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**Maddock**

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(54) **METHODS, APPARATUS AND CONTROLLERS FOR A RAID STORAGE SYSTEM**

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(\* ) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 497 days.

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(30) **Foreign Application Priority Data**

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(51) **Int. Cl.**  
**G06F 1/00** (2006.01)

(52) **U.S. Cl.** ..... 713/310; 714/7; 711/114

(58) **Field of Classification Search** ..... 713/310;  
711/114; 714/6, 7  
See application file for complete search history.

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(57) **ABSTRACT**

Provided are RAID storage systems, methods, and controllers for RAID storage systems. A first method includes storing a first copy of the data in a first RAID array corresponding to a first RAID level providing redundancy (such as RAID-5), and storing a second copy of the data in a second RAID array corresponding to a second RAID level (such as RAID-0) which differs from the first RAID level. Data is read from the two RAID arrays in parallel for improved read performance. A controller is responsive to a disk failure which results in data becoming inaccessible from one of the arrays to retrieve the data from the other one of the arrays. The redundancy within the first RAID array also enables the controller to restore data following a failure of one disk drive by reference to the remaining disk drives of the first array.

**10 Claims, 7 Drawing Sheets**

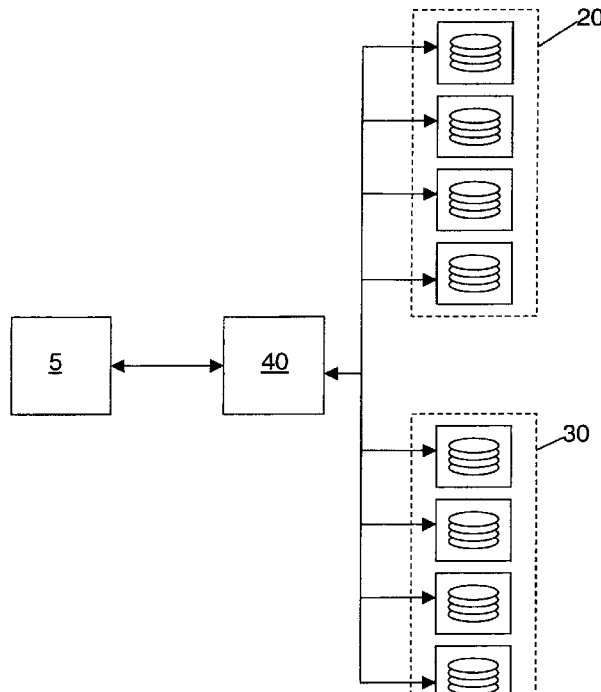
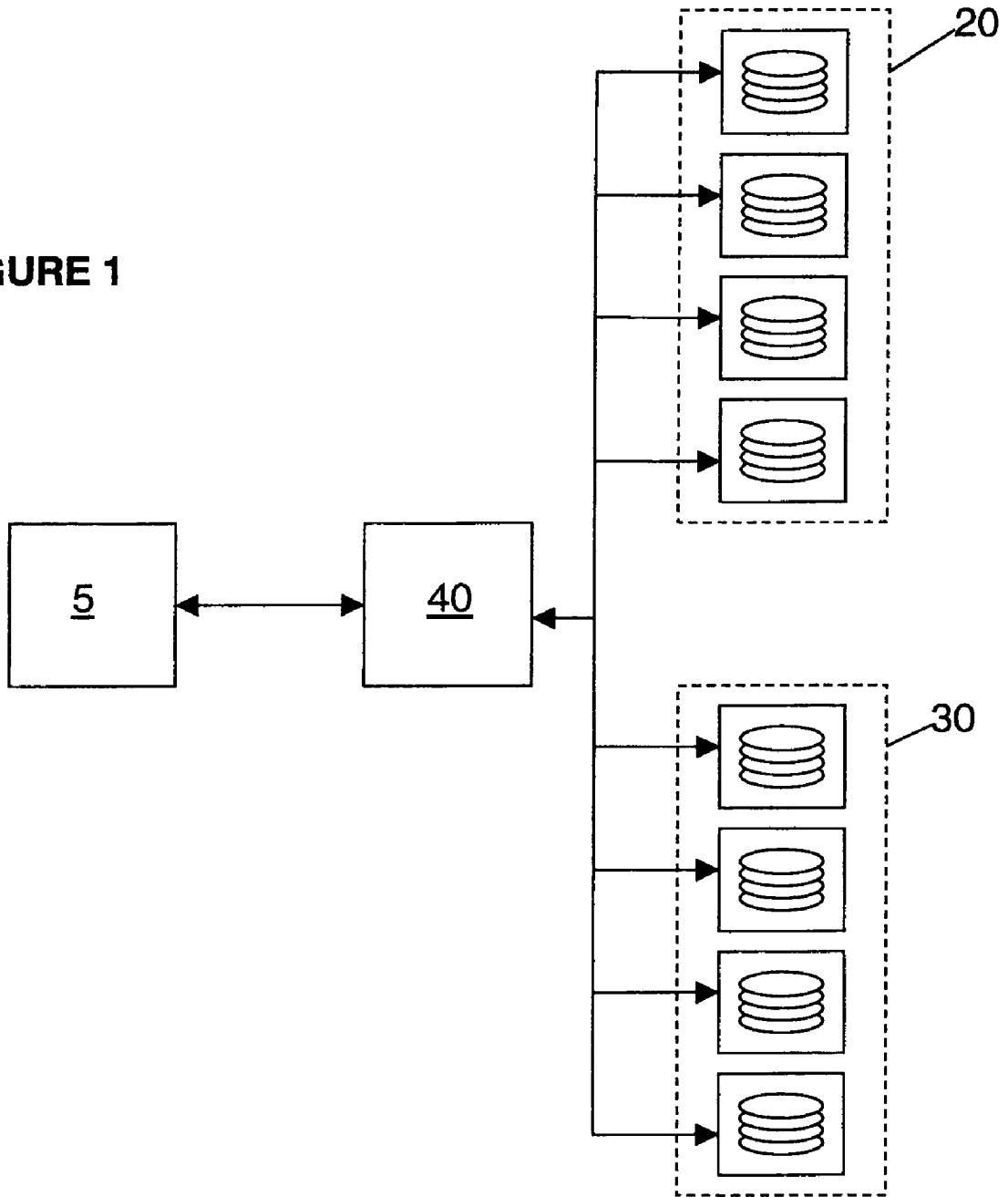


FIGURE 1



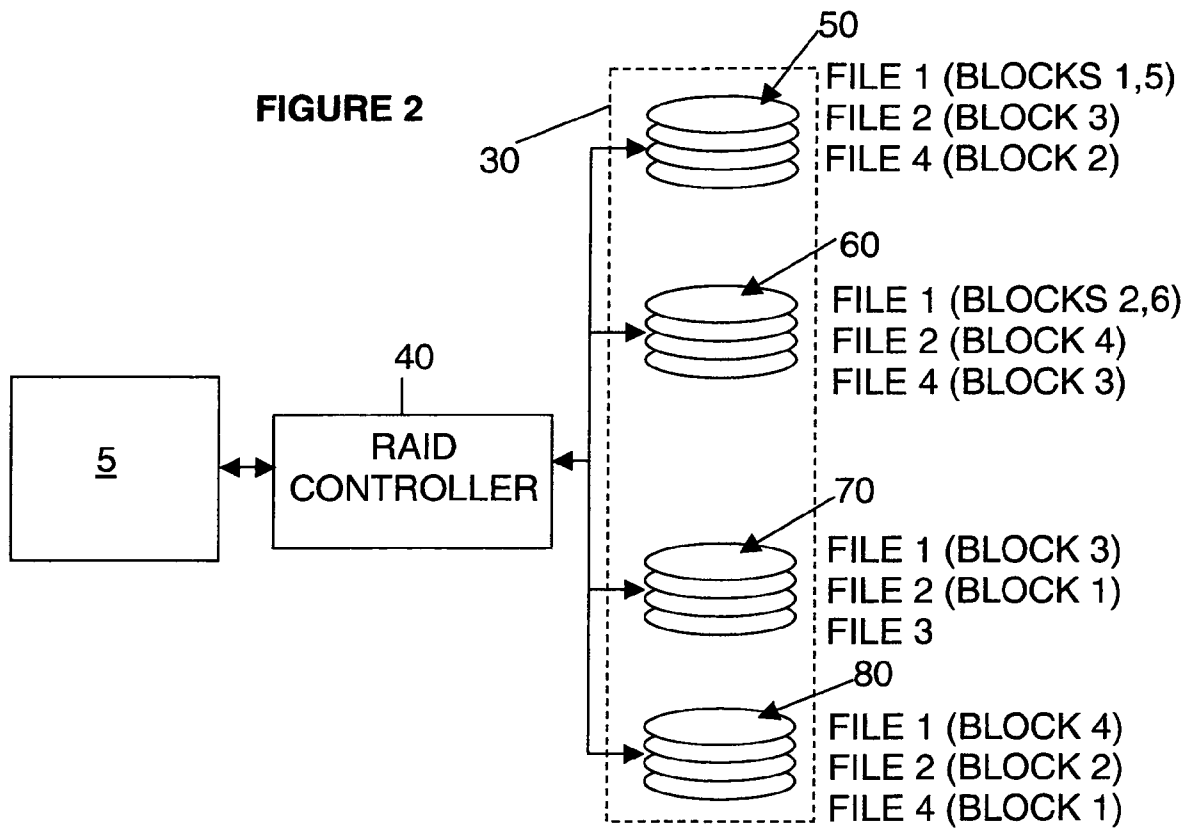


FIGURE 3

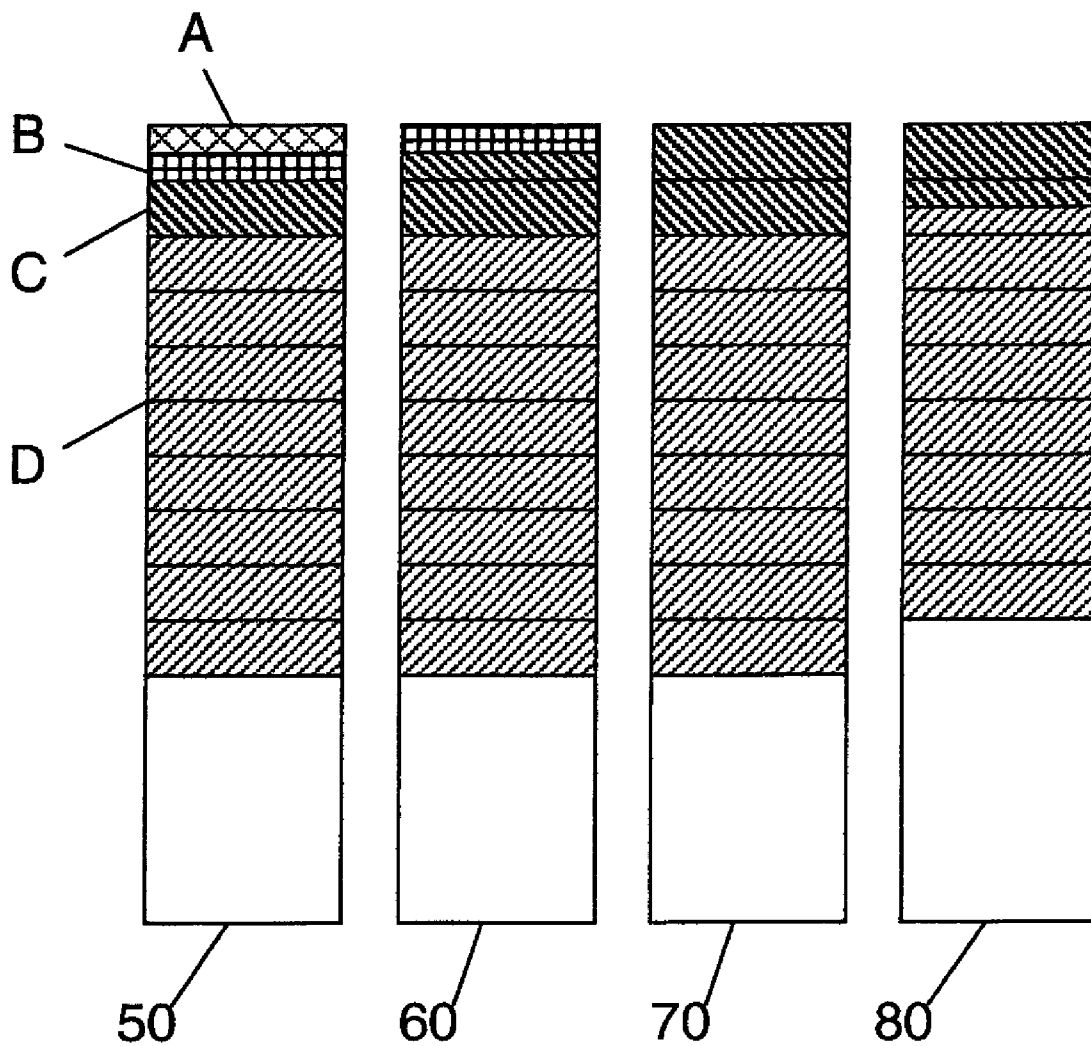
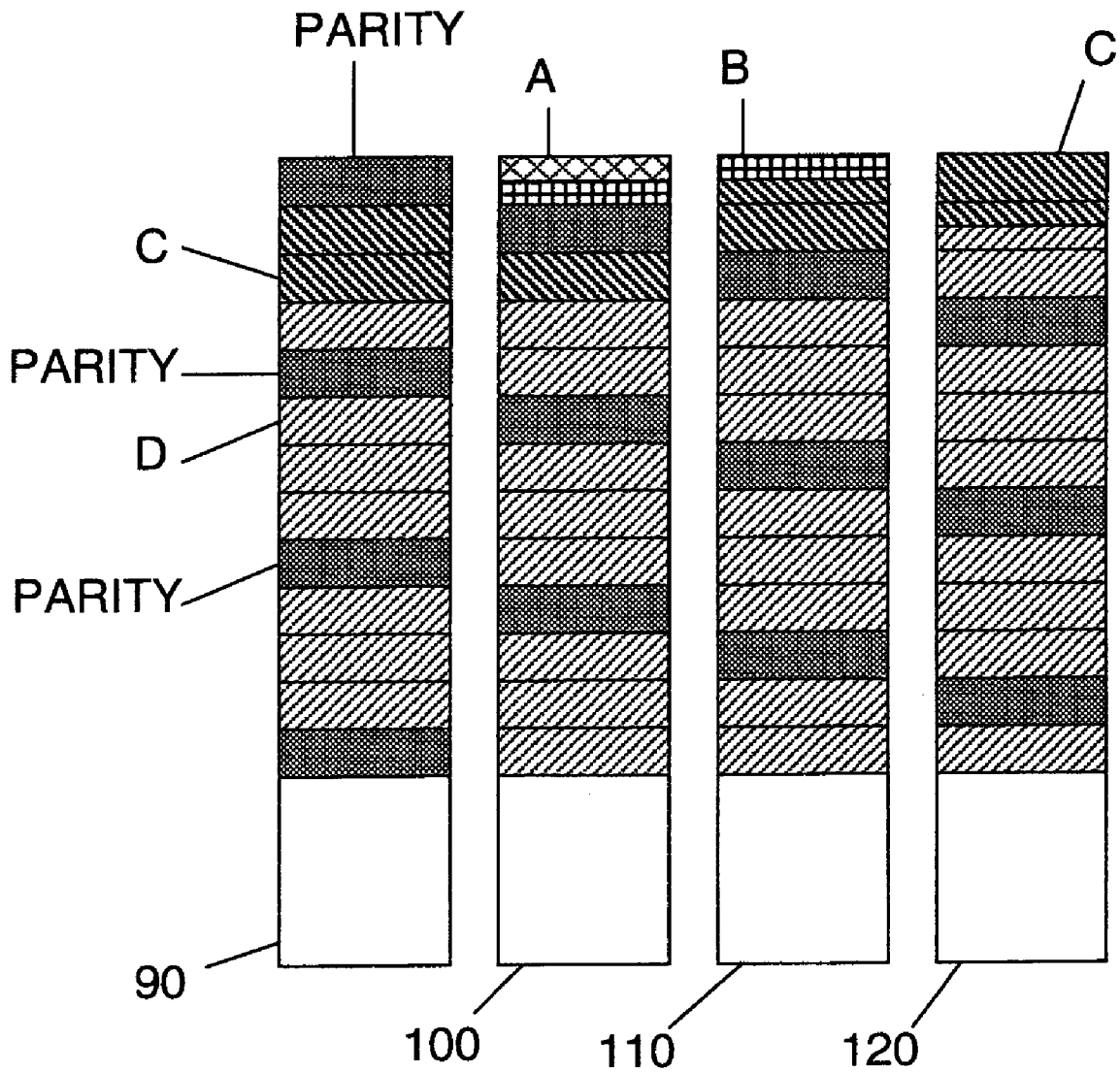


FIGURE 4



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