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**Gorobets et al.**

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(54) **NON-VOLATILE MEMORY AND METHOD WITH MULTI-STREAM UPDATE TRACKING**

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patent is extended or adjusted under 35  
U.S.C. 154(b) by 272 days.

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**Related U.S. Application Data**

*Primary Examiner*—Hiep T. Nguyen

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filed on Dec. 16, 2004, now Pat. No. 7,315,916.

(74) *Attorney, Agent, or Firm*—Davis Wright Tremaine LLP

(51) **Int. Cl.**  
**G06F 12/00** (2006.01)

(57) **ABSTRACT**

(52) **U.S. Cl.** ..... **711/103**

(58) **Field of Classification Search** ..... 711/103;  
365/185.33

See application file for complete search history.

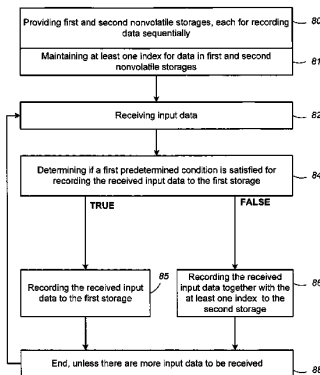
Update data to a non-volatile memory may be recorded in at  
least two interleaving streams such as either into an update  
block or a scratch pad block depending on a predetermined  
condition. The scratch pad block is used to buffered update  
data that are ultimately destined for the update block.  
Synchronization information about the order recording of  
updates among the streams is saved with at least one of the  
streams. This will allow the most recently written version of  
data that may exist on multiple memory blocks to be  
identified. In one embodiment, the synchronization informa-  
tion is saved in a first block and is a write pointer that  
points to the next recording location in a second block. In  
another embodiment, the synchronization information is a  
time stamp.

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**41 Claims, 43 Drawing Sheets**



Updating Using Two Streams With Index Stored In One Stream

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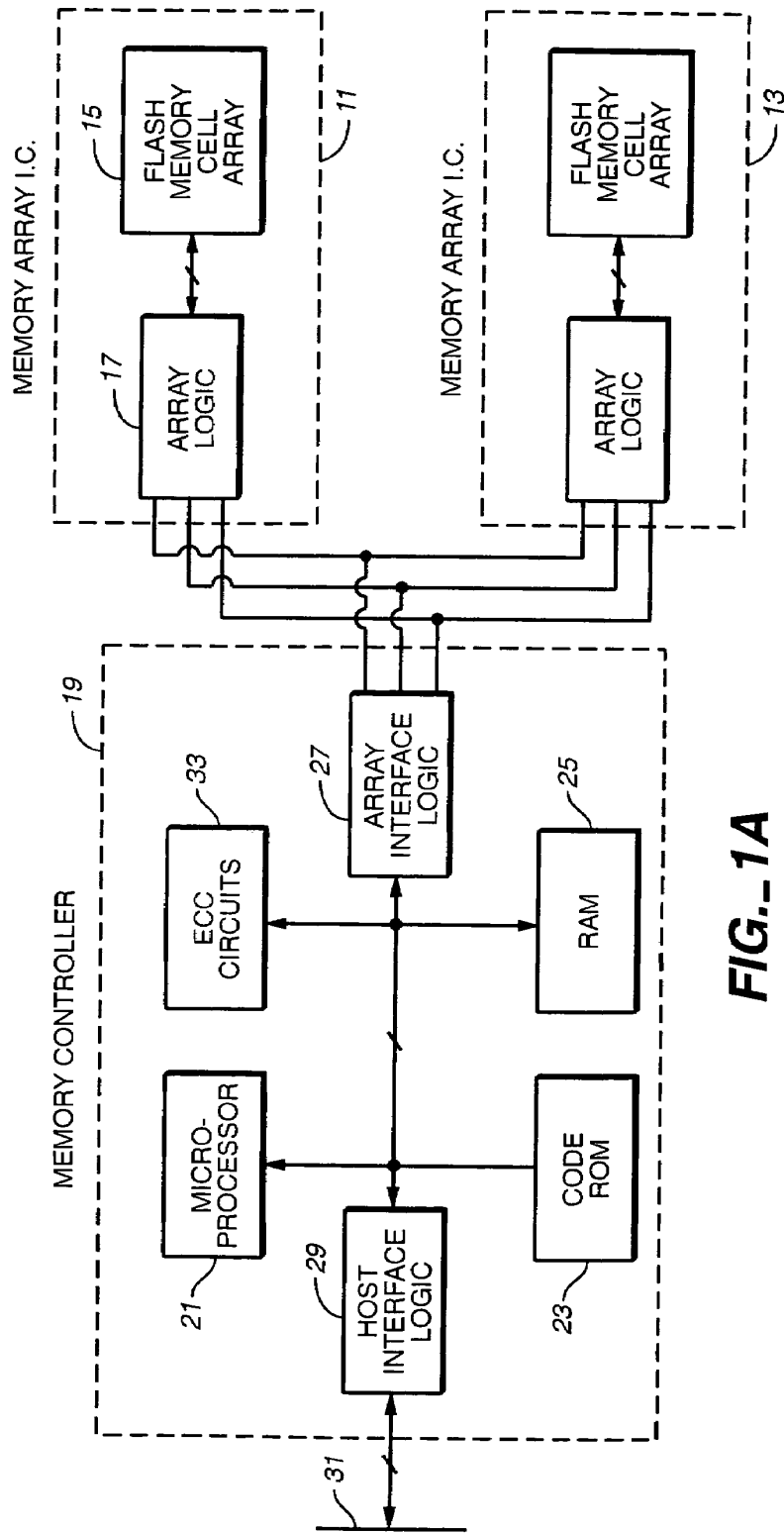


FIG. 1A

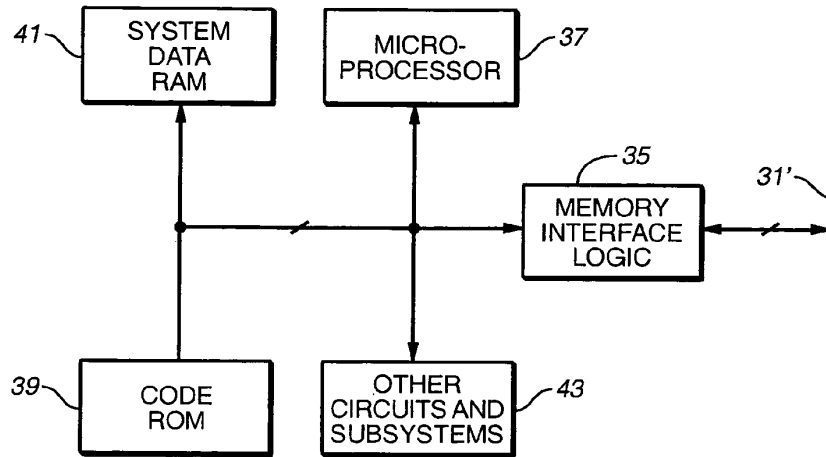


FIG. 1B

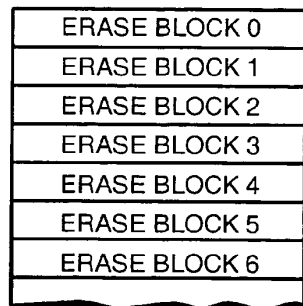


FIG. 2

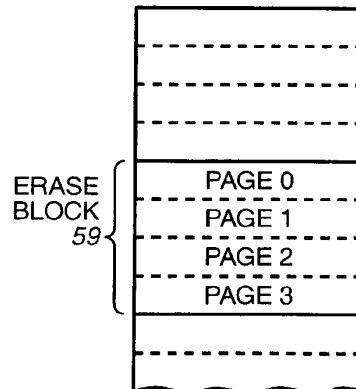


FIG. 4

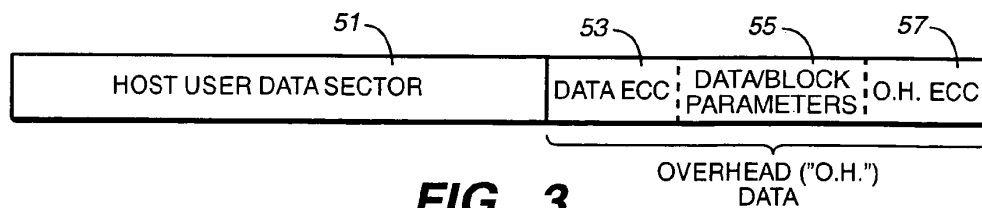
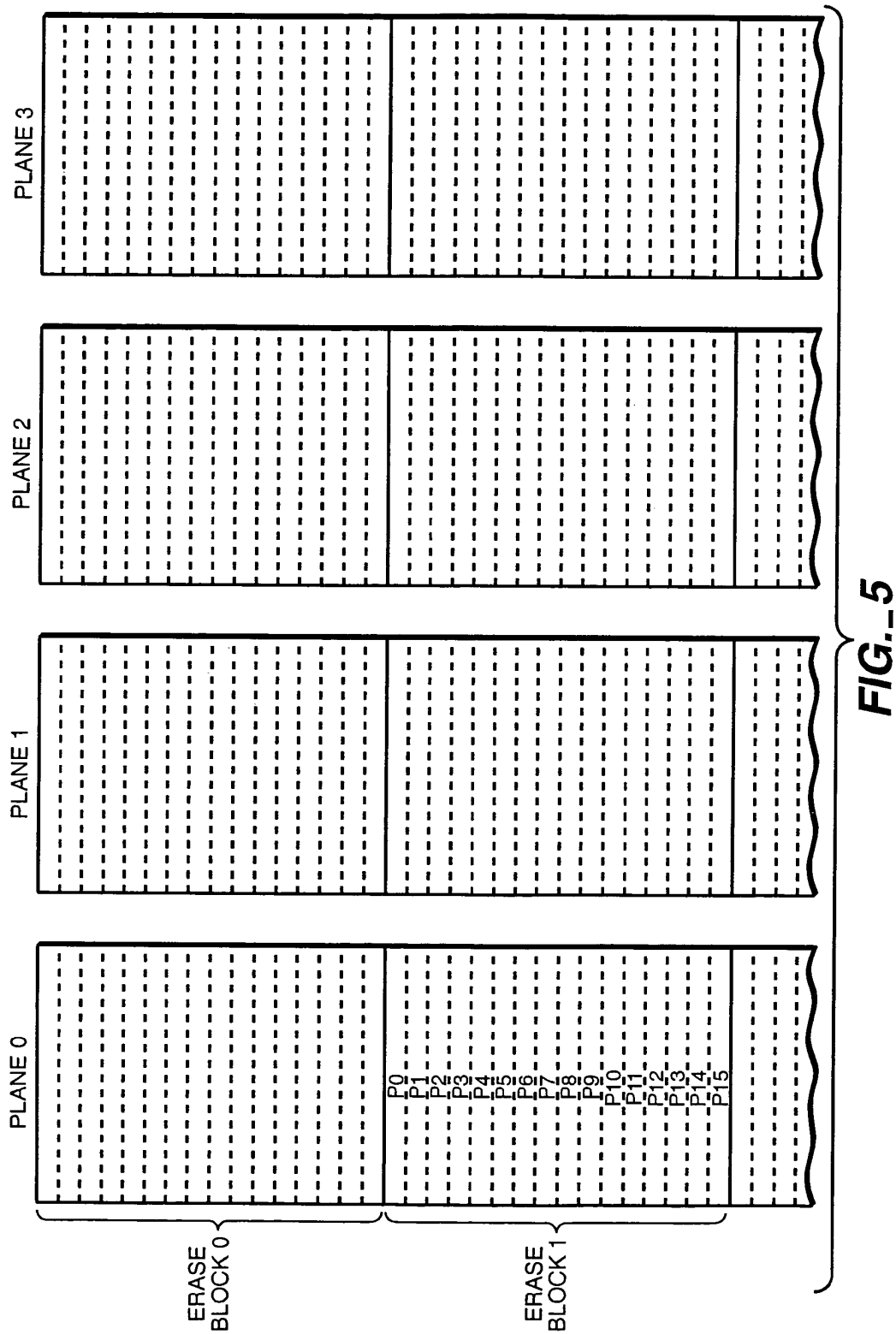


FIG. 3



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