

The opinion in support of the decision being entered today was not written for publication and is not binding precedent of the Board.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. 18

UNITED STATES PATENT AND TRADEMARK OFFICE

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BEFORE THE BOARD OF PATENT APPEALS  
AND INTERFERENCES

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Ex parte SORIN IACOBOVICI,  
WILLIAM R. BRYG, and JOSEPH H. HASSOUN

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Appeal No. 2002-2237  
Application No. 09/336,046

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ON BRIEF

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

DECISION ON APPEAL

This is a decision on appeal under 35 U.S.C. § 134 from the examiner's final rejection of claims 1-5 and 21<sup>1</sup>.

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<sup>1</sup> The rejection of claims 6, 7, and 22-28 under 35 U.S.C. § 103(a) has been withdrawn by the examiner (answer, page 2).

BACKGROUND

Appellants' invention relates to formed linked lists using content addressable memory (CAM). An understanding of the invention can be derived from a reading of exemplary claim 1, which is reproduced as follows:

1. In a computing system, a method for traversing a linked list comprising the following steps:

(a) accessing a first entry in the linked list; and,

(b) accessing a second entry in the linked list, including the following substep;

(b.1) searching a content addressable memory, which contains at least a portion of the second entry, for a reference to the first entry in the linked list, the reference functioning as a pointer from the second entry to the first entry, wherein existence of the pointer within a valid entry is sufficient identification of the valid entry as being uniquely the second entry.

The prior art references of record relied upon by the examiner in rejecting the appealed claims are:

Holtz	4,366,551	Dec. 28, 1982
Smith et al. (Smith)	5,283,882	Feb. 1, 1994

Claims 1, 3, 4, and 21 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Holtz.

Claims 2 and 5 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Holtz in view of Smith.

Rather than reiterate the conflicting viewpoints advanced by the examiner and appellants regarding the above-noted rejections, we make reference to the examiner's answer (Paper No. 14, mailed May 8, 2001) for the examiner's complete reasoning in support of the rejections, and to appellants' brief (Paper No. 13, filed February 5, 2001) and reply brief (Paper No. 15, filed June 12, 2001) for appellants' arguments thereagainst. Only those arguments actually made by appellants have been considered in this decision. Arguments which appellants could have made but chose not to make in the brief have not been considered. See 37 CFR 1.192(a).

#### OPINION

In reaching our decision in this appeal, we have carefully considered the subject matter on appeal, the rejections advanced by the examiner, and the evidence of obviousness relied upon by the examiner as support for the rejections. We have, likewise, reviewed and taken into consideration, in reaching our decision, appellants' arguments set forth in the briefs along with the examiner's rationale in support of the rejections and arguments in rebuttal set forth in the examiner's answer.

Upon consideration of the record before us, we reverse. Appellants assert (brief, page 4, and reply brief, page 2) that the claims stand or fall together. Consistent with this statement, appellants present arguments with respect to claim 1. However, as appellants are entitled, procedurally, to a review of at least one claim for each ground of rejection, we select claim 1 as representative of the claims rejected under 35 U.S.C. § 103(a) as unpatentable over Holtz, and select claim 2 as representative of the claims rejected under 35 U.S.C. § 103(a) as unpatentable over Holtz in view of Smith.

We begin with the rejection of claims 1, 3, 4, and 21 under 35 U.S.C. § 103(a). We turn to claim 1.

In rejecting claims under 35 U.S.C. § 103, it is incumbent upon the examiner to establish a factual basis to support the legal conclusion of obviousness. See In re Fine, 837 F.2d 1071, 1073, 5 USPQ2d 1596, 1598 (Fed. Cir. 1988). In so doing, the examiner is expected to make the factual determinations set forth in Graham v. John Deere Co., 383 U.S. 1, 17, 148 USPQ 459, 467 (1966), and to provide a reason why one having ordinary skill in the pertinent art would have been led to modify the prior art or to combine prior art references to arrive at the claimed invention. Such reason must stem from some teaching, suggestion

or implication in the prior art as a whole or knowledge generally available to one having ordinary skill in the art. Uniroyal, Inc. v. Rudkin-Wiley Corp., 837 F.2d 1044, 1051, 5 USPQ2d 1434, 1438 (Fed. Cir. 1988); Ashland Oil, Inc. v. Delta Resins & Refractories, Inc., 776 F.2d 281, 293, 227 USPQ 657, 664 (Fed. Cir. 1985); ACS Hosp. Sys., Inc. v. Montefiore Hosp., 732 F.2d 1572, 1577, 221 USPQ 929, 933 (Fed. Cir. 1984). These showings by the examiner are an essential part of complying with the burden of presenting a prima facie case of obviousness. Note In re Oetiker, 977 F.2d 1443, 1445, 24 USPQ2d 1443, 1444 (Fed. Cir. 1992). If that burden is met, the burden then shifts to the applicant to overcome the prima facie case with argument and/or evidence. Obviousness is then determined on the basis of the evidence as a whole. See id.; In re Hedges, 783 F.2d 1038, 1039, 228 USPQ 685, 686 (Fed. Cir. 1986); In re Piasecki, 745 F.2d 1468, 1472, 223 USPQ 785, 788 (Fed. Cir. 1984); and In re Rinehart, 531 F.2d 1048, 1052, 189 USPQ 143, 147 (CCPA 1976).

The examiner's position (answer, page 4) is that "Holtz does not detail a linked list in particular as the figures clearly show a tree structure." The examiner asserts (id.) that it would have been obvious to apply "the same linking techniques to linked lists as to a tree as both structures involve the li[n]king of

nodes[,] and the particular method of linking of Holtz provides a compact structure which is quickly searched when implemented in an [sic] content addressable memory improving the versatility of the DP system."

Appellants assert (brief, page 2) that the present invention presents a scheme for a linked list that is different in several respects from a traditional linked list. Each entry includes a pointer. However, instead of pointing to a next entry, the pointer points to a previous entry. To access a next entry, a search is done to determine which entry contains a pointer to the current entry. The entry that contains a pointer to the current entry is the next entry. Appellants argue (brief, pages 5 and 6) that in Holtz, the existence of a pointer within a valid entry is not sufficient identification of the valid entry as being uniquely the next entry. Appellants argue (brief, page 6) that claim 1 requires a content addressable memory that includes at least a portion of a second entry, and that the memory is searched for a reference to a first entry in the linked list. The reference functions as a pointer from the second entry to the first entry. It is argued (id.) that this feature is not taught or suggested by Holtz because in Holtz, to find a next entry, it is necessary to match a gate (e.g., the letter "R") and

a pointer to uniquely identify a sought after entry. It is further argued (brief, page 7) that because Holtz's associative memory search system is dependent upon use of a tree structure, that it would not have been obvious to modify Holtz to utilize a linked list structure rather than a tree structure. Appellants add (brief, page 9) that in the sections of Holtz relied upon by the examiner, a search of a content addressable memory is not done for a pointer alone, but rather that a search is done for a matrix having both a pointer and output data. It is additionally argued (brief, page 10, and reply brief, page 3) that because the search in Holtz is for content (i.e., the associated data/gate in addition to a pointer), Holtz uses content addressable memory. If Holtz used only pointers, and did not search on content, Holtz would not have been motivated to use content addressable memory. Moreover, appellants argue (brief, page 11) that the examiner has made no showing of any suggestion or motivation in the prior art as to why it would be desirable to implement a linked list using content addressable memory in Holtz. It is lastly argued (brief, pages 12 and 17) that "in order to implement a forward linked list in a content addressable memory, it is necessary for a next entry to link backwards. Thus to traverse forward in the linked list it is necessary to access backward pointers. This use of

backward pointers to move forward through a linked list is counter intuitive and makes the implementation of a linked list in content addressable memory nonobvious."

From our review of Holtz, we find that the graphic network displayed in figure 2 is in the form of a tree structure. We agree with the examiner (answer, pages 5 and 6) that:

Holtz shows a tree implemented (fig. 2 and fig. 3) in a "content addressable memory" or cam (fig. 4, index 12). One of ordinary skill in the art at the time of the invention would have a knowledge of the data structures known as trees and those known as linked lists. He would know the trees are commonly made of nodes linked by pointers, starting at a route [sic, root] node which would provide links to one or more child nodes and each of the child nodes capable of having multiple child nodes. The tree forming branched chains of nodes terminating in leaf nodes which have no further children. One of ordinary skill in the art would know the linked lists are also a [sic] common data structures which start ant [sic, at] a head which is linked to another node which may be linked to still another. The linked list forming a single chain of nodes, which terminates in an end node. One of ordinary skill in the art would realize that a linked list is related to a tree, in effect being a simplified tree as it does not allow branching. One of ordinary skill in the art would realize that the links in trees are pointers the same as they are in linked lists. Also that the same modifications which are favorable applied to links in trees could also favorable be applied in lists.

We agree with the examiner (answer, page 6) that a linked list is in effect a simplified tree structure, and we take notice of this fact<sup>2</sup>. We further find that in the stored network displayed in figure 3, the addresses have pointers that point to a previous entry. For example, address 8 includes pointer 7, which points to address 7. In addition, address 7 includes pointer 6, which points to address 6. Address 6 includes pointer 0, which points to address 0. Claim 1 recites "(b.1) searching a content addressable memory, which contains at least a portion of the second entry, for a reference to the first entry in the linked list." It is unclear as to how the stored network of figure 3 is implemented in a content addressable memory; i.e., it is unclear as to whether figure 3 is a content addressable memory. In addition, it is unclear as to whether figure 3 discloses searching a content addressable memory, which contains at least a portion of a second entry, for a reference to a first entry in a linked list.

From our review of the portions of Holtz relied upon by the examiner (col. 6, line 34 through col. 7, line 58) we find no support for the examiner's position that the reference suggests

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<sup>2</sup> Pascal Plus, Data Structures, Second Edition, © 1988 D.C. Heath and Company, page 393. A copy of the pertinent page is enclosed with the Decision.

"searching a content addressable memory, which contains at least a portion of the second entry, for a reference to the first entry in the linked list" i.e., using backward pointers in a linked list of a content addressable memory. Moreover, from steps 27-29 (col. 7, lines 28-35) we find that Holtz teaches or suggests pointing to the next entry and not to the prior entry, when using a content addressable memory. Further, we note that Holtz discloses in the embodiment of figure 9 that the input and output gates may not be required (col. 9, lines 28-39). However, we find no teaching or suggestion in this embodiment of Holtz regarding the use of backward pointers. In addition, because in the tree structure of Holtz, (figure 2), addresses 10 and 11 both point to the same address 9, we find that Holtz does not teach or suggest that the existence of a pointer within a valid entry is sufficient identification of the valid entry as being uniquely the second entry, which would occur in a true linked list, in contrast to the tree structure disclosed by Holtz. From all of the above, we find that the examiner has failed to establish a prima facie case of obviousness of claim 1. Accordingly, the rejection of claim 1, and claims 3 and 21 dependent therefrom, is reversed. We additionally reverse the rejection of independent claim 4 as the claim includes similar limitations as claim 1 with

respect to performing a content search using the link reference to the prior entry within the next additional entry, and that the content search uniquely locates the next entry, because at most there is only one valid entry that includes a link reference to the immediately prior entry. Accordingly, the rejection of claim 4 under 35 U.S.C. § 103(a) is reversed.

We turn next to the rejection of claims 2 and 5 under 35 U.S.C. § 103(a) as being unpatentable over Holtz in view of Smith. Although appellants do not specifically argue why they believe the combination of Holtz and Smith does not suggest the invention set forth in claims 2 and 5, we reverse the rejection of claim 5 because Smith does not make up for the basic deficiencies of Holtz. Accordingly, the rejection of claims 2 and 5 under 35 U.S.C. § 103(a) is reversed.

CONCLUSION

To summarize, the decision of the examiner to reject claims 1-5 and 21 under 35 U.S.C. § 103(a) is reversed.

REVERSED

LEE E. BARRETT	)	
Administrative Patent Judge	)	
	)	
	)	
	)	
	)	BOARD OF PATENT
STUART S. LEVY	)	APPEALS
Administrative Patent Judge	)	AND
	)	INTERFERENCES
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MAHSHID D. SAADAT	)	
Administrative Patent Judge	)	

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