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UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

Ex parte ANDREW ROBERT CAMPBELL and
JUSTIN RORKE BUCKLAND

Appeal 2018-003757
Application 13/983,472
Technology Center 3700

Before JAMES P. CALVE, BENJAMIN D. M. WOOD, and ANNETTE R. REIMERS, *Administrative Patent Judges.*

REIMERS, *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 1–16, 21 and 23. Claims 17–20, 22, 24, and 25 have been canceled. We has 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 The Technology Partnership PLC, A.K.A. TTP plc. Appeal Brief ("Appeal Br.") 3, filed Aug. 30, 2017.

CLAIMED SUBJECT MATTER

The claimed subject matter "relate[s] generally to a pump for fluid and, more specifically, to a pump having a substantially disc-shaped cavity with substantially circular end walls and a side wall and a valve for controlling the flow of fluid through the pump." Spec. ¶ 1, Figs. 4A–4D, 5A–5D.

Claim 1, the sole independent claim on appeal, is representative of the claimed subject matter and recites:

> 1. A pump comprising:
>
> a side wall closed at each end by an end wall forming a substantially circular or elliptical cavity for, in use, containing a fluid;
>
> at least one actuator, each actuator operatively associated with one or more of the end walls to cause an oscillatory motion of the associated end wall(s) whereby, in use, these axial oscillations of the end wall(s) drive substantially radial oscillations of the fluid pressure in the cavity wherein a ratio of a radius of the cavity (a) to a height of the side wall (h) is greater than 1.7;
>
> two or more apertures in the cavity; and
>
> a valve disposed in at least two of the apertures;
>
> wherein the actuator(s) is/are arranged to be axially asymmetric such that, in use, a pressure oscillation with at least one nodal diameter is generated within the cavity, and the apertures in which a valve is disposed are located at antinodes of the pressure oscillation.

REFERENCES

The prior art relied upon by the Examiner is:

Reference Name	Document ID	Pub. Date
Dooley[2]	US 6,672,847 B2	Jan. 6, 2004
Yamada[3]	US 7,424,827 B2	Sept. 16, 2008
Miyazawa[4]	US 2009/0104056 A1	Apr. 23, 2009
Janse Van Rensburg[5]	US 2010/0310398 A1	Dec. 9, 2010

REJECTION[6]

Claims 1–16, 21, and 23 stand rejected under 35 U.S.C. § 103(a) as unpatentable over Janse Van Rensburg, Miyazawa, Dooley, and Yamada.

ANALYSIS

Claim 1 is directed to a pump having at least one actuator, "wherein the actuator(s) is/are arranged to be axially asymmetric such that, in use, a

[2] Appellant refers to the Dooley reference as ("the '847 patent"). Appeal Br. 9.
[3] Appellant refers to the Yamada reference as ("the '827 patent"). *Id.*
[4] Appellant refers to the Miyazawa reference as ("the '056 publication"). *Id.*
[5] Appellant refers to the Janse Van Rensburg reference as ("the '398 publication"). *Id.* The Examiner refers to the Janse Van Rensburg reference as ("Rensburg"). Final Office Action ("Final Act.") 6, dated Apr. 19, 2017.
[6] It appears that Appellant and the Examiner have come to an agreement to resolve the rejection of claims 1–4, 14–16, 21, and 23 under nonstatutory double patenting after the art-based rejections under appeal have been decided. *See* Appeal Br. 8–9 (Appellant "accordingly appreciates the Examiner's acknowledgement, in the April 19 Office Action, that the duty to respond to this nonstatutory double patenting rejection is being held in abeyance until the claims of the present invention have been indicated as being allowable but for the nonstatutory double patenting rejection."); Final Act. 2. Accordingly, the nonstatutory double patenting rejection is not before us for review.

pressure oscillation with at least one nodal diameter is generated within the cavity." Appeal Br. 27 (Claims App.). The Examiner finds that Janse Van Rensburg discloses the pump of claim 1 including at least one actuator but Janse Van Rensburg is "silent on the actuator being arranged axially asymmetric." Final Act. 7 (emphasis omitted); *see also* Ans. 4, 6.[7] The Examiner relies on the teachings of Miyazawa for this limitation with evidence from Yamada. Final Act. 7–8; *see also* Ans. 4, 6. In particular, the Examiner finds that Miyazawa discloses a "piezoelectric actuator" that has axially asymmetric features. Final Act. 7; *see also* Ans. 4, 6. Specifically, according to the Examiner, an "actuator having two electrodes with opposite polarities *is interpreted to be* an axially asymmetric actuator" and in Miyazawa (1) "base member 310 deforms with the expansion and contraction of piezoelectric layers 320a and 320b"; and (2) electrodes 330a and 330b apply "an electric field to [] piezoelectric layers [320a and 320b]" and have "opposite polarities to cause the expansion and contraction of piezoelectric layers [320a and 320b]." Final Act. 7(citing Miyazawa ¶¶ 44, 55, Fig. 6); *see also* Ans. 6.

Additionally, the Examiner finds that "a pressure oscillation wave would have *the same shape as* that of the displacement wave for the piezoelectric actuator; thus[,] if a nodal diameter(s) is/are seen in the displace[ment] wave of the actuator then the pressure oscillation wave would have *the same number* of nodal diameter(s) associated." Final Act. 7–8 (emphases added); *see also* Ans. 6. The Examiner also cites to Yamada as extrinsic evidence to show that the shape of the displacement wave of the actuator has one nodal diameter. Final Act. 8; *see also* Ans. 6.

[7] Examiner's Answer ("Ans."), dated Dec. 28, 2017.

Appellant contends the Examiner's finding that "a pressure oscillation wave would have the same shape as that of the displacement wave for the piezoelectric actuator; thus[,] if a nodal diameter(s) is/are seen in the displace[ment] wave of the actuator then the pressure oscillation wave would have the same number of nodal diameter(s) associated" is conclusory and "an incorrect statement of a principle of resonant cavity operation." Appeal Br. 18; *see also* Reply Br. 9;[8] Final Act. 7–8.

Moreover, Appellant provides an explanation for why this would not be the case. Appeal Br. 18–19. Specifically, Appellant states that

> the resonant pressure oscillation modes that are possible within a medium in a cavity depend on the geometry of the cavity, the frequency of oscillation, and the medium in the cavity. Each resonant oscillation mode has a different pattern of nodes. An arbitrary displacement of the wall of a cavity will excite one or more of these resonant modes with greater or lesser efficiency depending on the coupling between the displacement of the wall and each resonant mode of the medium in the cavity. The resonant pressure oscillation in the medium in the cavity will therefore not generally have the same mode-shape as the arbitrary displacement of a driving wall. An illustrative analogous example is that of a drumskin, whose possible modes of vibration are defined only by the drum construction. When struck, the drumskin resonates in one or more of these modes dependent on the coupling between the strike and each mode. It is not the case that a drumskin will vibrate resonantly in an arbitrary mode-shape that matches how it is struck.

Id.

Appellant has the better position here. As discussed above, we understand the Examiner to be citing to the teachings of Yamada to establish that the shape of the *displacement wave* of the actuator of Figure 6 of Miyazawa has one nodal diameter. Final Act. 8 ("In Miyazawa, the

[8] Reply Brief ("Reply Br."), filed Feb. 23, 2018.

displacement wave of the actuator can be seen in fig. 6. This wave has 1 nodal diameter, as evidenced by **Yamada** (in fig. 21[])]" and "[a]s evidenced by **Yamada** (Col. 1, lines 55-60), the *displacement* of the piezoelectric actuator in a micro pump affects the throughput of the fluid in the pump.") (emphasis added); *see also* Appeal Br. 21 (Yamada "teaches the requirement of a *displacement* which is sufficiently large for the pump to work.") (emphasis added). Stated differently, the Examiner looks to the teachings of Yamada as extrinsic evidence to establish that the shape of the *displacement wave* of the actuator of Figure 6 of Miyazawa has one nodal diameter.

However, the Examiner does not direct us to any discussion in either Miyazawa or Yamada or provide any technical reasoning to support a finding that a "pressure oscillation" wave would *necessarily have the same shape as* that of a "displacement" wave for a piezoelectric actuator and thus, that the nodal diameter of the "displacement" wave of the actuator would *necessarily be the same as* that of the "pressure oscillation" wave. *See* Final Act. 7–8.

Additionally, in response to Appellant's contentions, the Examiner cites to paragraph 49 of Janse Van Rensburg, which refers to mode-shape matching between the cavity and the actuator. Ans. 8; *see also* Janse Van Rensburg ¶ 49. The Examiner then extends this teaching of Janse Van Rensburg to conclude that if a skilled artisan desired to excite any other resonant mode of the cavity then he/she would drive the actuator in a mode that ensured similar matching. Ans. 8; *Id.* (A skilled artisan "could desire to have any other resonant pressure oscillation mode in the cylindrical cavity of the pump of [Janse Van Rensburg] out of the possible resonant pressure oscillation modes that the cavity would have" and "thus vibrate the actuator

at a mode that is similar to the desire resonant pressure oscillation mode."); *see also* Janse Van Rensburg ¶ 49.

Based on these teachings from Janse Van Rensburg, the Examiner then asserts that by looking at Figure 6 of Miyazawa, a skilled artisan would *infer* that Miyazawa's actuator "would enable a differential pressure curve, similar in shape to that of the vibrational curve of the actuator in the cavity of the pump." Ans. 8–9; *see also id.* at 8 (The Examiner "believes that vibration mode of the actuator [of Figure 6 of Miyazawa] would enable a differential pressure curve, similar in shape to that of the vibrational curve of the actuator, to be generated within the cavity of Miyazawa.").

We agree with Appellant that the Examiner's findings are conclusory and are "not supported by the teachings of the cited references." Reply Br. 9. In particular, the Examiner does not establish adequately how in applying the mode-shape matching teachings of Janse Van Rensburg to Miyazawa's Figure 6, a skilled artisan would *necessarily infer* that Miyazawa's actuator, "would enable a differential pressure curve, similar in shape to that of the vibrational curve of the actuator in the cavity of the pump." *See* Ans. 8–9; *see also* Reply Br. 9. ("[T]he Examiner cites to [] portions of [Janse Van Rensburg,] which refer to the need for mode-shape matching between the cavity and the actuator." "The Examiner then leaps to assert that the actuator of [Miyazawa] 'would enable a differential pressure curve, similar in shape to that of the vibrational curve of the actuator in the cavity of the pump.'").

We also agree with Appellant that "[t]he fact that mode[-]shape matching *may be desirable* does not mean that an actuator having a particular mode[-]shape will [necessarily] generate a pressure oscillation in a resonant cavity with the same or a similar mode[-]shape." Reply Br. 9

(italics added). As correctly pointed out by Appellant, "[i]f this were the case, then the condition of mode-shape matching *would be irrelevant*, because mode-shape matching would result naturally *in the case of <u>any</u>* arbitrary actuator motion." *Id*. (emphases added). Consequently, for the above reasons, the Examiner fails to establish adequately by a preponderance of the evidence that the combined teachings of Janse Van Rensburg, Miyazawa, Yamada, and Dooley disclose the pump of claim 1.

For these reasons, we do not sustain the Examiner's rejection of claims 1–16, 21, and 23 as unpatentable over Janse Van Rensburg, Miyazawa, Dooley, and Yamada

CONCLUSION

In summary:

Claims	**35 U.S.C. §**	**Basis/References**	**Affirmed**	**Reversed**
1–16, 21, 23	103(a)	Janse Van Rensburg, Miyazawa, Dooley, Yamada		1–16, 21, 23

<u>REVERSED</u>