United States Patent [19]

Niijima et al.

US005457658A [11] **Patent Number: 5,457,658**

[45] Date of Patent: Oct. 10, 1995

[54] NONVOLATILE MEMORY WITH CLUSTER-ERASE FLASH CAPABILITY AND SOLID STATE FILE APPARATUS USING THE SAME

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- [21] Appl. No.: 200,343
- [22] Filed: Feb. 23, 1994

[30] Foreign Application Priority Data

Feb. 24, 1993 [JP] Japan 5-035228

- [51] Int. Cl.⁶ G11C 13/00

[56] **References Cited**

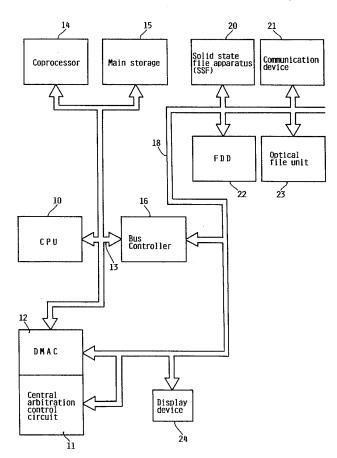
U.S. PATENT DOCUMENTS

Primary Examiner—Terrell W. Fears Attorney, Agent, or Firm—Matthew J. Bussan

[57] ABSTRACT

A nonvolatile memory with cluster-erase flash capability. A cluster information sector is included in each of N clusters, the cluster information sector of each cluster being written with the sequence number assigned to the cluster so that no two clusters have the same sequence number. When erasing a given sector, a controller saves its sequence number prior to erasure. Then, when initializing a given erased sector, the controller sets its sequence number to a value greater than the current maximum sequence number. The controller writes user data to sectors other than the cluster information sector for the cluster thus initialized according to their address sequence. Accordingly, an invalid sector can be distinguished from a valid sector without using an overwrite approach.

17 Claims, 12 Drawing Sheets



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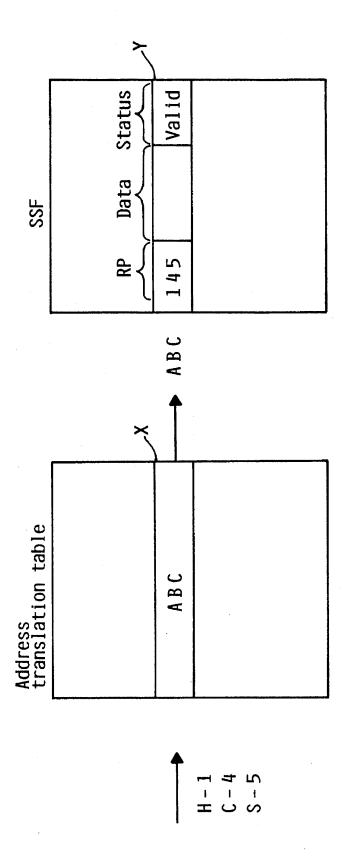


FIG. I (PRIOR ART)

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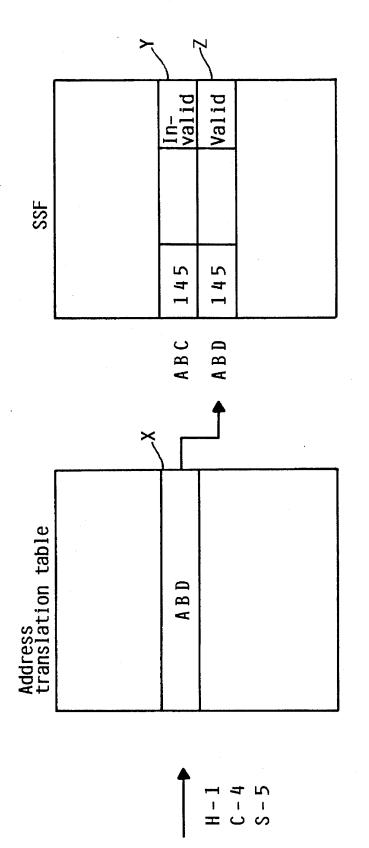


FIG. 2 (PRIOR ART)

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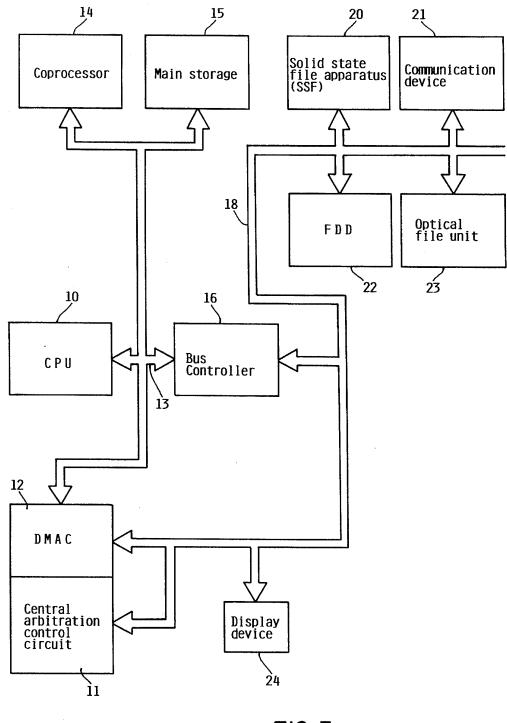


FIG. 3

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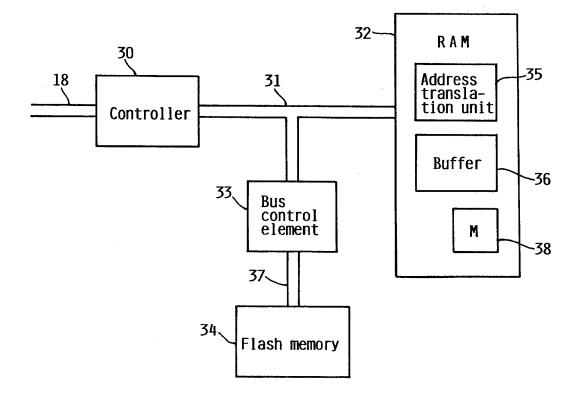


FIG. 4

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