UNITED STATES PATENT AND TRADEMARK OFFICE

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14/748,515	06/24/2015	Priya N. Vaidya	P83299	5725

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UNITED STATES PATENT AND TRADEMARK OFFICE
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BEFORE THE PATENT TRIAL AND APPEAL BOARD
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Ex parte PRIYA N. VAIDYA and
PREMANAND SAKARDA[1]
_____

Appeal 2018-004173
Application 14/748,515
Technology Center 2100
_____

Before BRADLEY W. BAUMEISTER, MIRIAM L. QUINN, and
STACEY G. WHITE, *Administrative Patent Judges*.

BAUMEISTER, *Administrative Patent Judge*.

DECISION ON APPEAL

Appellant appeals under 35 U.S.C. § 134(a) from the Examiner's final
rejection of claims 1–24, which constitute all claims pending in this
application. Appeal Br. 5.[2] We have jurisdiction under 35 U.S.C. § 6(b).

We affirm.

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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 Intel Corporation as the real party in
interest. Appeal Brief filed June 26, 2017 ("Appeal Br.") 3.
[2] Rather than repeat the Examiner's positions and Appellant's arguments in
their entirety, we refer to the above mentioned Appeal Brief, as well as the
following documents for their respective details: the Final Action mailed
January 27, 2017 ("Final Act."); the Examiner's Answer mailed January 10,
2018 ("Ans."); and the Reply Brief filed March 9, 2018 ("Reply Br.").

CLAIMED SUBJECT MATTER

Appellant describes the present invention as follows:

> Systems and methods may provide for making a power efficiency determination at runtime based on one or more runtime usage notifications and scheduling a workload for execution on a hardware accelerator if the power efficiency determination indicates that execution of the workload on the hardware accelerator will be more efficient than execution of the workload on a host processor. Additionally, the workload may be scheduled for execution on the host processor if the power efficiency determination indicates that execution of the workload on the host processor will be more efficient than execution of the workload on the hardware accelerator. In one example, making the power efficiency determination includes applying one or more configurable rules to at least one of the one or more runtime usage notifications.

Abstract.

STATEMENT OF THE REJECTIONS

Claims 7–12 stand rejected under 35 U.S.C. § 101 as being directed to patent ineligible subject matter. Final Act. 4–5.

Claims 1, 6, 7, 12, 13, 18, 19, and 24 stand rejected under 35 U.S.C. § 103 as being unpatentable over Hanson et al. (US 8,301,742 B2; issued Oct. 30, 2012) ("Hanson") and Wang et al. (*Workload Analysis and Efficient OpenCL-based Implementation of SIFT Algorithm on a Smartphone*, IEEE Global Conference on Signal and Information Processing (GlobalSIP), Dec. 2013) ("Wang"). Final Act. 6–9.

Claims 2, 3, 5, 8, 9, 11, 14, 15, 17, 20, 21, and 23 stand rejected under 35 U.S.C. § 103 as being unpatentable over Hanson, Wang, and Degenaro et al. (US 8,434,087 B2; issued Apr. 30, 2013) ("Degenaro"). Final Act. 9–12.

Claims 4, 10, 16, and 22 stand rejected under 35 U.S.C. § 103 as being unpatentable over Hanson, Wang, and Nguyen et al. (US 7,870,185 B1; issued Jan. 11, 2011) ("Nguyen"). Final Act. 12–13.

STANDARD OF REVIEW

The Board conducts a limited *de novo* review of the appealed rejections for error based upon the issues identified by Appellant, and in light of the arguments and evidence produced thereon. *Ex parte Frye*, 94 USPQ2d 1072, 1075 (BPAI 2010) (precedential).

THE 101 REJECTION

Illustrative Claim 7

Independent claim 7, reproduced below, illustrates the subject matter of claims 7–12, which stand rejected under 35 U.S.C. § 101:

> 7.   An apparatus comprising:
>
> logic, implemented at least partly in one or more of configurable logic or fixed functionality logic hardware, to:
>
>> make a power consumption determination at runtime based on one or more runtime usage notifications;
>>
>> schedule a workload for execution on a hardware accelerator if the power consumption determination indicates that execution of the workload on the hardware accelerator will be more efficient than execution of the workload on a host processor; and
>>
>> schedule the workload for execution on the host processor if the power consumption determination indicates that execution of the workload on the host processor will be more efficient than execution of the workload on the hardware accelerator.

Determinations and Contentions

The Examiner determines that the language of claim 7 is broad enough to read on software, per se, and, therefore, claim 7 is broad enough to read on non-statutory subject matter. Final Act. 4. According to the Examiner, software constitutes a description or expression of a computer program, which is not a physical thing. *Id.*

The Examiner cites to both the language of claim 7 and Appellant's Specification to support the determination that the claim reads on software per se. Ans. 3–4. First, the Examiner notes that the express language of claim 7 states that the logic may be implemented either in "configurable logic or fixed functionality logic hardware." *Id.* at 4. The Examiner also notes that Appellant's Specification discloses that the "configurable logic *may be*, for example, programmable logic arrays (PLAs), field programmable gate arrays (FPGAs), complex programmable logic devices (CPLDs)." *Id*. (citing Spec. ¶ 13) (emphasis added). The Examiner reasons that the Specification's use of the permissive term "may be" indicates that that the Specification does not limit the claimed "configurable logic" to the hardware examples listed, and, therefore, does not exclude software embodiments. *Id.*

Appellant argues that "there is no legal basis for the contention that software is per se non-statutory subject matter." Appeal Br. 11. According to Appellant, claims that are directed to software, as opposed to hardware, are not inherently abstract. *Id.* (citing *Enfish, LLC v. Microsoft Corp.*, 822 F.3d 1327, 1335 (Fed. Cir. 2016)).

Appellant further argues "claims directed to a *specific improvement* to the way computers operate are patentable, even in the context of software."

Id. at 11. According to Appellant, claims recite patent-eligible subject matter when they are "directed to a specific improvement–a particular database technique–in how computers could carry out their functions of storage and retrieval of data." *Id.* at 11–12 (*citing Enfish, LLC*, 822 F.3d at 1336). Appellant also contends that claims are patent eligible when they are "directed to a software-based invention that improves the performance of the computer system itself." *Id.* at 12 (*citing also BASCOM Global Internet Servs., Inc., v. AT&T Mobility LLC,* 827 F.3d 1341 (Fed. Cir. 2016)).

Analysis

Appellant's arguments are unpersuasive. The question posed is *not* whether a claim is *per se* patent-ineligible merely because some of the limitations may recite software, as well as hardware. Rather, the relevant question is whether a claim reciting only software *per se* is patent ineligible. *Enfish* and *BASCOM*, cited by Appellant, are not on point because the claims at issue in those cases recited physical elements, as well as improvements to software.

More specifically, claim 17 of *Enfish* recited "A data storage and retrieval system for a computer memory, comprising means for configuring said tables. . ." *Enfish*, 822, F.3d at 1336. Claim 1 of BASCOM recited "A content filtering system for filtering content retrieved from an Internet computer network. . . , said filtering system comprising: a local client computer; . . . [and] a remote [Internet Service Provider] server coupled to said client computer and said Internet computer network. *BASCOM*, 827 F.3d at 1345.

Appellant points to no persuasive authority for the proposition that software per se is patent eligible. Instead, it is well settled that "[a]bstract

software code is an idea without physical embodiment . . . ." *Microsoft Corp. v. AT&T Corp.*, 550 U.S. 437, 449 (2007). Moreover, a patent claim that is broad enough to cover both statutory subject matter and nonstatutory subject matter is subject to rejection under 35 U.S.C. § 101. *Amgen, Inc. v. Hoechst Marion Roussel, Inc.*, 314 F.3d at 1329.

Because a claim to computer software per se constitutes non-statutory subject matter, we do not perform an analysis pursuant to the 2019 Revised Patent Subject Matter Eligibility Guidance (84 Fed. Reg. 50). Only after a claim is determined to fall within a statutory category of subject matter, e.g., a useful process or machine (35 U.S.C. § 101), is this patent-eligibility analysis performed. *Alice Corp. v. CLS Bank Int'l*, 573 U.S. 208, 216–17 (2014). Such a patent-eligibility analysis is undertaken in order to address the separate question of whether a claim reciting a statutory category of invention, nonetheless, is directed to an exception to patent-eligible subject matter without reciting significantly more. *Id.*

Furthermore, Appellant merely argues that software *per se* is not necessarily patent ineligible. Appellant does not set forth any persuasive substantive arguments as to why the Examiner is incorrect in determining that claim 7 does, in fact, only recite software *per se*. Appeal Br. 11–14; Reply Br. 5–7.

Accordingly, we sustain the rejection of claim 7 under § 101 as being directed to non-statutory subject matter. We, likewise, sustain the rejection of dependent claims 8–12, which Appellant does not argue separately. *See* 37 C.F.R. § 41.37(c)(1)(iv).

THE 103 REJECTIONS

Illustrative claim 1

Independent claim 1, reproduced below, illustrates the appealed claims:

> 1.   A system comprising:
>
> a hardware accelerator;
>
> a host processor; and
>
> logic, implemented at least partly in one or more of configurable logic or fixed functionality logic hardware, to:
>
> > make a power consumption determination at runtime based on one or more runtime usage notifications,
> >
> > schedule a workload for execution on the hardware accelerator if the power consumption determination indicates that execution of the workload on the hardware accelerator will be more efficient than execution of the workload on the host processor, and
> >
> > schedule the workload for execution on the host processor if the power consumption determination indicates that execution of the workload on the host processor will be more efficient than execution of the workload on the hardware accelerator.

Determinations and Contentions

The Examiner finds that Hanson discloses a host processor that includes logic to make power consumption determinations at runtime based on runtime usage notifications. Final Act. 6 (citing Hanson col. 2, l. 53– col. 3, l. 8, col 7, ll. 6–43). According to the Examiner,

> Hanson does not explicitly teach a hardware accelerator; scheduling a workload for execution on the hardware accelerator if the power consumption determination indicates that execution of the workload on the hardware accelerator will be more efficient than execution of the workload on the host processor;

> and scheduling the workload for execution on the host processor
> if the power consumption determination indicates that execution
> of the workload on the host processor will be more efficient than
> execution of the workload on the hardware accelerator.

Final Act. 6.

The Examiner finds that Wang teaches this limitation and that motivation existed to combine the teachings of Hanson and Wang. *Id.* at 7–8. More specifically, the Examiner finds that Wang teaches a graphics processing unit (GPU) and that this GPU discloses a hardware accelerator, as claimed. *Id.* at 7. The Examiner further finds that Wang teaches measuring processing performance and processing times of workloads that are performed on a central processing unit (CPU) and comparing those parameters to when the workloads are performed on the GPU. *Id.* (citing Wang p. 3 § D; p. 4, § V). According to the Examiner, Wang teaches workloads either being kept on the CPU or alternatively offloaded to the GPU dependent upon which device provides better performance for the workload. *Id.* The Examiner also determines that Wang's disclosure of comparing workload processing times is synonymous with disclosing comparing power consumption. *Id.*

Appellant acknowledges in the Appeal Brief that "Wang teaches to offload functions to the GPU if the ***processing time*** of the GPU is shorter than the CPU processing time." Appeal Br. 13. Appellant argues, though, that Wang does not teach scheduling the workload for execution on the host processor or hardware accelerator based upon a determination of which execution will produce the more efficient power consumption. *Id*. at 13–14. Appellant also argues that Hanson does not compensate for this purported failure of Wang's teaching. *Id*. at 14.

In response, the Examiner further explains that the following passage of Wang provides the basis for reaching the Examiner's conclusion that was set forth in the Final Action:

> To measure **energy efficiency**, we compute [the scale-invariant feature transform (SIFT)] on the same dataset for several minutes, measure the average system power, and then subtract the idle system power. We measured l490mW and l429mW **power consumptions** for the CPU-only implementation and the heterogeneous implementation, respectively. The average energy consumption per image is 413.0mJ for the CPU-only implementation, and 242.3mJ for the heterogeneous one. Therefore, a 41% reduction in **energy consumption** is achieved.

Ans. 5 (citing Wang, p. 5 § V. Experimental Results) (emphasis added in the Examiner's Answer); *see also id.* (citing Wang p. 2. ¶ 2, titled "IV. ALGORITHM PROFILING AND WORKLOAD PARTITIONING").

The Examiner also cites to Wang's more general discussion of using Open Computing Language (OpenCL) to achieve an efficient, high-performance implementation of GPUs on mobile processors:

> the clock frequency of mobile GPUs is typically between 200 and 400 MHz, which is much slower than their desktop counterparts, which typically reach l GHz clock frequency. For these reasons, it is critical that targeted algorithms are carefully analyzed to find a good mapping to mobile GPUs. On the other hand, the low clock frequency of mobile GPUs suggests the possibility of **efficient low power designs**, in which offloading

some parallelizable computationally[]intensive algorithms to GPUs may **reduce power consumption**.

Ans. 5 (citing Wang, p. 1, col. 2, § II. OpenCL on Mobile

Processors)[3] (emphasis added in the Examiner's Answer).

The Examiner concludes that because Wang recognized that processing time is reasonably correlated to power consumption, Wang's disclosure of making decisions to offload workloads from a CPU to a GPU reasonably can be understood to be a teaching that decisions to offload workloads to a hardware accelerator were known to be based on the processor and accelerator's relative power consumptions. *Id.* at 6.

In the Reply Brief, Appellant responds to the Examiner's reliance on Section V of Wang, as set forth in the Examiner's Answer:

> While section V of Wang does discuss experimental results of using the SIFT algorithm, this section is comparing and contrasting the results of implementing the SIFT algorithm using only a CPU of a mobile device versus implementing the algorithm in a heterogen[e]ous manner[] (i.e., using both the CPU and a GPU of a mobile device). That is, the energy efficiency that is mentioned in section V is only mentioned with respect to: 1) only using the mobile CPU to implement the SIFT algorithm, and, separately, 2) implementing the SIFT algorithm using a GPU+CPU of a mobile device.

Reply Br. 9–10.

Appellant reiterates the argument that "Wang only discusses the energy efficiency result of experiments based on ***processing times*** of the mobile device's GPU and CPU, and there is absolutely no discussion of how

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[3] The Examiner's Answer incorrectly refers to page 1 of Wang as page 2. This clerical error constitutes harmless error.

workloads are partitioned onto a mobile device CPU and GPU based on energy consumption." *Id.* at 10.

Analysis

The Examiner's position reasonably can be understood to be that Wang teaches that measuring processing time is synonymous with measuring processing power. Furthermore, the Examiner sets forth a factual basis for why one of ordinary skill who is in possession of Wang would have understood the teaching of the former additionally to be a teaching of the latter. *See, e.g.,* Ans. 4–6.

Moreover, and contrary to Appellant's assertion (Reply Br. 10), Wang does discuss how workloads are determined to be partitioned. In *Section D. Profiling Results and Workload Partitioning*, Wang states that "[b]ased on the profiling results, we partition the SIFT algorithm to a CPU-GPU heterogeneous implementation to minimize the total processing and memory transfer time, as shown in in Fig. 2." Wang. p. 3, col. 2, *cited in* Final Act. 7.

Accordingly, Appellant does not persuade us of error in the Examiner's obviousness rejection of claim 1 based upon the combination of Hanson and Wang. We, therefore, sustain the rejection of that claim and of claims 6, 7, 12, 13, 18, 19, and 24, which Appellant does not argue separately. Appeal Br. 12–14; *see* 37 C.F.R. § 41.37(c)(1)(iv).

We, likewise, sustain the Examiner's obviousness rejections of claims 2, 3, 5, 8, 9, 11, 14, 15, 17, 20, 21, and 23 over the combination of Hanson, Wang, and Degenaro, as well as the claims 4, 10, 16, and 22 over the combination of Hanson, Wang, and Nguyen. Appellant does not particularly pointed out errors in the Examiner's reasoning regarding the

additional teachings of Degenaro or Nguyen, but merely argues that neither of the references cures the purported deficiencies of Hanson and Wang that Appellant alleges in relation to independent claim 1. Appeal Br. 14–15.

DECISION SUMMARY

In summary:

Claims Rejected	35 U.S.C. §	Basis	Affirmed	Reversed
7–12	101	Eligibility	7–12	
1, 6, 7, 12, 13, 18, 19, and 24	103	Hanson, Wang,	1, 6, 7, 12, 13, 18, 19, and 24	
2, 3, 5, 8, 9, 11, 14, 15, 17, 20, 21, and 23	103	Hanson, Wang, Degenaro	2, 3, 5, 8, 9, 11, 14, 15, 17, 20, 21, and 23	
4, 10, 16, and 22	103	Hanson, Wang, Nguyen	4, 10, 16, and 22	
Overall Outcome			1–24	

TIME PERIOD FOR RESPONSE

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). *See* 37 C.F.R. § 1.136(a)(1)(iv).

AFFIRMED