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(54) **CACHE SYSTEM WITH GROUPS OF LINES AND WITH COHERENCY FOR BOTH SINGLE LINES AND GROUPS OF LINES**

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(51) **Int. Cl.^{7}** **G06F 12/00**
(52) **U.S. Cl.** **711/145**; 711/141; 711/144; 711/146; 711/147; 711/148
(58) **Field of Search** 711/141, 145, 711/146, 147, 148

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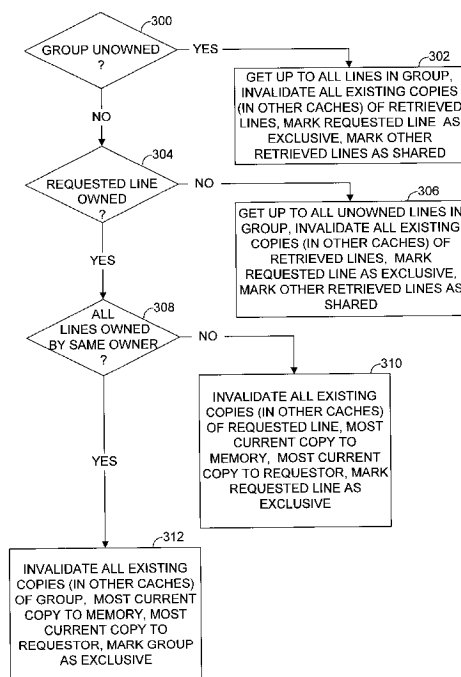
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(57) **ABSTRACT**

In a computer system with caching, memory transactions can retrieve and store groups of lines. Coherency states are maintained for groups of lines, and for individual lines. A single coherency transaction, and a single address transaction, can then result in the transfer of multiple lines of data, reducing overall latency. Even though lines may be transferred as a group, the lines can subsequently be treated separately. This avoids many of the problems caused by long lines, such as increased cache-to-cache copy activity. In one alternative, when a cache memory requests a group of lines, and when the group of lines is partially owned by another cache memory, then the requesting cache receives fewer than all the lines in the requested group.
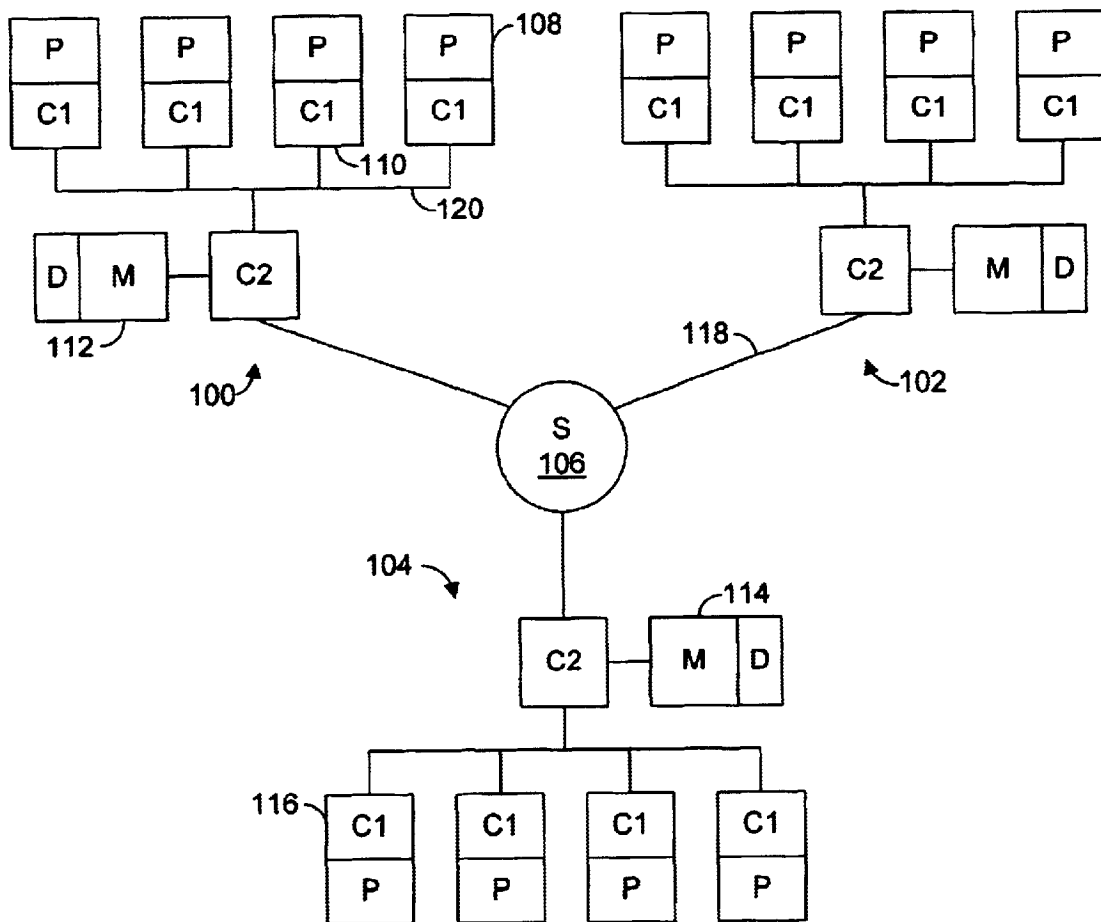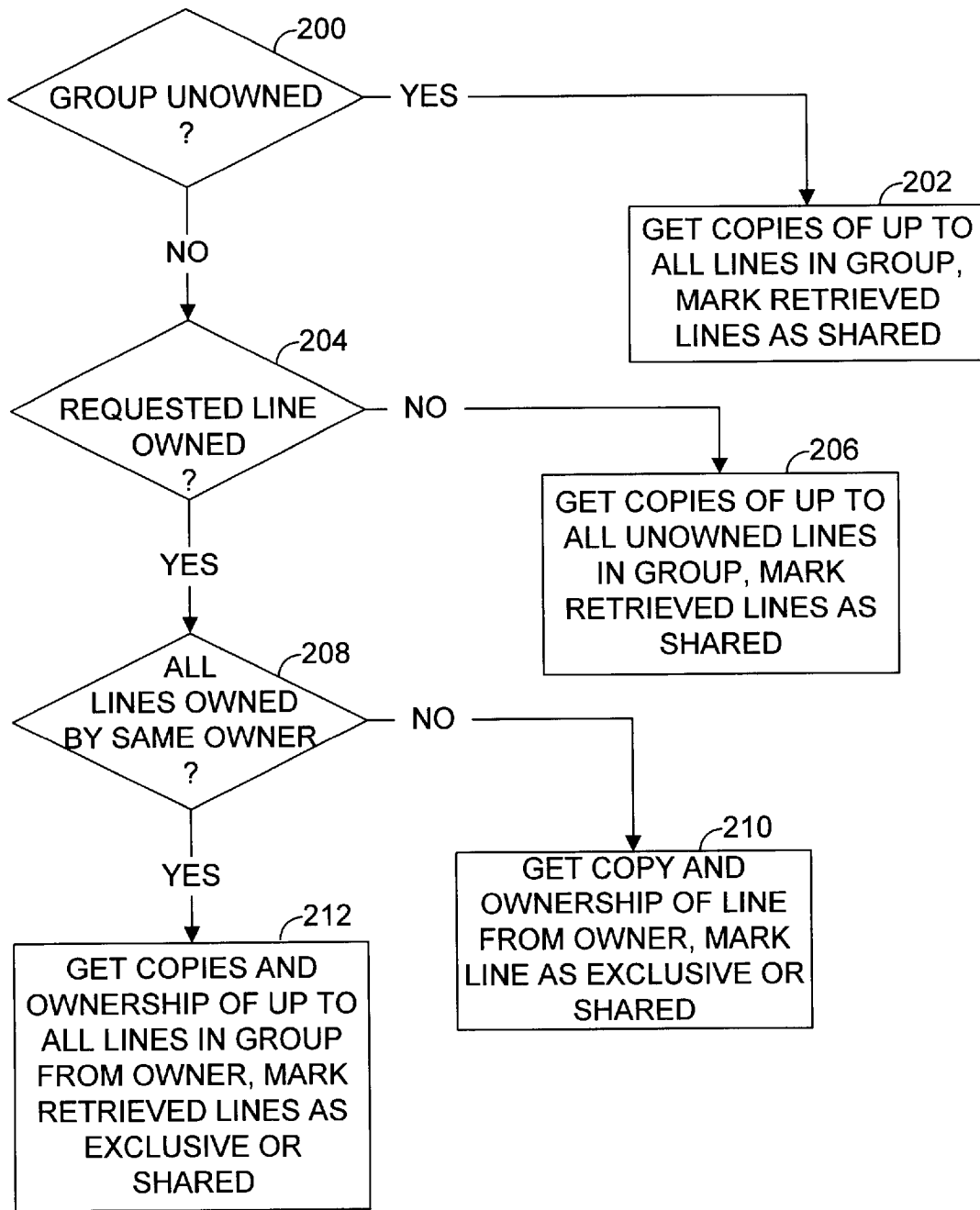
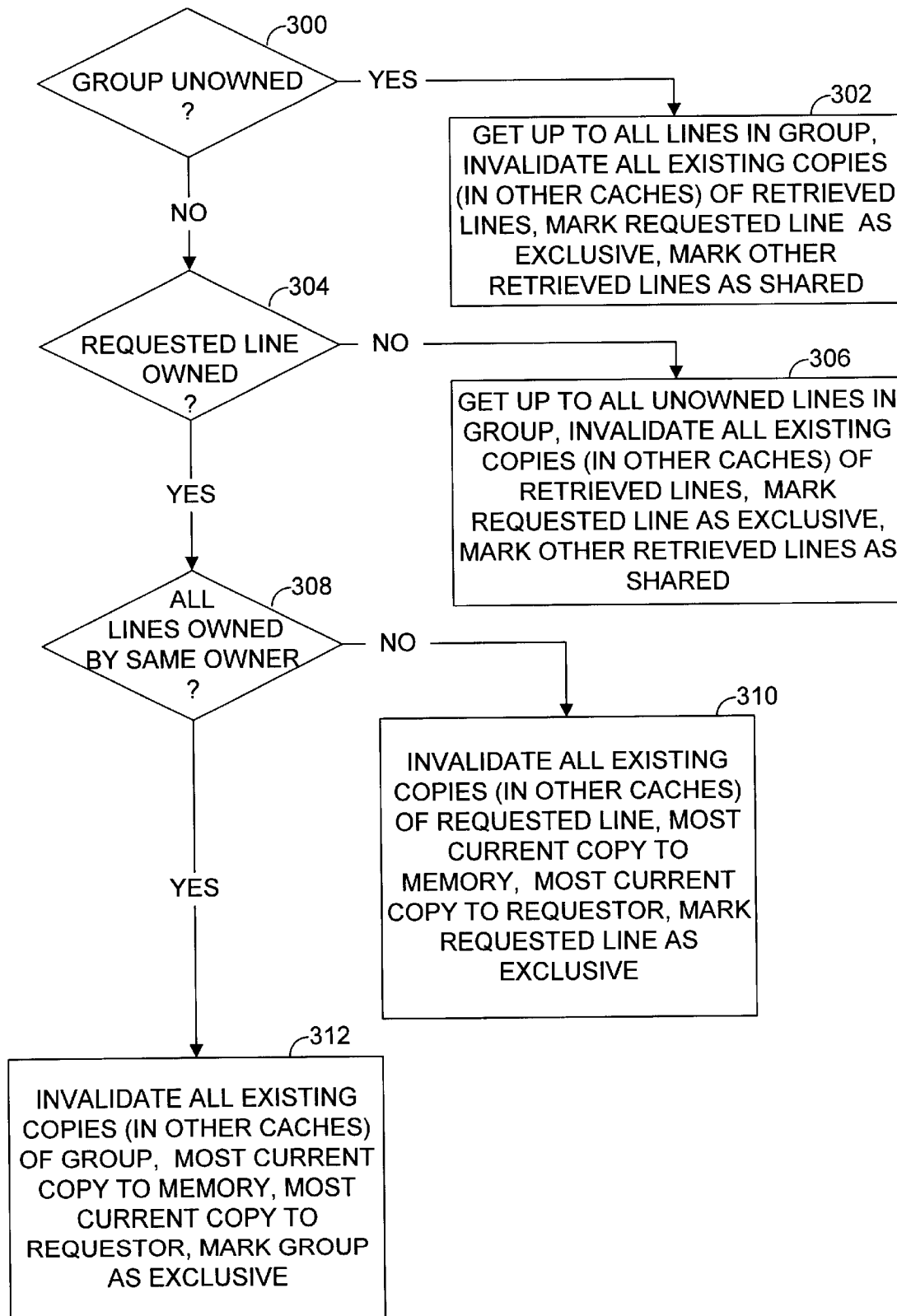**9 Claims, 5 Drawing Sheets**

FIG. 1

FIG. 2

GROUP UNOWNED ? — 300

YES

GET UP TO ALL LINES IN GROUP, INVALIDATE ALL EXISTING COPIES (IN OTHER CACHES) OF RETRIEVED LINES, MARK REQUESTED LINE AS EXCLUSIVE, MARK OTHER RETRIEVED LINES AS SHARED — 302

NO

REQUESTED LINE OWNED ? — 304

NO

GET UP TO ALL UNOWNED LINES IN GROUP, INVALIDATE ALL EXISTING COPIES (IN OTHER CACHES) OF RETRIEVED LINES, MARK REQUESTED LINE AS EXCLUSIVE, MARK OTHER RETRIEVED LINES AS SHARED — 306

YES

ALL LINES OWNED BY SAME OWNER ? — 308

NO

INVALIDATE ALL EXISTING COPIES (IN OTHER CACHES) OF REQUESTED LINE, MOST CURRENT COPY TO MEMORY, MOST CURRENT COPY TO REQUESTOR, MARK REQUESTED LINE AS EXCLUSIVE — 310

YES

INVALIDATE ALL EXISTING COPIES (IN OTHER CACHES) OF GROUP, MOST CURRENT COPY TO MEMORY, MOST CURRENT COPY TO REQUESTOR, MARK GROUP AS EXCLUSIVE — 312
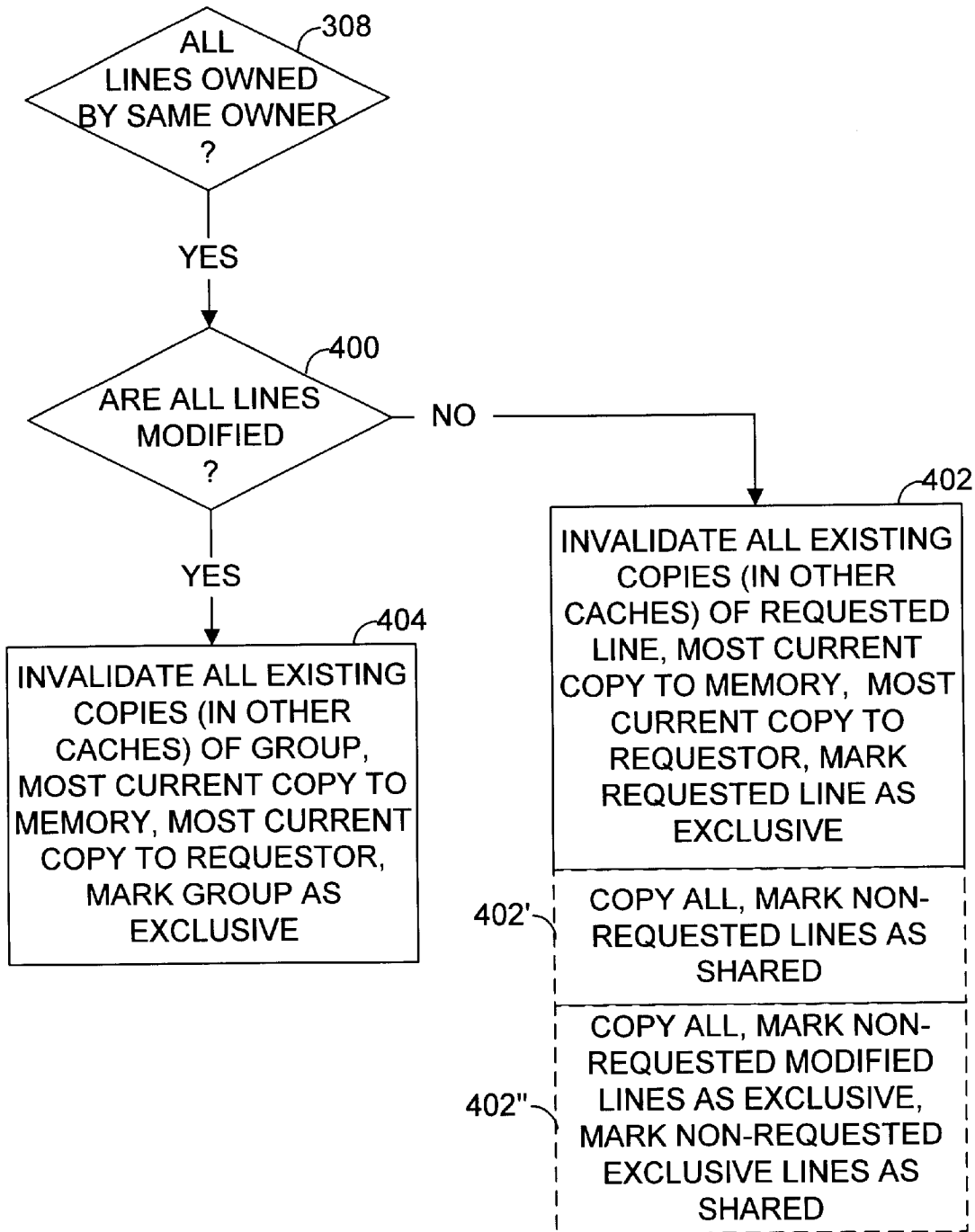
FIG. 3

FIG. 4

DOCKET ALARM

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