(a) as unpatentable over Simpson, McCoskey, Desgoffe, and Cameron. Final Act. 3.

II. Claim 18 stands rejected under 35 U.S.C. § 103(a) as unpatentable over Simpson, McCoskey, Desgoffe, Cameron, and Nistor. Final Act. 7.

III. Claims 24 and 25 stand rejected under 35 U.S.C. § 103(a) as unpatentable over Simpson, McCoskey, Desgoffe, Cameron, and Zalis. Final Act. 8.

ANALYSIS

Rejection I

The Examiner finds, *inter alia,* that Simpson discloses a pump assembly comprising a stator 11 with a stator vane thread having a constant radial height and a thickness, and a rotor 10 with a rotor vane thread having a constant radial height and a thickness that is less than the stator vane thickness. Final Act. 3–4. The Examiner then finds that Simpson does not disclose its rotor vane radial height being greater than its stator vane radial height, or a radial height ratio range of 3.5 to 4.5. *Id.* at 4. The Examiner determines, however, that Simpson teaches the selection of vane parameters being "an obvious design choice which depends upon the desired performance of the pump." *Id*. (citing Simpson 5:8–15 ("performance of a pump is affected by the cross-sectional area of the threads or grooves, their pitch or helix angle, and the overall length of the rotor within the stator. Generally, the greater the cross-section and the steeper the pitch, the greater

the volume.")). Similarly, the Examiner contends that selection of "specific vane heights would have been obvious choices to be made, and would depend upon the desired pump performance relative to fluid being pumped, as suggested in Simpson." *Id.* (citing Simpson 1:6–14; 11:32–12:8).

We note that while vane radial height may dictate a vane's cross-sectional area, which Simpson appreciates effects pump performance, the "vane parameters" contemplated by Simpson as effecting pump performance are not relative vane parameters such as the claimed vane radial height ratio.

Regarding vane height specifically, the Examiner finds that McCoskey teaches that (1) a skilled artisan "would appreciate the implementation of a rotor vane 18 height that is significantly greater than a stator vane 3 height" when pumping a fluid vertically, and (2) "the fluid being pumped, when using a rotor vane height that is greater than the stator vane height, can contain 'foreign matter, such as sand or gravel' without incurring significant wear on the pump." Final Act. 4–5 (citing McCoskey Fig. 2 (showing a rotor vane having a height that appears greater than a surrounding stator vane), ll. 76–80 ("water containing foreign matter, such as sand and gravel, can be raised with equal facility and with little or no wear on the pump.")); Ans. 18–19.

We note that McCoskey never ties the radial heights of its stator and rotor vanes, much less the range of relative radial heights thereof, to its ability to raise water containing foreign matter without wear.

The Examiner next finds that, with respect to the claimed 3.5 to 4.5 ratio of vane radial heights, "the selection of a specific ratio would have been an obvious choice" depending on "the desired pump performance relative to fluid being pumped." Final Act. 5. According to the Examiner,

Desgoffe evidences that a skilled artisan "would recognize that a 3.5 to 4.5 [vane radial height] ratio has at least been suggested in the context of pumping a fluid vertically." *Id.* (citing Desgoffe Fig. 6). The Examiner continues that Desgoffe evidences that a skilled artisan "would appreciate that the condition of the material to be pumped is an important factor . . . when considering the selection of vane parameters." *Id.* (citing Desgoffe 2:91–101 ("The shape, number, and capacity of these threads, which may be the same or different on the piston and case, may vary almost indefinitely, the conditions of the material to be elevated being the most important factor in determining the form most advantageous.")).

We note that Desgoffe, although stating that the shape of its threads may differ on its piston and case, and "may vary almost indefinitely," never contemplates such ratios or links the material to be elevated with a thread/vane radial height ratio.

The Examiner lastly contends that "the selection of a specific [vane height] ratio is considered to be routine optimization of result-effective variables," and "the pump performance identified in Simpson is a result that is ultimately affected by a plurality of variables, such as the cross-sectional area of the vane threads." Final Act. 5–6 (citing MPEP § 2144.05(II)).

We note that while Simpson may be considered to address routine optimization of thread cross-sectional area, it does not address routine optimization of thread/vane radial height ratios.

Appellant initially contends, apparently to refute the Examiner's "design choice" conclusion of obviousness, that the claimed radial height ratio range of 3.5 to 4.5 is not arbitrary, as evidenced by Fig. 9(c), which shows that a rotor vane height to stator vane height ratio within the claimed

range of 3.5 to 4.5 (i.e., 4.2), advantageously and unexpectedly "make[s] performance of the pump independent of the viscosity of the fluid being pumped." Appeal Br. 7–8 (emphasis omitted) (citing the '800 Patent, Fig. 9(c) and 11:41–48 ("Surprisingly . . . the performance of the pump assembly 1 is effectively independent of the viscosity of the fluid being pumped. Extensive testing has confirmed that this effect is provided when the rotor vane height 24 to stator vane height 26 ratio is 3.5 to 4.5.")).

The Examiner responds that Appellant's Figs. 9(a)–9(c) fail to establish that "the attendant viscosity result [is] unexpected," because it does not account for other parameters such as the vane clearance/radial gap and rotational speed, which "would appear to be particularly important considerations when designing a reversing-thread pump." Ans. 15. According to the Examiner, "[t]here is no indication in the '800 Patent that the 4.2 ratio of vane heights results of Fig. 9(c) were achieved by testing a pump that was otherwise identical to, and operated under the same conditions as, the pump of Figs. 9(a)/9(b)." *Id.* at 17. Further, it is the Examiner's opinion that "the statement in the specification of the '800 Patent indicating that the performance results illustrated in Fig. 9(c) are *surprising* . . . , is not seen as dispositive in establishing those results to also be unexpected." *Id.*

In reply, Appellant explains the results shown in each of Figures 9(a) to 9(c), and provides a comparison thereof, explaining why Figures 9(a) – 9(c), with relevant portions of the written description, evidence that the claimed ratio of vane radial heights causes pump performance to be "beneficially independent of the viscosity of the fluid being pumped." Reply Br. 5–6. Further, the '800 Patent specifically characterizes this result

as "surprising," which Appellant contends denotes an unexpected result. *Id.* at 6–7. Appellant argues that "[t]he Examiner's position that 'surprising' results are not the same as 'unexpected' results . . . is both illogical and unreasonable." *Id.* at 8 (referring to Ans. 17).

Here, Appellant has the better argument. While the Examiner may be correct that some of the background of the test results shown in Figures 9(a) – 9(c) are not specifically disclosed, a skilled artisan viewing the test results and reviewing the relevant written description would understand that Appellant's Figures 9(a) – 9(c) evidence that the claimed ratio of vane radial heights causes pump performance to be beneficially independent of the viscosity of the fluid. Further, Appellant characterizes such results as "surprising" in the written description, which informs us that the result was not expected by Appellant, who we assume is at least one of ordinary skill in the art.

Regarding Desgoffe, which the Examiner finds suggests a 3.5 to 4.5 vane radial height ratio, Appellant argues that there is nothing in Desgoffe's Figure 6 that suggests the claimed 3.5 to 4.5 ratio of constant rotor vane radial height to constant stator vane radial height along the length of the pump assembly. Appeal Br. 8. Appellant contends that there is no indication that Desgoffe's Figure 6 is drawn to scale, so that "there is no evidence at all that the specific claimed ratio of 3.5 to 4.5 would have been gleaned by one of ordinary skill in the art simply by looking at the figure." *Id.* at 9 (citing MPEP § 2125(II) ("[I]t is well established that patent drawings do not define the precise proportions of the elements and may not be relied on to show particular sizes if the specification is completely silent on the issue." (alteration in original)); Reply Br. 2. Appellant argues,

regarding Desgoffe's statement that "[t]he shape, number, and capacity of these threads . . . may vary almost indefinitely," that such disclosure fails to "explain why or give any hint to one of ordinary skill in the art that, the claimed *ratio* would have been 'advantageous', or even beneficial for a 'particular material to be elevated'." Appeal Br. 10 (quoting Desgoffe 2:91–101) (emphasis added).

In the Answer, the Examiner makes a finding that "Desgoffe discloses a pump . . . including a ratio of vane heights that falls within the range of 3.5 to 4.5." Ans. 10. The Examiner appears to be relying on Desgoffe's Figure 6 for this finding. *See* Final Act. 6 ("Desgoffe illustrates a ratio of vane height parameters that appears to be very close to, if not encompassed by, the specific ratio recited in claim 1.").

Appellant again has the better argument. "[T]he description of the article pictured can be relied on, in combination with the drawings, for what they would reasonably teach one of ordinary skill in the art." MPEP § 2125 (citing *In re Wright*, 569 F.2d 1124 (CCPA 1977)). While Desgoffe's drawings would teach a skilled artisan that rotor vane radial heights can be greater than stator vane radial heights, the Examiner speculates about the exact ratio of the vane radial heights, as evidence by use of the word "appears" in the Examiner's finding based on Desgoffe's Figure 6. *See* Final Acts 5; Ans. 11–12. Speculation is not evidence. Thus, the Examiner's finding that Desgoffe discloses a pump with a ratio of vane heights that falls within the range of 3.5 to 4.5 lacks substantial evidence. The Examiner erred in making this finding.

The Examiner alternatively argues that the claimed range of vane height ratio would have been obvious in light of the combined prior art teachings, because a skilled artisan

> would find reason to implement rotor and stator vane height parameters that define a ratio significantly greater than one[], and would be free to select the vane height parameters based upon the specific fluid to be pumped. In making such a selection, the person of ordinary skill would find no teaching in the prior art that excludes a vane height ratio in the range of 3.5–4.5. . . . In Desgoffe, the reversing-thread pump not only forms part of the analogous prior art, but uses a vane height ratio that appears to be very close to, if not encompassed by, the 3.5–4.5 range recited in claim 1.

Ans. 11–12.

Appellant replies that the Examiner's contention about the prior art not excluding the claimed vane radial height ration takes an incorrect position that "if the prior art doesn't specifically exclude the claimed range, then the claimed range would have been obvious," which is not the legal test for obviousness. Reply Br. 4.

Appellant next argues that "the claimed vane radial height ratio of 3.5 to 4.5" is not obvious because it is not a result effective variable, because the prior art references fail to recognize the vane radial height ratio as a parameter to be manipulated to change pumping results. *See* Appeal Br. 12–13.

The Examiner disagrees, arguing that Simpson, Cameron, and Desgoffe "indicate that the vane parameters directly affect the performance of the pump," and Desgoffe shows a vane height ratio that "appears to be in the range of 3.5 to 4.5." Ans. 18. "In the [E]xaminer's view, the burden lies

with Appellant to show that the claimed ratio range produces an unexpected result." *Id.* (citing MPEP §§ 2142, 2144.05(III)(A)).

The Examiner later responds that "a ratio of vane heights is an inherent characteristic that is associated with any reversing-thread pump," and again contends that Desgoffe's Figure 6 shows a vane height ratio that "appears to be in the range of 3.5 to 4.5" while Desgoffe additionally states that the shape number and capacity of the threads "may be the same or different on the piston and case" and "may vary almost indefinitely." *Id.* at 19 (quoting Desgoffe 2:96–101). The Examiner determines that "the applied prior art, when considered as a whole, indicates that a reversing-thread pump having a vane height ratio in the range of 3.5 to 4.5 would have been a predictable result obtained by combining known pump parameters in a known way." *Id.* (citing MPEP § 2143 (I)(A)). The Examiner further notes that Desgoffe, alone, is not being relied on to teach a vane radial height ratio that maintains a constant 3.5 to 4.5 value along a length of the pump, because McCoskey discloses a constant vane height ratio. *Id*.

Appellant replies that the prior art must recognize a variable as result effective before the determination of an optimum range can be characterized as routine optimization and obvious. Reply Br. 9. Appellant argues that there is "no factual evidence at all that any of the cited references discusses vane radial height ratios as achieving some beneficial (recognized) result, . . . [and thus] ratios of piston vane radial height to cylinder vane radial height were not known as a result-effective variable," i.e., "a parameter to be manipulated to change pumping results." *Id.* (emphasis omitted). Even if the prior art indicates that pump performance (a result) is affected by vane

parameters generally, none of the references considers "a vane radial height ratio as one of those parameters." *Id.* (emphasis omitted).

Appellant has the better argument. The prior art must recognize a variable as result effective before the determination of an optimum range can be characterized as routine optimization and obvious. The variable here is, specifically, vane height ratio. As explained above, Desgoffe does not provide support for the Examiner's finding that the combined prior art discloses the claimed vane height ratio. Further, the Examiner has provided evidence that the prior art teaches vane cross section effecting pump performance, but not specifically vane radial height ratios achieving a beneficial result. Therefore, the Examiner has not established that the ratio of piston vane radial height to cylinder vane radial height was known as a result-effective variable. For this reason, the Examiner has not established prima facie obviousness.

In addition, the Examiner finds that a rotor vane height greater than a stator vane height allows pumped fluid to contain foreign matter without incurring significant wear on the pump, Appellant argues that "[s]imply teaching a rotor vane height that is greater than the stator vane height does not explain why, or give any hint to one of ordinary skill in the art that, the claimed ratio of 3.5 to 4.5 would have been desirable . . . for pumping the fluid with McCoskey's device." Appeal Br. 14; Reply Br. 1.

As set forth above, McCoskey never ties the heights of its stator and rotor vanes, much less the range of relative radial heights thereof, to its ability to raise water containing foreign matter without wear. Therefore, although McCoskey's rotor and stator vane heights may be constant and its

rotor vane height may be greater than its stator vane height, McCoskey never ties this vane height difference to any change in pump performance.

For these reasons, we do not sustain Rejection I.

Rejections II and III

Because the Examiner's findings and conclusions set forth in Rejection I are applied to Rejections II and III, and the Examiner does not assert that either Nistor or Zalis cure the above-noted deficiencies in Rejection I, we do not sustain Rejection II or Rejection III.

DECISION SUMMARY

In summary:

Claims Rejected	**35 U.S.C. §**	**Basis**	**Affirmed**	**Reversed**
1, 2, 4, 19, 20, 22, 35	103	Simpson, McCoskey, Desgoffe, Cameron		1, 2, 4, 19, 20, 22, 35
18	103	Simpson, McCoskey, Desgoffe, Cameron, Nistor		18
24, 25		Simpson, McCoskey, Desgoffe, Cameron, Zalis		24, 25
Overall Outcome				1, 2, 4, 18–20, 22, 24, 25, 35

REVERSED