

THIS OPINION WAS NOT WRITTEN FOR PUBLICATION

The opinion in support of the decision being entered today (1) was not written for publication in a law journal and (2) is not binding precedent of the Board.

Paper No. 14

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE BOARD OF PATENT APPEALS
AND INTERFERENCES

Ex parte PATRICK W. P. DIRKS

Appeal No. 97-2696
Application 08/231,657¹

HEARD: MARCH 10, 1999

Before THOMAS, FLEMING and LALL, Administrative Patent Judges.
LALL, Administrative Patent Judge.

DECISION ON APPEAL

This is an appeal from the final rejection of claims 1, 2, 5, 6, 7 and 9 through 23. Claims 3, 4 and 8 have been objected to and are thus not on appeal.

The disclosed invention relates to the management of

¹ Application for patent filed April 25, 1994.

virtual memory in a computer system. The logical addresses in the virtual memory are mapped to the physical memory on an as needed basis in a page table. In conventional systems, the page table is cleared in one colossal sweep after all the free addresses have been used up. The invention carries out the clearing or sweeping of the used addresses in an incremental, ongoing manner, to avoid significant delays caused by one colossal sweep. This is accomplished by the fact that, upon the occurrence of a regular event such as the allocation of free addresses to a new thread or program, a limited number of entries in the page table are examined and those entries that have already been used and are no longer needed are deleted or cleared and added back to the list of free entries.

Representative claims 1 and 17 are reproduced as follows:

1. A method for allocating address space in a virtual memory system for a computer, comprising the steps of:

maintaining a list of available addresses that are free to be allocated to a program;

allocating addresses to a program in response to requests for address space;

recording entries in a page table relating to addresses that have been allocated;

Appeal No. 97-2696
Application 08/231,657

upon each allocation of an available address, examining a number of entries in the page table, which number is less than the total number of entries in the table, to determine whether the entries have been identified as no longer active;

removing the entries from the table which have been determined to be no longer active, and maintaining a list of the addresses associated with the entries being removed; and

transferring the list of addresses associated with removed entries to the list of allocatable addresses.

17. A system for managing memory in a computer, comprising:

means for allocating ranges of logical addresses to provide access to the memory of the computer;

a page table containing entries which map allocated logical addresses to physical addresses for the memory;

means for indicating that a range of logical addresses has been deallocated;

means responsive to the occurrence of a predetermined event for examining a limited number of the entries in the page table to determine whether they are associated with an address that has been deallocated, and for removing each such entry from the page table; and

means for indicating that addresses whose entries have been removed from the page table are available for further allocation.

The references relied on by the examiner are:

Perazzoli, Jr. (Perazzoli) 5,101,485 Mar. 31, 1992

Appeal No. 97-2696
Application 08/231,657

Orbits et al. (Orbits)	5,237,673	Aug. 17, 1993
Abramson et al. (Abramson)	5,269,013	Dec. 7, 1993

Claims 1, 2, 6, 7, 10 to 13, 15, 17 to 20, 22 and 23 stand rejected under 35 U.S.C. § 102 over Perazzoli. Claims 1,

2, 5 to 7, 9 to 15, 17 to 20, 22 and 23 stand rejected under 35 U.S.C. § 102 over Orbits. Claims 16 and 21 stand rejected under 35 U.S.C. § 103 over Orbits and Abramson.

Reference is made to Appellant's brief and the Examiner's answer for their respective positions.

OPINION

We have considered the record before us, and we will reverse the rejection of claims 1, 2, 5, 6, 7 and 9 through 23, all the claims on appeal.

We take the various rejections in the order they appear in the brief and the answer.

First we deal with the two rejections based on anticipation under 35 U.S.C. § 102. In so doing, we keep in mind that anticipation under 35 U.S.C. § 102 requires that

Appeal No. 97-2696
Application 08/231,657

all elements of the claimed invention be described in a single reference. In re Spada, 911 F.2d 705, 708, 15 USPQ2d 1655, 1657 (Fed. Cir. 1990).

Rejection under 35 U.S.C. § 102 over Perazzoli

Claims 1, 2, 6, 7, 10 to 13, 15, 17 to 20, 22 and 23 are rejected as being anticipated under 35 U.S.C. § 102 by Perazzoli. We take claim 1 as representative. We have

considered Appellant's arguments [brief, pages 7 to 9] and Examiner's position [answer, pages 3, 4, 6 and 7] regarding claim 1. The Examiner has not found in Perazzoli any specific text and figure which show, for example, these claimed limitations: "upon each allocation of an available address, examining ... whether the entries have been identified as no longer active;" (claim 1, lines 6 to 8), and "removing the entries ... and maintaining a list of the addresses associated with the entries being removed;" (claim 1, lines 9 to 10).

From our review of Perazzoli we also do not find. Perazzoli swaps page table pages when the pages get used up (column 2, lines 35 to 52). Perazzoli does not keep track of the addresses of the entries on an ongoing basis as the entries

Appeal No. 97-2696
Application 08/231,657

are being allocated and/or removed. We, therefore, conclude that the anticipation rejection of claim 1 over Perazzoli is not sustainable.

With respect to the independent claim 6, it too contains the claimed limitations corresponding to the limitations discussed above, namely: "maintaining a list of addresses that have been deleted;", "upon the occurrence of ... event, examining ... whether those entries are associated with any of the addresses on said list;" and "removing each examined entry from the page table

which is associated with an address on said list;" (claim 6, lines 5 to 10). For the same rationale as claim 1, the anticipation rejection of claim 6 over Perazzoli is also not sustainable.

Regarding the independent claim 17, we find that it contains the corresponding limitations, namely: "means for indicating that a range of logical addresses has been deallocated;", "means ... for examining a limited number of the entries in the page table to determine whether they are associated with an address that has been deallocated, and for

Appeal No. 97-2696
Application 08/231,657

removing each such entry from the page table;" (claim 17, lines 6 to 10). The anticipation rejection of claim 17 is, therefore, also not sustainable for the same reasons as claim 1.

Since the dependent claims 2, 7, 10 to 13, 15, 18 to 20, 22 and 23 contain at least the above discussed limitations of their respective independent claims 1, 6 and 17, their anticipation rejection over Perazzoli is not sustained.

Rejection under 35 U.S.C. § 102 over Orbits

Claims 1, 2, 5 to 7, 9 to 15, 17 to 20, 22 and 23 are rejected as being anticipated under 35 U.S.C. § 102 over Orbits.

We take claim 1 for example. We have considered Appellant's arguments [brief, pages 10 to 11] and Examiner's position [answer, pages 4, 7 and 8] regarding claim 1. The Examiner has not identified in Orbits any specific text and figure which show, for example, these claimed limitations: "upon each allocation of an available address, examining ... whether the entries have been identified as no longer active;" (claim 1,

Appeal No. 97-2696
Application 08/231,657

lines 6 to 8), and "removing the entries ... and maintaining a list of the addresses associated with the entries being removed;" (claim 1, lines 9 to 10). From our review of Orbits we also are unable to find these limitations. Orbits runs the paging daemon at regular prescribed time intervals to clear pages which are no longer being used, and once the daemon is activated, the entire core is scanned. Also, Orbits does not keep track of the addresses of the entries on an ongoing basis as the entries are being allocated and/or removed. We, therefore, conclude that the anticipation rejection of claim 1 over Orbits is not sustainable.

With respect to the independent claim 6, it too contains the claimed limitations corresponding to the limitations discussed, namely: "maintaining a list of addresses that have been deleted;", "upon the occurrence of ... event, examining ...

whether those entries are associated with any of the addresses on said list;" and "removing each examined entry from the page table which is associated with an address on said list;" (claim 6, lines 5 to 10). For the same reasons as claim 1,

Appeal No. 97-2696
Application 08/231,657

the anticipation rejection of claim 6 over Orbits is also not sustainable.

Regarding the independent claim 17, we find that it contains the corresponding limitations, namely: "means for indicating that a range of logical addresses has been deallocated;", "means ... for examining a limited number of the entries in the page table to determine whether they are associated with an address that has been deallocated, and for removing each such entry from the page table;" (claim 17, lines 6 to 10). The anticipation rejection of claim 17 is, therefore, is also not sustainable for the same reasons as claim 1.

Since the dependent claims claims 2, 5, 7, 9 to 15, 18 to 20, 22 and 23 contain at least the above limitations of their respective independent claims 1, 6 and 17, their anticipation rejection over Orbits is not sustained.

Rejection under 35 U.S.C. § 103 over Orbits and Abramson

The Examiner has rejected claims 16 and 21 as being obvious over Orbits in view of Abramson. We have reviewed

Appeal No. 97-2696
Application 08/231,657

Appellant's arguments [brief, pages 13 to 14] and Examiner's position [answer, pages 5, 6, 8 and 9] in regard to these claims. Claims 16 and 21 depend on the independent claims 6 and 17 respectively and, therefore, contain at least the same limitations as discussed in regard to claims 6 and 17. Since Abramson does not cure the deficiencies of Orbits in regard to those limitations, the obviousness rejection of claims 16 and 21 is also not sustained.

In summary, we have not sustained the anticipation rejection of claims 1, 2, 6, 7, 10 to 13, 15, 17 to 20, 22 and 23 over Perazzoli. We have not sustained the anticipation rejection of claims 1, 2, 5 to 7, 9 to 15, 17 to 20, 22 and 23 over Orbits. We also have not sustained the obviousness rejection of claims 16 and 21 over Orbits and Abramson.

DECISION

The decision of the Examiner rejecting claims 1, 2, 6, 7, 10 to 13, 15, 17 to 20, 22 and 23 under 35 U.S.C. § 102 over Perazzoli, rejecting claims 1, 2, 5 to 7, 9 to 15, 17 to 20, 22

Appeal No. 97-2696
Application 08/231,657

and 23 under 35 U.S.C. § 102 over Orbits, and rejecting claims
16 and 21 under 35 U.S.C. § 103 over Orbits and Abramson is
reversed.

REVERSED

JAMES D. THOMAS)	
Administrative Patent Judge)	
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MICHAEL R. FLEMING)	BOARD OF PATENT
Administrative Patent Judge)	APPEALS AND
)	INTERFERENCES
)	
)	
PARSHOTAM S. LALL)	
Administrative Patent Judge)	

Appeal No. 97-2696
Application 08/231,657