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Kunzler Law Group
50 W. Broadway
10th Floor
Salt Lake City, UT 84101

EXAMINER	
GORTAYO, DANGELINO N	

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UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

Ex parte JAMES PETERSON, EVAN ORME, KEVIN VIGOR, and MICHAEL ZAPPE

Appeal 2016-002761
Application 13/531,316
Technology Center 2100

Before JOHN A. JEFFERY, BRADLEY W. BAUMEISTER, and DENISE M. POTHIER, *Administrative Patent Judges*.

POTHIER, *Administrative Patent Judge*.

DECISION ON APPEAL

STATEMENT OF THE CASE

Appellants appeal under 35 U.S.C. § 134(a) from the Examiner's rejection of claims 1–25. App. Br. 1.[1] We have jurisdiction under 35 U.S.C. § 6(b). We reverse.

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[1] Throughout this opinion, we refer to (1) the Final Action (Final Act.) mailed December 12, 2014, (2) the Appeal Brief (App. Br.) filed June 26, 2015, (3) the Examiner's Answer (Ans.) mailed November 6, 2015, and (4) the Reply Brief (Reply Br.) filed January 6, 2016.

Invention

Appellants' invention indexes data of an append-only, log-based structure. Spec. ¶ 2. In particular, the invention maps logical-block addresses to physical locations on a solid-state storage media. *Id.* ¶ 168. In one embodiment, a log-based structure contains an index for reconstructing this logical-to-physical mapping. *Id.* ¶¶ 167, 172. Sequentially stored data can serve as the log. *Id.* ¶ 162. For instance, the invention stores index data by sequentially appending data packets to an "append point" of a log-based structure. *Id.* ¶ 192. To retrieve the stored index data, the invention uses an index root (e.g., 660) with pointers to index segments (e.g., 650, 652, 654). *Id.* ¶ 204, Figs. 6–7. Because the index data is stored sequentially, corrupted or lost indices may be reconstructed by addressing the solid-state storage media in the order that the data was written. Spec. ¶ 167. Claim 1 is reproduced below with emphasis:

1. A method comprising:

writing a plurality of data packets to a storage medium by sequentially appending the data packets to an append point of a log-based structure of the storage medium, the data packets associated with different logical identifiers belonging to a logical address space that is independent of physical storage locations on the storage medium;

writing an index segment associated with the plurality of data packets to the append point of the log-based structure, the index segment comprising index entries for determining the logical identifiers of the data packets; and

recording information on the storage medium, the information indicating where the index segment is written on the storage medium.

The Examiner relies on the following as evidence of unpatentability:

Hung	US 8,239,619 B2	Aug. 7, 2012
Eom	US 8,261,010 B2	Sept. 4, 2012
Post	US 8,478,796 B2	July 2, 2013

The Rejections

Claims 1, 2, 4–20, and 22–24 are rejected under 35 U.S.C. § 103(a) as unpatentable over Eom and Hung. Final Act. 3–16.

Claims 3, 21, and 25 are rejected under 35 U.S.C. § 103(a) as unpatentable over Eom, Hung, and Post. Final Act. 16–19.

THE OBVIOUSNESS REJECTION OVER EOM AND HUNG

Contentions

The Examiner finds that Eom discloses every recited element of claim 1, except for the recited index segment comprising index entries for determining the logical identifiers of the data packets. Final Act. 3–4. The Examiner relies on Hung to teach this feature when combined with Eom in concluding that claim 1 would have been obvious. *Id.* at 4–5. In this proposed combination, the Examiner finds that Eom's log blocks correspond to the recited data packets. *Id.* at 3. Furthermore, the Examiner finds that Eom's log block mapping-table entries correspond to the recited index segment. *Id.* at 4.

Appellants argue that Eom does not write an index segment to the append point where the data packets are appended. App. Br. 7; Reply Br. 2–3. According to Appellants, Eom's log-block mapping table is separate from the log blocks. App. Br. 7. In Appellants' view, Eom does not write an index segment to *the* append point—even under the Examiner's

mapping—because Eom writes the mapping-table entries ("index segments") and log blocks ("data packets") to separate points. *Id.*

Issue

Under § 103, has the Examiner erred in rejecting claim 1 by finding that Eom would have taught or suggested writing data packets and the associated index segments to the same append point of a log-based structure?

Analysis

We begin by noting that Hung was not relied upon to teach the limitation at issue. *See* Final Act. 3–5. Accordingly, we confine our discussion to Eom.

Claim 1 calls for, in pertinent part, "an append point of a log-based structure." Appellants use a log-based structure to reconstruct a mapping from logical to physical memory. Spec. ¶ 167. Sequentially stored data can serve as this log. *Id.* ¶ 162. One embodiment appends data to the head of the log. *Id.* ¶ 160. In another example, the log is a logical ring-like data structure. *Id.* ¶ 149. In this example, new data is appended to the log such that previously used, physical capacity is reused in a circular manner. *Id.* Although these examples inform our construction, the Specification does not define "an append point" to limit our interpretation to these particular embodiments.

The Examiner interprets the append point as "the available, free block of data in a memory device." Ans. 5. Given this interpretation, the Examiner finds that Eom appends data to the log-based structure.

Id. at 5 (citing Eom 5:53–59). Specifically, the Examiner finds that an append point is "the location" in Eom's sequential log block where log blocks ("data packets") and mapping-table entries ("index segments") are written. *Id.* at 4–5; Final Act. 3–4.

In claim 1, the antecedent basis for "the append point" in the "writing an index segment" step is the append point in the previously recited "writing data packets" step. That is, claim 1 requires writing data packets and the associated index segments to the same append point. The Examiner finds "the append point is defined as a location in the log-based data structure" (Ans. 4) or "the available, free block of data in a memory device" (*id.* at 5). Using this understanding, we agree with Appellants' argument that Eom does not write log blocks ("data packets") and mapping-table entries ("index segments") to the same append point. *See* App. Br. 7.

Specifically, Eom discloses a flash-memory device including physical flash-memory data blocks and a flash translation layer (FTL). Eom 6:16–24. The FTL maps logical addresses to physical memory addresses. *Id.* The physical memory's data blocks are classified into log blocks and data blocks. *Id.* at 9:16–19. Log blocks store write requests for previously written data blocks. *See id.* at 11:1–3. So if the system generates an update request on a page written in a data block, the system puts the page's write request in a log block to fulfill the update request. *Id.* To record this activity, Eom's log-block mapping table associates the log block to the corresponding data block. *Id.* at 11:4–15. In particular, the log-block mapping table's entries hold a logical log-block number (LLBN) and the corresponding logical block number (LBN). *Id.*; *see also id.*, Figs. 11H–11I (showing the data

packets (e.g., p1–p3) and log blocks (e.g., L0–L3) as well as the log-block mapping table to the right).

The Examiner has not shown that Eom writes log blocks entries ("data packets") and log block mapping-table entries ("index segments") to the same append point. *See* Final Act. 3–4. Rather, the Examiner's cited example shows that Eom's log blocks and mapping-table entries are written to separate data structures. *See* Ans. 7 (citing Eom 14:33–40, Fig. 11H). For example, Eom's Figure 11H shows a log block having blocks L0 through L3. Eom, Fig. 11H. The incoming write request causes an update to pages p5, p6, and p7. *See id.* Eom writes the log data ("data packet") to the next available log block L1. *See id.*, Fig. 11I; *see also id.* at 14:41–46. Yet, Eom writes the table entry ("index segment") to the second row of the log-block mapping table—a different, free block. *See id.*, Fig. 11I. That is, Eom fails to teach "writing an index segment . . . to the append point of the log-based structure" even under the Examiner's interpretation of the recited append point. *See* Ans. 5.

Granted, the log block mapping table has entries for log blocks (e.g., L0–L1) in its table. *See* Eom, Figs. 11H–I (e.g., L0 and L1 in the LLBN's (logical log block number) column); *see also* Ans. 7 (reproducing Eom's Fig. 11H and discussing "a corresponding association between the log block number and logical log block number in a log block mapping table.") Yet, this relationship between log blocks and the log block mapping table does not establish sufficiently that the data packets and index segments are written to the same append point as recited.

To the extent that the Examiner interprets an entire storage area as the recited append point (Ans. 6), we find that this interpretation is unreasonably broad.

As best understood, the Examiner also presents an interpretation where the combination of (1) log blocks in memory and (2) the FLT that contains a log-block mapping table are the recited log-based structure, and thus both the data packets and index segment are written to points or locations within this structure. *See id.* But as recited, the append point is "of a log-based structure." In other words, claim 1 requires that the append point must be a point or location in the structure—not the entire structure itself. As mapped by the Examiner, the recited append point and the recited log-based structure are one and the same. *See* Ans. 4–6. Such an interpretation by the Examiner (*id.* at 4, 6) is unreasonably broad because Eom's entire storage area for the log-based structure cannot be mapped to both the recited append point and the recited log-based structure itself.

Because Appellants' argument regarding the recited append point is dispositive (*see* App. Br. 7; Reply Br. 2–3), we need not reach Appellants' remaining arguments. *See* App. Br. 7–13; Reply Br. 3–7.

Given the record, Appellants have persuaded us of error in the rejection of (1) independent claim 1, (2) independent claims 19 and 23, which recite commensurate limitations, and (3) dependent claims 2, 4–15, 20, 22, and 24 for similar reasons.

Claims 16–18

We also do not sustain the rejection of claim 16 for the same reasons as explained in relation to claim 1. Claim 16 is not separately argued.

App. Br. 7–9. However, we note that, unlike claim 1, claim 16 writes data packets by sequentially appending the packets to "one or more append points of one or more log-based structures." But similar to claim 1, claim 16 writes the index segments to "one or more of *the* append points of the one or more log-based structures" (emphasis added). That is, the antecedent basis for the append points where the index segments are written are the append points for the plurality of data packets.

Accordingly, we are persuaded that the Examiner erred in finding that Eom discloses these append points in the rejection of independent claim 16, as well as dependent claims 17 and 18, for similar reasons to those discussed above in connection with claim 1. *See* App. Br. 7.

THE OBVIOUSNESS REJECTION OVER EOM, HUNG, AND POST

We also do not sustain the Examiner's rejection of dependent claims 3, 21, and 25 for the same reasons discussed above in connection with independent claims 1, 19, and 23. The additional reference, Post, was not relied upon to teach the append point, which as stated above is missing from Eom, and, thus, does not cure the deficiency explained previously given the record. *See* Final Act. 16–19.

DECISION

We reverse the Examiner's rejections of claims 1–25 under § 103.

REVERSED