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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* MANISH K. AHLUWALIA

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Appeal 2010-003184  
Application 10/790,509  
Technology Center 2100

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Before: ROBERT E. NAPPI, ERIC S. FRAHM, and TREVOR M.  
JEFFERSON, *Administrative Patent Judges*.

JEFFERSON, *Administrative Patent Judge*.

DECISION ON APPEAL

STATEMENT OF CASE

Appellant appeals under 35 U.S.C. § 134(a) from a Final rejection of claims 1-23. We have jurisdiction under 35 U.S.C. § 6(b).

We affirm.

*Introduction*

The claims are directed to memory management using virtual address space and physical address space for a process associated with a removable memory, mappable device. Abstract. Claims 1 and 23 reproduced below are illustrative of the claimed subject matter:

1. A computing device, comprising:
  - a processor;
  - a memory coupled to the processor; and
  - program instructions provided to the memory and executable by the processor to:
    - track a virtual address space for a process associated with a device connected to the computing device;
    - release a physical address space associated with the virtual address space when the device has a connection removed from the computing device;
    - provide an indication in a virtual memory data structure associated with the process that the virtual address space, previously available to the process, is no longer valid for use by the process;
      - wherein the indication is triggered by detection that the physical address space that was being used by processes associated with the device has been released; and
      - wherein the indication occurs responsive to the physical address space being released and before release of the virtual address space by the process.
  
23. A computer readable storage medium having computer readable instructions stored thereon for execution by a device to perform a method, comprising:

dereferencing a virtual address space for a process associated with a removable memory mappable device as part of a memory management system on a computing device;

releasing a physical address space when the device is logically disconnected from the computing device; and

at the release of the physical address space used by the process and before the process has released the virtual address space, registering an indication in a virtual memory data structure for the process that the virtual address space is no longer available to the process in a manner which does not violate semantics for an operating system the computing device.

### *Rejections*

The Examiner made the following rejections:

Claim 23 stands rejected under 35 U.S.C § 112 first paragraph as failing to comply with written description requirement. Ans. 3-4.

Claim 1-23 stands rejected under 35 U.S.C § 103(a) as being unpatentable over Arimilli (US 6,907,494 B2, Jun. 14, 2005) and Browning (US 6,918,023 B2, Jul. 12, 2005). Ans. 4-12.

### *Claim Grouping*

Appellant's arguments for independent claims 8 (App. Br. 18-24), 19 (App. Br. 27-33), 22 (App. Br. 33-38), and 23 (App. Br. 38-43) rely on the arguments presented for independent claim 1. We select independent claim 1 as representative of claims 8, 19, 22 and 23. Appellant presents separate argument for independent claims 13 and 23, which we address separately. Finally, dependent claims 2-7, 9-12, 14-18 and 20-21 stand or fall with their respective independent claims.

ANALYSIS

*Claim 23 – 35 U.S.C. § 112 ¶1 Rejection*

Issue: Did the Examiner err in rejecting claim 23 under 35 U.S.C. § 112 ¶1 for failing to clearly define “computer readable storage medium” as recited in claim 23?

We do not agree with the Examiner that Appellant’s Specification fails to define or describe the term and is therefore not in possession of the invention of claim 23 because:

it is . . . well known in the art that computer readable medium is a broad term in accordance with plain meaning that includes any type of memory devices, as well as signals or carrier waves such that any type of memory devices, as well as signals or carrier waves can store and transfer information.

Ans. 13. Appellant’s Specification describes computer readable media sufficient to convey that the inventor possesses “computer readable storage medium” as recited in claim 23. App. Br. 9-10; Reply 1-2. In addition, an amendment to exclude transitory signals would typically not give rise to a new matter amendment. *See* David J. Kappos, Subject Matter Eligibility of Computer Readable Media, 1351 OFF. GAZ. PAT. OFFICE 212 (Feb. 23, 2010)(noting that adding “non-transitory” to avoid a 35 U.S.C. § 101 rejection would not raise the issue of new matter). Here, we find that the Examiner erred in finding that “computer readable storage medium” failed to comply with 35 U.S.C. § 112 ¶1. We do not sustain the Examiner’s rejection of claim 23.

*Independent Claim 1 – § 103(a) Rejection*

Issue: Did the Examiner err in rejecting claim 13 under 35 U.S.C. § 103(a) by finding that Arimilli and Browning teach or suggest “an indication in a virtual memory data structure associated with the process that the virtual address space, previously available to the process, is no longer valid” and that “the indication is triggered by detection that the physical address space that was being used by the process associated with the device has been released” as recited in claim 1?

Appellant contends that the RPN list processing in Browning does not teach or suggest “indication in a virtual memory data structure associated with the process that the virtual address space, previously available to the process, is no longer valid.” App. Br. 11-16; Reply 2-4. Specifically, Appellant contends that the RPN entry is invalid merely indicates that the “virtual-to-physical mapping contained in the RPN ... must be updated.” App. Br. 12 (emphasis omitted). Appellant also argues that the RPN list is not “associated with the process” and thus cannot meet the limitation of claim 1. App. Br. 13. Finally, Appellant contends that the transient and memory-remove-in-progress flags identified by the Examiner fail to provide “an indication in a virtual memory structure” as recited in claim 1. App. Br. 13-14; Reply 2-3.

The Examiner found Browning teaches or suggests “providing a flag to indicate when virtual memory is removed in progress ... and reinitializing real page number RPN entry and mark entry as valid when memory remove in progress flag is not set.” Ans. 15. Thus, the memory remove in progress flag provides an indication in a virtual memory structure as recited in claim 1. Ans. 15 (citing Browning col. 8, ll. 32-44; Fig. 8, step 834). The

Examiner also found that the memory remove process, in addition to setting the memory remove in progress flag, also scans all registered RPN lists and invalidates all entries that correspond to the range of memory to be removed. Ans. 5; *see* Browning, col. 8, l. 53 – col. 9, l. 10; Fig. 9. Thus, the Examiner asserts that the memory remove in progress flag is set in the buffer descriptor which is stored with the RPN list, which contains the sets of virtual addresses. Ans. 16.

Having reviewed Appellant’s arguments that the Examiner erred, we agree with the Examiner. Although the Examiner identifies the transient flag in Browning as teaching the claimed “indication in a virtual data structure,” Ans. 15, the Examiner specifically states that the memory remove in progress flag also corresponds to the indication that is part of a virtual data structure as part of the buffer descriptor stored with the RPN. Ans. 16. We agree with the Examiner that the memory remove process invalidates the RPN list and sets the memory remove in progress flag, thus indicating within the RPN lists or data structure that the physical memory associated with the RPN lists is invalid. *See* Ans. 5; 15-16; Browning, col. 8, l. 18 – col. 9, l. 10; Figs. 8 and 9.

We are also not persuaded by Appellant’s contention that the RPN list is not associated with a process. App. Br. 14; Reply 4-5. One cannot show nonobviousness by attacking references individually where the rejections are based on combinations of references. *See In re Merck & Co., Inc.*, 800 F.2d 1091, 1097 (Fed. Cir. 1986). The Examiner relies on Arimilli, not Browning, to teach or suggest virtual address space associated with a particular process and release of the physical address space when the device has a connection removed. Ans. 4 (citing Arimilli, col. 5, l. 66 – col. 6, l.

39; Fig. 2; col. 7 ll. 32-57). Furthermore, the Examiner correctly states Browning teaches or suggests that RPN lists include multiple sets of virtual address lists, such that one of ordinary skill in the art would understand that such lists correspond to particular processes disclosed in Arimilli. *See* Ans. 16. Thus, it is the combination of Arimilli and Browning that the Examiner properly found teaches or suggests an indication in a virtual memory data structure associated with the process that the virtual address space, previously available to the process, is no longer valid as recited in claim 1.

Appellant contends that the moving or removing of real pages of memory in Browning is not the same as the release of physical address space as recited in claim 1. *Id.*, Reply 5. Thus, Appellant contends that Arimilli and Browning do not teach or suggest “the indication is triggered by detection that the physical address space that was being used by the process associated with the device has been released” as recited in claim 1. App. Br. 14-18. We disagree with Appellant. During the memory remove process, Browning teaches or suggests setting an in-progress flag and invalidating the RPN lists associated with that memory. Ans. 5; *see* Browning, col. 8, l. 53 – col. 9, l. 10; Figs 8 and 9. Accordingly, we agree with the Examiner that Browning teaches to trigger an indication during a memory remove process. Ans. 17-18. The triggering and remove process is separate from the Browning teachings that the RPN lists are reinitialized or remapped to the new memory space. *Id.* Contrary to Appellant’s arguments (App. Br. 14-18; Reply 5), the additional steps of relocating the physical or real memory space does not negate that Browning teaches that removal of real pages of memory from its prior location invalidates the RPN list and sets the in-

progress flag. Ans. 5; *see* Browning, col. 8, l. 53 – col. 9, l. 10; Figs. 8 and 9.

Based on the foregoing, we find that the Examiner did not err in finding that Arimilli and Browning teach or suggest “an indication in a virtual memory data structure associated with the process that the virtual address space, previously available to the process, is no longer valid” and that “the indication is triggered by detection that the physical address space that was being used by the process associated with the device has been released” as recited in claim 1. Accordingly, we sustain the Examiner’s rejection of claim 1 under 35 U.S.C. § 103(a). We also sustain the Examiner’s rejection of independent claims 8, 19, 22 and 23 under 35 U.S.C. § 103(a), which rely on the same arguments presented for independent claim 1.

*Independent Claim 13 – § 103(a) Rejection*

Issue: Did the Examiner err in finding that Browning and Arimilli teach or suggest “means unmapping a virtual address space for the process ... in a manner which does not violate semantics for an operating system of the computing device” as recited in claim 13.

Appellant contends that Arimilli fails to teach or suggest unmapping virtual space in manner that does not violate operating system semantics. App. Br. 27. Appellant contends that its Specification describes various techniques of unmapping “without violating semantics of an operating system” that are not encompassed by the Arimilli teaching for unmapping without the need for operating system supervision as found by the Examiner. App. Br. 25-27 (citing Spec. 17:1-19, 19:6-23, 20:17-21:2).

We disagree with Appellant's contention. The Examiner found Arimilli teaches unmapping of a virtual memory address space for a process. Ans. 25. The Examiner also found that this unmapping takes place via the move and mapping engines of the processor without the operating system having to direct and control the reconfiguration of physical memory. *Id.*

Given the broadest reasonable construction in light of the disclosure, *see In re Am. Acad. of Sci. Tech. Ctr.*, 367 F.3d 1359, 1364 (Fed. Cir. 2004), unmapping in a manner that does not violate operating system semantics recited in claim 13 is not limited to techniques expressly found in Appellant's Specification. Indeed, Appellant's Specification simply provides examples of techniques but does not limit unmapping without violating semantics to a particular method. A determination of obviousness does not require the claimed invention to be expressly suggested by any one or all of the references. *See e.g., In re Keller*, 642 F.2d 413, 425 (CCPA 1981). Although Arimilli does not use the express techniques found in Appellant's Specification, we agree with the Examiner that the teaching of Arimilli that removes a memory module from physical memory without the operating system's direction or control, prior to the physical removal of the memory, encompasses the unmapping without violating semantics limitation of claim 13.

We find that Examiner did not err in finding that Browning and Arimilli teach or suggest "means unmapping a virtual address space for the process ... in a manner which does not violate semantics for an operating system of the computing device" as recited in claim 13. We sustain the Examiner's rejection of claim 13 under 35 U.S.C. § 103(a).

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DECISION

For the above reasons, we REVERSE the Examiner's rejection of claim 23 for failure to comply with 35 U.S.C. § 112 ¶1 and AFFIRM the Examiner's rejection of independent claims 1, 8, 13, 19, 22 and 23 and related dependent claims 2-7, 9-12, 14-18 and 20-21 under 35 U.S.C. § 103(a).

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)(iv).

AFFIRMED

ELD