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DeKoning et al.

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[54] **METHODS AND APPARATUS FOR COORDINATING SHARED MULTIPLE RAID CONTROLLER ACCESS TO COMMON STORAGE DEVICES**

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[52] **U.S. Cl.** **711/150**; 711/114; 711/148; 711/149; 711/151; 711/152; 711/153; 711/162; 711/168; 710/20; 710/21; 710/38; 710/241; 714/6; 714/11

[58] **Field of Search** 711/114, 152, 711/145, 148, 149, 150, 151, 153, 168, 162; 714/6, 11; 710/20, 21, 38, 241

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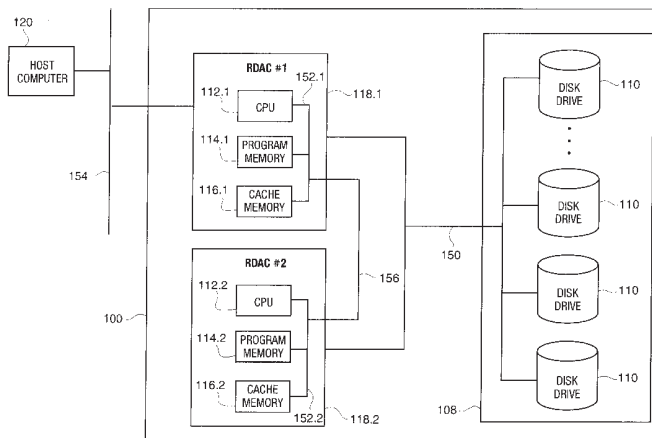|			
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[57] **ABSTRACT**

Methods and associated apparatus for performing concurrent I/O operations on a common shared subset of disk drives (LUNs) by a plurality of RAID controllers. The methods of the present invention are operable in all of a plurality of RAID controllers to coordinate concurrent access to a shared set of disk drives. In addition to providing redundancy features, the plurality of RAID controllers operable in accordance with the methods of the present invention enhance the performance of a RAID subsystem by better utilizing available processing power among the plurality of RAID controllers. Under the methods of the present invention, each of a plurality of RAID controllers may actively process different I/O requests on a common shared subset of disk drives. One of the plurality of controllers is designated as primary with respect to a particular shared subset of disk drives. The plurality of RAID controllers then exchange messages over a communication medium to coordinate concurrent access to the shared subset of disk drives through the primary controller. The messages exchanged include semaphore lock and release requests to coordinate exclusive access during critical operations as well as cache and meta-cache data to maintain cache coherency between the plurality of the RAID controllers with respect to the common shared subset of disk drives. These messages are exchanged via any of several well known communication mediums including, a shared memory common to the plurality of controllers and the communication bus connecting the shared subset of disk drives to each of the plurality of controllers.

36 Claims, 11 Drawing Sheets

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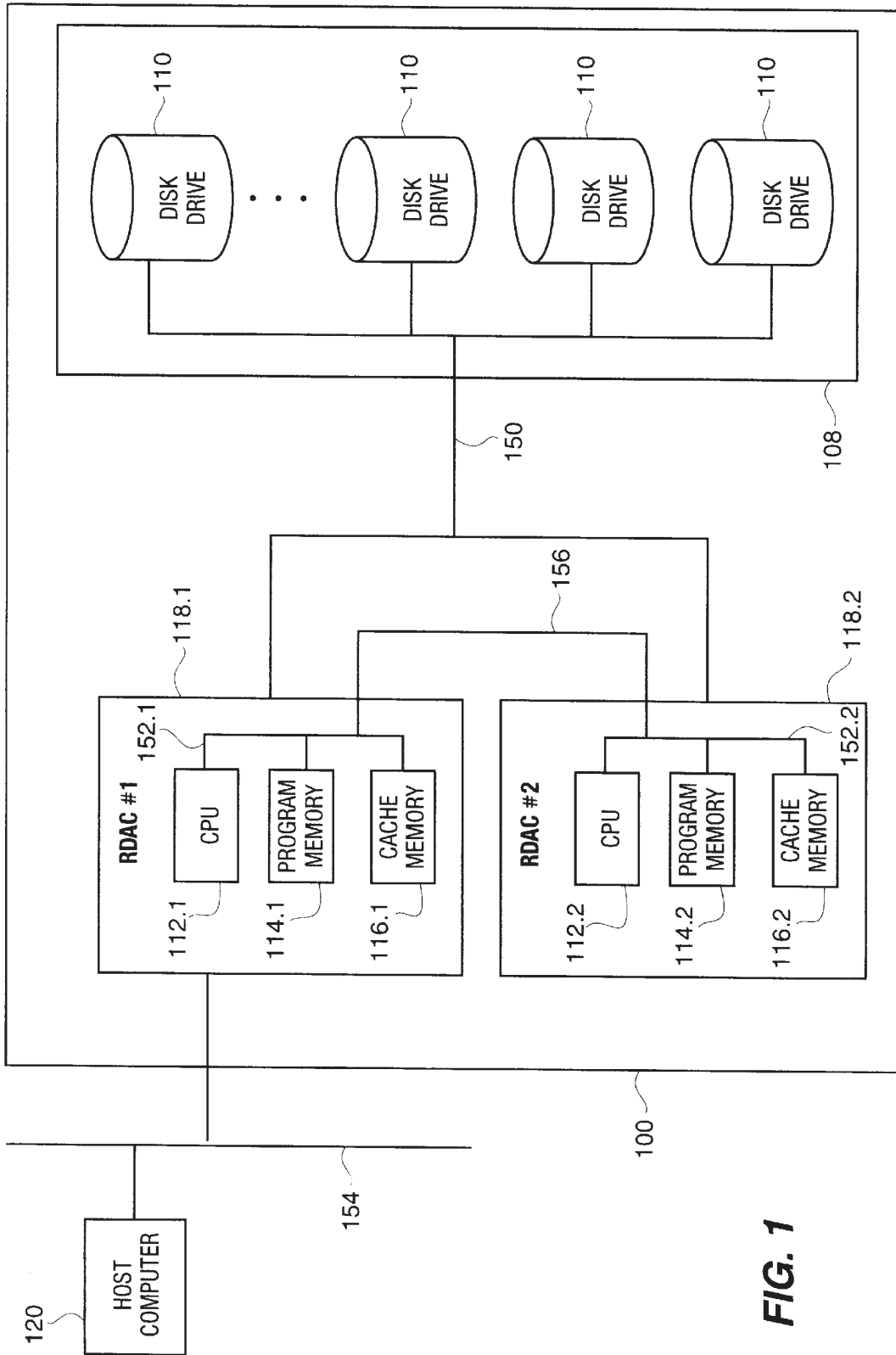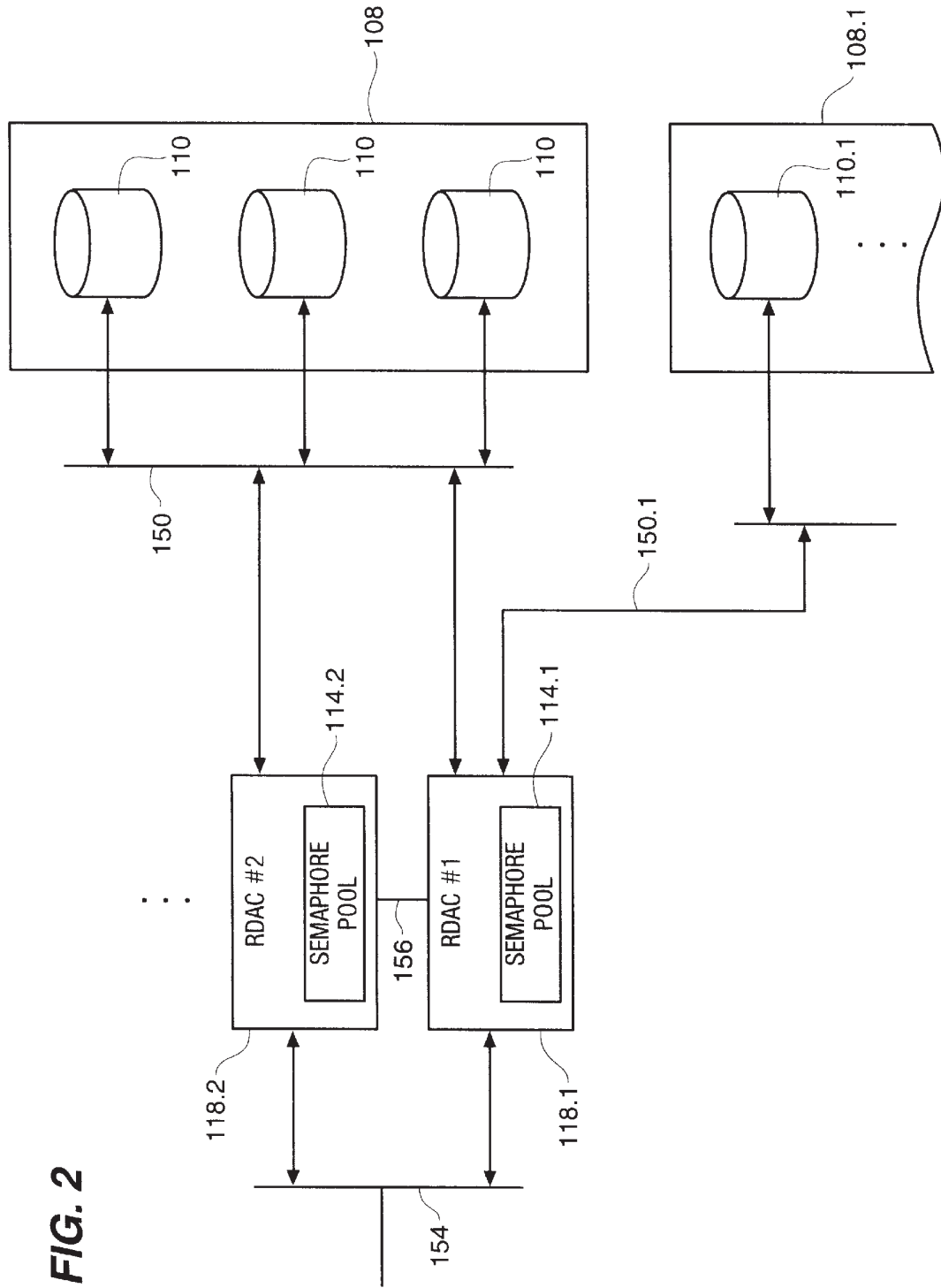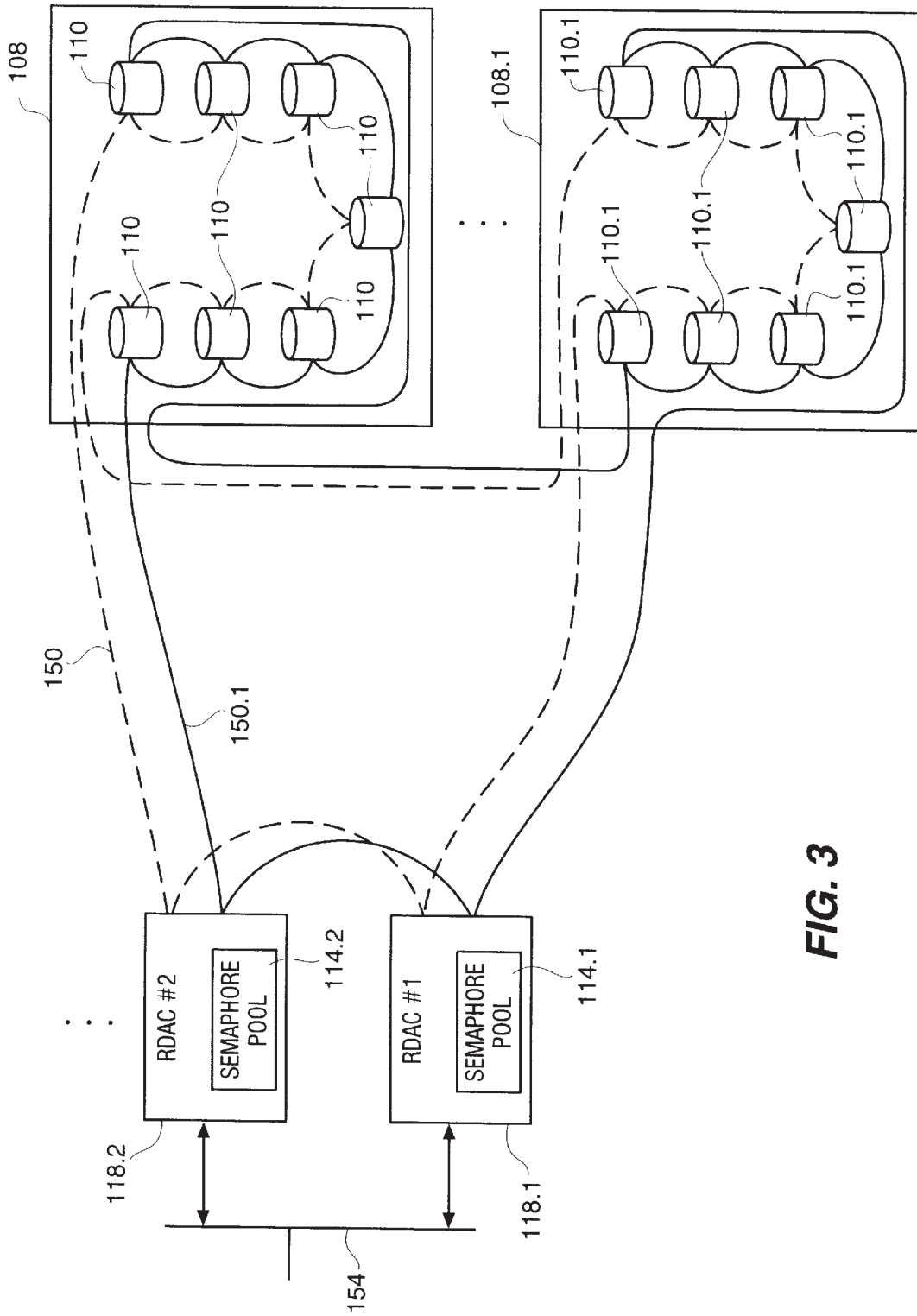|			
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FIG. 1

FIG. 2

FIG. 3

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