UNITED STATES PATENT AND TRADEMARK OFFICE

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BEFORE THE BOARD OF PATENT APPEALS
AND INTERFERENCES

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*Ex parte* TORU IDO and SOICHIRO ISHIZUKA

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Appeal 2008-5588
Application 11/263,453
Technology Center 2800

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Decided: November 25, 2008

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Before JOSEPH F. RUGGIERO, JOHN A. JEFFERY, and KARL D. EASTHOM, Administrative *Patent Judges*.

JEFFERY, *Administrative Patent Judge*.

DECISION ON APPEAL

Appellants appeal under 35 U.S.C. § 134 from the Examiner's rejection of claims 1-9. We have jurisdiction under 35 U.S.C. § 6(b). We affirm.

STATEMENT OF THE CASE

Appellants invented a class D amplifier having a digital to analog (D/A) converter operating at a first sampling frequency and a pulse width modulation (PWM) driver operating at a second sampling frequency. The amplifier includes a clock that synchronizes the second sampling frequency to the first sampling frequency to minimize aliasing noise.[1] Independent claim 1 is reproduced below:

> 1. A class D amplifier characterized by the fact that the class D amplifier is composed of the following parts:
>
> a) a D/A converter that operates at a first sampling frequency, and
>
> b) a PWM driver that receives the output of said D/A converter, and this PWM driver operates at a second sampling frequency synchronized to said first sampling frequency.

The Examiner relies upon the following as evidence in support of the rejection:

| | | |
|---|---|---|
| Duncan | US 4,772,873 | Sep. 20, 1988 |
| Hara | US 5,376,872 | Dec. 27, 1994 |

Appellants' admitted prior art ("AAPA") in Figure 8 and on pages 3 and 7 of the present application.

(1) The Examiner rejected claims 1 and 3-8 under 35 U.S.C. § 103(a) as being unpatentable over AAPA and Duncan (Ans. 3-6).

[1] *See generally* Spec. 5:7-26 and 8:15-9:30.

(2) The Examiner rejected claims 2 and 9 under 35 U.S.C. § 103(a) as being unpatentable over AAPA, Duncan, and Hara (Ans. 6-7).

Rather than repeat the arguments of Appellants or the Examiner, we refer to the Brief[2] and the Answer[3] for their respective details. In this decision, we have considered only those arguments actually made by Appellants. Arguments, which Appellants could have made but did not make in the Brief, have not been considered and are deemed to be waived. *See* 37 C.F.R. § 41.37(c)(1)(vii).

## OBVIOUSNESS REJECTION OVER AAPA AND DUNCAN

The Examiner first rejected claims 1 and 3-8 under 35 U.S.C. § 103(a) as being unpatentable over AAPA and Duncan. Appellants separately argue independent claim 5 from claims 1, 3, 4, and 6-8. Each grouping will be addressed separately.

### *Claims 1, 3, 4, and 6-8*

The Examiner finds the AAPA discloses all the limitations in representative independent claim 1,[4] except for the "driver operates at a second sampling frequency synchronized to said first sampling frequency" (Ans. 3-4). The Examiner cites Duncan to provide a teaching to synchronize the sampling frequencies of electrical components in order to avoid aliasing

[2] We refer to the Appeal Brief filed May 22, 2007, throughout this opinion.
[3] We refer to the Examiner's Answer mailed August 23, 2007, throughout this opinion.
[4] Appellants do not separately argue independent claim 6 from independent claim 1 (Br. 4). Appellants also do not particularly argue claims 3, 4, 7, and 8 (Br. 4). Accordingly, we select independent claim 1 as representative. 37 C.F.R. § 41.37(c)(1)(vii).

(Ans. 4). Appellants argue the AAPA does not disclose operating frequencies of the D/A converter and the PWM driver (Br. 4). Appellants also assert the AAPA includes a lowpass filter (LPF) to avoid aliasing and, therefore, has no need for synchronization (Br. 4). Finally, Appellants contend that Duncan does not disclose a PWM driver and does not suggest synchronizing a D/A converter with a PWM driver (Br. 4).

## ISSUE

Have Appellants shown the Examiner erred in finding the combination of the AAPA and Duncan teaches synchronizing the sampling frequencies of a PWM driver and a D/A converter of a D class amplifier in rejecting claim 1 under 35 U.S.C. §103?

## FINDINGS OF FACT

The record supports the following findings of fact (FF) by a preponderance of the evidence.

1. AAPA discloses a class D amplifier having a D/A converter (DAC) and a PWM driver (PWM) (Spec. 3:18-22 and 7:16-17; Fig. 8).
2. AAPA discloses the PWM circuits are used with CDs and DVDs (Spec. 3:23-26).
3. Duncan discloses a digital audio player having a D/A converter 4 (Duncan, col. 1, ll. 6-14 and col. 2, ll. 61-63; Fig. 1).
4. Duncan teaches the system includes a clocking on the first digital filter 2, and the clocking frequency is sent to the frequency divider 5 (Duncan, col. 2, ll. 64-68; Fig. 1).

5. Duncan explains to avoid aliasing and harmonic heterodyning the clocking for the D/A converter 4 is synchronized with the rest of the system (Duncan, col. 2, l. 68 – col. 3, l. 2).
6. Duncan's synchronization involves the frequency divider 5 supplying a divided clocking signal to the converter 4, the eight bit timer 6, the serial to parallel converter 7, and the parallel to serial converter 8 (Duncan, col. 2, l. 68 – col. 3, l. 27; Fig. 1)
7. The Examiner states the PWM driver in the AAPA has a clock to generate a sampling frequency (Ans. 4).

## PRINCIPLES OF LAW

Discussing the question of obviousness of a patent that claims a combination of known elements, *KSR Int'l v. Teleflex, Inc.*, 127 S. Ct. 1727 (2007), explains:

> If a person of ordinary skill can implement a predictable variation, § 103 likely bars its patentability. For the same reason, if a technique has been used to improve one device, and a person of ordinary skill in the art would recognize that it would improve similar devices in the same way, using the technique is obvious unless its actual application is beyond his or her skill. *Sakraida* [*v. AG Pro, Inc.,* 425 U.S. 273 (1976)] and *Anderson's-Black Rock*[*, Inc. v. Pavement Salvage Co.*, 396 U.S. 57 (1969)] are illustrative—a court must ask whether the improvement is more than the predictable use of prior art elements according to their established functions.

*KSR*, 127 S. Ct. at 1740.

"[T]he Examiner bears the initial burden, on review of the prior art or on any other ground, of presenting a prima facie case of unpatentability." *In re Oetiker*, 977 F.2d 1443, 1445 (Fed. Cir. 1992). If the Examiner's burden is met, the burden then shifts to the

Appellants to overcome the prima facie case with argument and/or evidence. Obviousness is then determined on the basis of the evidence as a whole and the relative persuasiveness of the arguments. *Id.*

## ANALYSIS

Appellants first argue that the AAPA does not discuss operating frequencies. Claim 1 does not recite an operating frequency but does recite the D/A converter has a "first sampling frequency" and the PWM driver has "a second sampling frequency." The operating frequencies of the D/A converter and PWM driver are, thus, not commensurate with the scope of claim 1. Moreover, any D/A converter, including the D/A converter of the AAPA (FF 1), includes a clock that samples the digital input signal at a given rate before converting the signal to its analog equivalent signal. Thus, the D/A converter will operate at a first sampling frequency as recited in claim 1. Additionally, the Examiner finds the PWM driver in the AAPA has a clock to generate a sampling frequency (FF 7). Appellants have not challenged this finding. Furthermore, one skilled in the art would have recognized including a counter to sample the input in a PWM driver so that the device is properly modulated. Thus, an ordinarily skilled artisan would have known the D/A converter has a first sampling frequency and the PWM driver has a second sampling frequency in order for these devices to operate and function properly.

The AAPA does not disclose whether the sampling frequencies of the D/A converter and the PWM driver are synchronized. The AAPA discloses the PWM circuits are used with CDs and DVDs or with audio signals (FF 2).

Similarly, Duncan discloses a digital audio player having a D/A converter 4 (FF 3). Duncan also teaches synchronizing components of an audio system is well known and specifically describes synchronizing the D/A converter 4 with the rest of the system to avoid aliasing and harmonic heterodyning (FF 5). That is, each component in Duncan having a clock (i.e., the D/A converter 4, the eight bit timer 6, the serial to parallel converter 7, and the parallel to serial converter 8) is synchronized with each other in order to avoid aliasing and harmonic heterodyning (FF 4-6). As explained previously, the D/A converter and the PWM driver of the AAPA have clocks and respective sampling frequencies. One, therefore, would have recognized Duncan's teaching would improve the AAPA amplifier in a similar manner by synchronizing the sampling frequencies of the D/A converter and the PWM driver so as to avoid aliasing and harmonic heterodyning. *See KSR*, 127 S. Ct. at 1740.

Appellants contend there is no need in the AAPA to synchronize the D/A converter with the PWM driver because a LPF already exists to remove aliasing noise (Br. 4). However, Duncan teaches that the synchronization of components does more than remove aliasing. Duncan further teaches the synching of sampling frequencies also avoids harmonic heterodyning (FF 5). Duncan thus provides to an ordinary skilled artisan a further reason for synchronizing the D/A converter with a PWM driver that the LPF will not solve – avoiding harmonic heterodyning. Moreover, the LPF does more than remove aliasing noise. For example, filters reject certain frequency spectrums while accepting others. The LPF in the AAPA, therefore, does not function only as a synchronization component, and synching the D/A converter with the PWM driver is not a complete substitute for a LPF.

Based on the above discussion, there are several reasons to have a LPF *and* a PWM in a D class amplifier.

For the foregoing reasons, we will sustain the rejection of claims 1, 3, 4, and 6-8 over the combination of AAPA and Duncan.

*Claim 5*

Claim 5 recites a clock generator for making a clock signal and synchronizing a first sampling frequency with a second sampling frequency and a PWM modulator operating at the second sampling frequency. Appellants repeat the arguments made with respect to claim 1 (Br. 5). We are not persuaded by Appellants' arguments, however, for the reasons stated in connection with claim 1.

We will sustain the rejection of claim 5 over the combination of AAPA and Duncan.

OBVIOUSNESS REJECTION OVER AAPA, DUNCAN, AND HARA

. Appellants rely on the asserted patentability of claims 1 and 6 in response to the Examiner's rejection of claims 2 and 9 (Br. 5; Ans. 6-7) We are, thus, not persuaded by Appellants' argument for the reasons stated in connection with claims 1 and 6.

For the above reasons, we will sustain the rejection of claims 2 and 9 over the combination of AAPA, Duncan, and Hara.

## CONCLUSION OF LAW

The Appellants have not shown the Examiner erred in finding the combination of the AAPA and Duncan teaches synchronizing the sampling frequencies of a PWM driver and a D/A converter of a D class amplifier in rejecting claim 1 under 35 U.S.C. § 103.

## ORDER

We have sustained the Examiner's rejection of all claims on appeal. Accordingly, the Examiner’s rejection of claims 1-9 is affirmed.

AFFIRMED

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