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BEFORE THE PATENT TRIAL AND APPEAL BOARD

Ex parte TAKAAKI MATSUI

Appeal 2019-003987
Application 14/547,665
Technology Center 3700

Before JILL D. HILL, LEE L. STEPINA, and ARTHUR M. PESLAK, *Administrative Patent Judges.*

PESLAK, *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, 3–11, and 14–19. *See* Final Act. 1. We have jurisdiction under 35 U.S.C. § 6(b).

We REVERSE.

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[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 Sumitomo Heavy Industries, Ltd. Appeal Br. 3.

THE CLAIMED SUBJECT MATTER

Appellant's invention relates to a cryopump system and a method of operating a cryopump system. Claims 1, 8, and 9 are independent. Claim 1, reproduced below with italics added, is illustrative of the claimed subject matter:

> 1. A cryopump system comprising:
>
> at least one cryopump including a refrigerator including a low temperature cooling stage and a high temperature cooling stage, a low temperature cryopanel cooled by the low temperature cooling stage, and a high temperature cryopanel cooled by the high temperature cooling stage; and
>
> a compressor unit including a compressor main body that compresses a working gas to be supplied to the refrigerator, an operating frequency of the compressor main body being variable,
>
> wherein the compressor unit is operated such that a pressure ratio between a high pressure of the compressor main body and a low pressure of the compressor main body is in a range between 1.6 and 2.5,
>
> wherein the refrigerator is operated with a refrigeration efficiency as a function of the pressure ratio to cool the low temperature cryopanel to a temperature zone between 9 K and 15 K,
>
> wherein the refrigeration efficiency is defined as $\varepsilon = Q/W$, where Q is refrigeration work of the refrigerator and W is compression work of the compressor unit,
>
> *wherein the cryopump system is configured such that, during operation of the compressor unit at a pressure ratio selected from the range between 1.6 and 2.5, the refrigeration efficiency is maximized at any temperature in the temperature zone between 9 K and 15 K.*

REFERENCES

The prior art relied upon by the Examiner is:

Name	Reference	Date
Shiibayashi	US 2002/0051719 A1	May 2, 2002
Kimura	US 2011/0016890 A1	Jan. 27, 2011
Tanaka	US 2012/0060519 A1	Mar. 15, 2012
Ando	US 2012/0067065 A1	Mar. 22, 2012

REJECTIONS

1. Claims 1, 4–11, and 14–19 are rejected under 35 U.S.C. § 103 as unpatentable over Tanaka, Kimura, and Shiibayashi.

2. Claims 3 is rejected under 35 U.S.C. § 103 as unpatentable over Tanaka, Kimura, Shiibayashi, and Ando.

OPINION

Rejection 1

The Examiner finds that Tanaka discloses most of the limitations of the cryopump of claim 1, including a compressor and a refrigerator that cools the low temperature cryopanel to a temperature zone between 9 K and 15 K, but does not disclose varying the operating frequency of the compressor, and does not disclose a compressor operating pressure ratio in the range between 1.6 and 2.5. Final Act. 3–4. The Examiner relies on Kimura to disclose a controller that controls the compressor and considers that it would have been obvious to use a controller in the system of Tanaka "to be able to adjust the operation of the compressor based on the operating parameters of the refrigerator." *Id.* at 4. The Examiner relies on Shiibayashi to disclose a compressor operating pressure ratio in the range between 1.6 and 2.5, and concludes that it would have been obvious to operate the

compressor of Tanaka at the claimed pressure ratio "so that a wider range of pressure ratios can be achieved without lowering the efficiency." *Id.*

Appellant points out that in the system of claim 1, when the pressure ratio is in the recited range between 1.6 and 2.5, "the refrigeration efficiency . . . is maximized at any temperature in the temperature zone between 9K and 15K." Appeal Br. 12. Appellant argues that Shiibayashi discloses that the design of Shiibayashi's compressor results in an increase in compressor efficiency, but does not disclose a corresponding increase in refrigeration efficiency. *See id.* at 16–17. According to Appellant, "Shiibayashi *fails* to disclose, teach, or suggest that a refrigeration efficiency of a refrigerator is a function of a pressure ratio of a compressor unit" and one of ordinary skill in the art would have reasonably concluded that Shiibayashi's compressor efficiency "*differs from the refrigeration efficiency* of the claimed invention." *Id.* at 18. Appellant argues, moreover, that Tanaka, Kimura, and Shiibayashi "are *silent as to a refrigeration efficiency as a function of the pressure ratio*." *Id.* at 22.

The Examiner responds that because the compressor is part of the refrigeration cycle, an increase in compressor efficiency "would result in a higher refrigeration efficiency." Ans. 16. The Examiner finds, moreover, that Appellant is arguing against the references individually, and that because the combined teachings of the references have "the same operating conditions as the claims, it would have naturally flowed from the combination of Tanaka and Shiibayashi to have such a maximum efficiency." *Id.*

Appellant replies that the arguments do not attack the references individually, but point out that none of the references disclose that

refrigeration efficiency is a function of a pressure ratio. *See* Reply Br. 7–8. Specifically, Appellant asserts that the Examiner's Answer acknowledges that Tanaka and Kimura do not disclose this feature, and according to Appellant, "Shiibayashi *does not* show prior knowledge in the art regarding the *refrigeration efficiency* of a refrigerator being a function of a *pressure ratio* between a high pressure of compressor main body and a low pressure of the compressor main body." *Id.* at 8–10 (citing Ans. 4). For the following reasons, we do not sustain the rejection of claim 1.

Although we appreciate that Shiibayashi's increase in compressor efficiency would appear to result in an increase in refrigeration efficiency as the Examiner suggests, the Examiner does not direct us to any disclosure in Shiibayashi showing that, or otherwise adequately explain why, Shiibayahsi's increase in efficiency *is a function of pressure ratio* across the compressor. Shiibayashi discloses that when conventional compressors, which normally operated at higher pressure ratios, were operated at a pressure ratio "of around 1.5 to around 2" that "efficiency reduction becomes remarkable." Shiibayahsi ¶ 3. Shiibayashi further discloses that an object of the invention is "to provide a scroll compressor capable of performing a stable operation [at lower pressure ratios] without lowering the efficiency." *Id.* at ¶ 5. Specifically, Shiibayashi discloses setting the volume ratio of a scroll wrap portion V_r of a compressor between 1.8 to 2.3 and that when using "the above-described structure, the overall adiabatic efficiency increases at the exceedingly low operating pressure ratio and a high-performance scroll compressor can be obtained." Shiibayashi ¶ 14. However, establishing an increasing in the efficiency of the compressor at the same pressure ratio range used in the conventional compressors is not

equivalent to establishing that the recited refrigeration efficiency is a function of pressure ratio across the compressor. To the contrary, paragraph 14 of Shiibayashi discloses that the volume ratio of the scroll wrap portion of the compressor increases the efficiency for a fixed pressure ratio. Thus, although Shiibayashi increases compressor efficiency, the Examiner has not shown that Shiibayashi relates the increase to the operating pressure ratio across the compressor. By contrast, claim 1 requires operating the "compressor unit at a pressure ratio selected from the range between 1.6 and 2.5, the refrigeration efficiency is maximized at any temperature in the temperature zone between 9 K and 15 K."

The Examiner, thus, has not established by a preponderance of the evidence that Shiibayashi discloses that [refrigeration] efficiency is a function of the compressor pressure ratio as required by claim 1. As the rejection is based on an erroneous factual finding, the conclusion of obviousness cannot stand. *See In re Warner*, 379 F.2d 1011, 1017 (CCPA 1967) (holding that "[t]he legal conclusion of obviousness must be supported by facts. Where the legal conclusion is not supported by facts it cannot stand."). Consequently, we do not sustain the rejection of claim 1 and claims 4–7, 10, 11, 14, and 15 which depend from claim 1.

The Examiner's findings in support of the rejection of independent claims 8 and 9 are substantially similar to the findings set forth for claim 1. Final Act. 6–10. Appellant contends that the arguments in connection with the rejection of claim 1 "are incorporated herein by reference," and that claims 8 and 16–17 stand together, and that claims 9 and 18–19 stand together. Appeal Br. 27–28. For the same reasons discussed above in connection with claim 1, we do not sustain the rejection of claims 8, 9, and

16–19 as unpatentable under 35 U.S.C. § 103(a) over Tanaka, Kimura, and Shiibayashi.

Rejection 2

Claim 3 depends from claim 1. Appeal Br. 30 (Claims App.). The Examiner does not rely on the additional disclosure from Ando to cure the deficiencies in Tanaka, Kimura, and Shiibayashi discussed above. *See* Final Act. 12. Consequently, we do not sustain the rejection of claim 3.

CONCLUSION

The Examiner's rejections are REVERSED.

More specifically,

DECISION SUMMARY

Claims Rejected	35 U.S.C. §	Reference(s)/Basis	Affirmed	Reversed
1, 4–11, 14–19	103	Tanaka, Kimura, Shiibayashi		1, 4–11, 14–19
3	103	Tanaka, Kimura, Shiibayashi, Ando		3
Overall Outcome:				1, 3–11, 14–19

REVERSED