

The opinion in support of the decision being entered today was not written for publication and is not binding precedent of the Board.

Paper No. 24

UNITED STATES PATENT AND TRADEMARK OFFICE

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BEFORE THE BOARD OF PATENT APPEALS  
AND INTERFERENCES

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Ex parte LUKE M. BROWNING  
and JEFFREY S. PEEK

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Appeal No. 2001-0048  
Application No. 08/497,481

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ON BRIEF

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Before BARRETT, FLEMING, and SAADAT, Administrative Patent Judges.  
SAADAT, Administrative Patent Judge.

DECISION ON APPEAL

This is a decision on appeal from the Examiner's final rejection of claims 1, 3, 6, 7, 9, 10, 12 and 13. Claims 2, 4, 5, 8 and 11 have been canceled.

We affirm-in-part.

BACKGROUND

Appellants' invention is directed to a method and system for optimizing thread processing in a multiprocessor data processing system by establishing a priority order of threads executed within the system. Threads are assigned to a local execution

queue and are executed in a particular order such that the affinity threads that have a high degree of shared resource utilization are assigned to the same local queue (specification, page 1). The queue order is determined by selecting a most favored runnable thread from among either a current thread, a most favored thread, or an affinity thread (specification, page 4). Alternatively, the current thread is dispatched for execution if it is runnable and has the same priority as the highest priority thread (specification, page 12). Otherwise, the system selects the affinity thread if it has the same priority as the thread with the highest priority (id.).

Representative independent claims 1 and 3 are reproduced below:

1. A method, within a multiprocessor data processing system including a plurality of processors, and a single execution queue of multiple threads from which threads are dispatched for execution by any of said plurality of processors in a priority order, for establishing said priority order, said method comprising:

(a) determining whether a current executing thread may still be run on a selected one of said plurality of processors;

(b) in response to said current executing thread being runnable, placing said current executing thread on said single execution queue;

(c) in response to an availability of said selected one of said plurality of processors selecting a thread having the highest priority on said single execution queue;

(d) determining whether said current executing thread has the same priority as said thread having highest priority selected from said single execution queue;

(e) upon determining said current executing thread and said highest priority thread are equal, running said current executing thread;

(f) otherwise, if said highest priority thread is greater in priority than said current executing thread, determining whether a thread having affinity has the same priority as said highest priority thread; and

(g) running said affinity thread if equal to said thread having highest priority.

3. A method for establishing a priority order of threads within a single execution queue of a multiprocessor data processing system, comprising:

selecting for execution within a selected processor a most favored runnable thread from either a current thread executing within said selected processor having the same priority as a most favored thread or an affinity thread having the same priority as said most favored thread.

The Examiner relies on the following references in rejecting the claims:

Raj Vaswani et al. (Vaswani), "The Implications of Cache Affinity on Processor Scheduling for Multiprogrammed, Shared Memory Multiprocessors," ACM, 1991, pp. 26-40.

Cochcroft, Jr. et al. (Cochcroft) 5,317,738 May. 31, 1994

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Claims 1, 3, 6, 7, 9, 10, 12 and 13 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Vaswani and Cochcroft.

Rather than reiterate the viewpoints of the Examiner and Appellants, we make reference to the answer (Paper No. 22, mailed November 22, 1999) for the Examiner's complete reasoning in support of the rejection and the appeal brief<sup>1</sup> (Paper No. 21, filed September 13, 1999) for Appellants' arguments thereagainst.

#### OPINION

At the outset, we note that Appellants state that claims 1, 7, 10 and 13 constitute one group while claims 3, 6, 8, 9 and 12 stand or fall together (brief, page 6). It is unclear why Appellants have grouped independent claims 3, 9 and 12 separately from their corresponding dependent claims 7, 10 and 13. Although Appellants have provided a statement regarding the groupings of the claims, Appellants provide no particular explanation in support of grouping claims 7, 10 and 13 with claim 1 as required by 37 C.F.R. § 1.192(c)(7) (1997), nor do we discern proper justification from the language of the claims. We will, thereby,

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<sup>1</sup> A supplemental appeal brief was filed apparently in response to a communication from the Examiner (paper No. 20, mailed August 30, 1999) subsequent to filing the original appeal brief (Paper No. 19, filed June 14, 1999).

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consider claim 1 as one group and the remaining claims as another group represented by independent claim 3.

With respect to the rejection of claim 1, Appellants recognize that the current/last task of Vaswani is actually the task with the greatest affinity with a particular processor (brief, Page 7). Appellants further point out that Vaswani executes the current/last task if it is runnable and has a priority equal to the highest priority task but executes only the highest priority task otherwise (id.). Referring to the situation in which the current/last task is not runnable or has a priority not equal to the highest priority task, Appellants assert that claim 1 differs from the prior art since it requires the additional step of determining whether an affinity task having the same priority as the highest priority task is present (brief, page 8).

In response to Appellants' arguments, the Examiner asserts that Vaswani's last task is not necessarily the current task and "is determined by checking the history; e.g. a process having affinity for that processor is located" (answer, pages 4 & 5). The Examiner also argues that it is this last task which is run if "that task is runnable and has a priority as high as any runnable process" (answer, page 5). The Examiner concludes that

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the claimed step of determination of an affinity thread having the same priority as the highest priority thread is the same as Vaswani's "identifying the last task from the processor's history and executing it if its priority is as high" (id.).

In rejecting claims under 35 U.S.C. § 103, the Examiner bears the initial burden of presenting a prima facie case of obviousness. See In re Rijckaert, 9 F.3d 1531, 1532, 28 USPQ2d 1955, 1956 (Fed. Cir. 1993). The conclusion that the claimed subject matter is obvious must be supported by evidence, as shown by some objective teaching in the prior art or by knowledge generally available to one of ordinary skill in the art that would have led that individual to combine the relevant teachings of the references to arrive at the claimed invention. See In re Fine, 837 F.2d 1071, 1074, 5 USPQ2d 1596, 1598 (Fed. Cir. 1988). Furthermore, to reach a conclusion of obviousness under § 103, the examiner must also produce factual basis supported by teaching in a prior art reference or shown to be common knowledge of unquestionable demonstration, consistent with the holding in Graham v. John Deere Co., 383 U.S. 1 (1966). Our reviewing court requires this evidence in order to establish a prima facie case. In re Piasecki, 745 F.2d 1468, 1471-72, 223 USPQ 785, 787-88

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(Fed. Cir. 1984); In re Cofer, 354 F.2d 664, 668, 148 USPQ 268, 271-72 (CCPA 1966).

Our review of Vaswani confirms that the reference relates to a scheduling order of tasks to be executed on multiprocessor systems by considering affinity of the task in order to improve processing efficiency. Section A.1 on page 31 of the reference, as relied on by the Examiner, and the two preceding paragraphs, state in part:

Introducing affinity to Dynamic requires that the allocator have access to processor and task *histories* ....

We incorporated processor affinity into Dynamic's allocation decisions as follows:

A.1 Whether a processor becomes available for reallocation, the last task to have run on it is identified using the processor's history. If that task (*last-task*) is not currently active on some other processor but is runnable with useful work to perform, and if the priority of the job to which *last-task* belongs is as high as that of any job currently requesting processors, then *last-task* is activated on the available processor. Otherwise, the processor is allocated to the requesting job of highest priority.

Therefore, Vaswani selects the last task to be executed if it is runnable and has a priority as high as the highest priority running task, otherwise selects the highest priority task.

Whether the last task is interpreted as the current task, as pointed out by Appellants, or as the affinity task, as asserted by the Examiner, Vaswani executes the highest priority task only

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if the last task is not runnable or does not have a priority equal to the highest priority task. Vaswani does not separately determine whether the priority of a current task and the priority of an affinity task are equal to the highest priority before allocating the processor to the highest priority task. We disagree with the Examiner's characterization of the last task as both the claimed current task and the affinity task (final rejection, pages 1& 2) since Vaswani determines the priority of the last task only once before moving on to executing the task with the highest priority. Therefore, the last task may be characterized as either the current task or the affinity task, not both, whereas claim 1 requires first, the selection of the current task having a priority equal to the highest priority, otherwise, the selection of the affinity task having the same priority as the highest priority.

Cochcroft, on the other hand is relied on by the Examiner for teaching the selection of processors from a single run queue (final rejection, page 2). However, Cochcroft fails to overcome the above deficiencies of Vaswani with respect to claim 1. Assuming, arguendo, that it would have been obvious to utilize the single run queue of Cochcroft in Vaswani's processor scheduling method, as held by the Examiner, the combination of

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references would still not disclose the claimed sequence of priority order from the current task to the affinity task. Accordingly, since the Examiner has failed to establish a prima facie case of obviousness, the 35 U.S.C. § 103 rejection of independent claim 1 cannot be sustained.

Turning now to the rejection of claim 3, we note that Appellants merely repeat the claim language and argue that Vaswani is silent on the subject of selecting a most favored thread (brief, page 9). The Examiner responds by questioning the meaning of a "most favored thread" in claim 3 and pointing to the alternative format of the claim which, as one of the alternatives, recites "selecting an affinity thread having the same priority as the most favored thread" (answer, page 5). The Examiner further characterizes the high priority threads and affinity threads of Vaswani as the most favored threads which may be selected as "a most favored thread (the thread which is finally selected) among favored threads (from high priority threads and threads having affinity for the particular processor)" (id.).

Before addressing the claim rejection based on prior art, as pointed out by our reviewing court, we must first determine the scope of the claim. "[T]he name of the game is the claim." In

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re Hiniker Co., 150 F.3d 1362, 1369, 47 USPQ2d 1523, 1529 (Fed. Cir. 1998). The terms used in the claims bear a "heavy presumption" that they mean what they say and have the ordinary meaning that would be attributed to those words by persons skilled in the relevant art. Texas Digital Systems, Inc. v. Telegenix, Inc., 308 F.3d 1193, 1201-1202, 64 USPQ2d 1812, 1817 (Fed. Cir. 2002). Furthermore, claims will be given their broadest reasonable interpretation consistent with the specification, and limitation appearing in the specification are not to be read into the claims. In re Etter, 756 F.2d 852, 858, 225 USPQ 1, 5 (Fed. Cir. 1985). Additionally, for proper claim interpretation, the starting point must be the words of the claim which will be given their ordinary and accustomed meaning, unless it appears that the inventor used them differently. Envirotech Corp. v. Al George, Inc., 730 F.2d 753, 759, 221 USPQ 473, 477 (Fed. Cir. 1984).

A review of claim 3 reveals that the recited step of selecting "a most favored runnable thread" requires selection from "either a current thread" or "an affinity thread." The current thread and the affinity thread must further have the same priority as a most favored thread. We find that Appellants' specification merely mentions the claimed "most favored thread"

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(specification, page 4, lines 14-27 and page 11, lines 19-26), but does not specifically describe how a thread becomes the most favored thread. Here, absent detailed disclosure to the contrary of what Appellants mean by the "most favored thread," the Examiner's interpretation of the term as the thread that is favored over another as it has for example, the highest priority or an affinity, is reasonable (answer, page 5). Therefore, the Examiner has properly corresponded Vaswani's thread, which is finally selected, to the claimed most favored thread which is selected as an affinity thread that has high priority. In response, Appellants have not pointed out any error in the Examiner's position and instead, have merely repeated the claim language and asserted that the prior art does not teach selecting a most favored thread (brief, page 9). Accordingly, we sustain the 35 U.S.C. § 103 rejection of independent claims 3, 9 and 12, as well as claims 6, 7, 10 and 13 dependent thereupon, over Vaswani and Cochcroft.

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CONCLUSION

In view of the foregoing, the decision of the Examiner rejecting claim 1 under 35 U.S.C. § 103 is reversed but sustained with respect to the rejection of claims 3, 6, 7, 9, 10, 12 and 13.

No time period for taking any subsequent action in connection with this appeal may be extended under 37 CFR § 1.136(a).

AFFIRMED-IN-PART

LEE E. BARRETT	)	
Administrative Patent Judge	)	
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	)	BOARD OF PATENT
MICHAEL R. FLEMING	)	APPEALS
Administrative Patent Judge	)	AND
	)	INTERFERENCES
	)	
	)	
MAHSHID D. SAADAT	)	
Administrative Patent Judge	)	

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