

**(12) United States Patent**  
**Hölzle et al.**

**(10) Patent No.: US 6,510,498 B1**  
**(45) Date of Patent: \*Jan. 21, 2003**

(54) **METHOD AND APPARATUS FOR MEMORY ALLOCATION IN A MULTI-THREADED VIRTUAL MACHINE**

5,727,178 A \* 3/1998 Pletcher et al. .... 711/202  
 5,893,159 A \* 4/1999 Schneider ..... 711/150

OTHER PUBLICATIONS

(75) Inventors: **Urs Hölzle**, Goleta, CA (US); **Steffen Grarup**, Palo Alto, CA (US)

Robert H. Halstead, Jr., "Multilisp: A Language for Concurrent Symbolic Computation," Oct. 1985, ACM Transactions on Programming Languages and Systems, vol. 7, No. 4.

(73) Assignee: **Sun Microsystems, Inc.**, Palo Alto, CA (US)

\* cited by examiner

(\* ) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

*Primary Examiner*—Matthew Kim  
*Assistant Examiner*—Pierre M. Vital  
 (74) *Attorney, Agent, or Firm*—Beyer Weaver & Thomas

This patent is subject to a terminal disclaimer.

**(57) ABSTRACT**

Methods and apparatus for the efficient allocation of shared memory in a multi-threaded computer system are disclosed. In accordance with one embodiment of the present invention, a computer-implemented method for allocating memory shared by multiple threads in a multi-threaded computing system includes partitioning the shared memory into a plurality of blocks, and grouping the multiple threads into at least a first group and a second group. A selected block is allocated to a selected thread which may attempt to allocate an object in the selected block. The allocation of the selected block to the selected thread is based at least partially upon whether the selected thread is a part of the first group or the second group. In one embodiment, grouping the multiple threads into the first group and the second group includes identifying a particular thread and determining whether the particular thread is a fast allocating thread. In such an embodiment, when the particular thread is fast allocating, the particular thread is grouped into the first group.

(21) Appl. No.: **09/724,737**

(22) Filed: **Nov. 28, 2000**

**Related U.S. Application Data**

(63) Continuation of application No. 09/108,047, filed on Jun. 30, 1998, now Pat. No. 6,209,066.

(51) **Int. Cl.<sup>7</sup>** ..... **G06F 12/00**

(52) **U.S. Cl.** ..... **711/153; 711/170; 711/173**

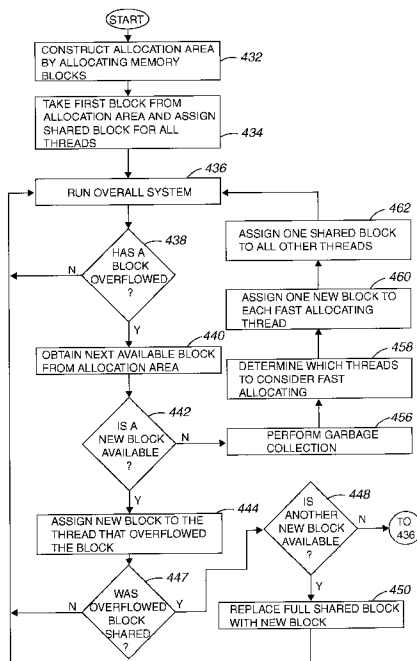
(58) **Field of Search** ..... 711/153, 170,  
 711/173; 709/104, 105, 107, 108, 312;  
 712/206, 215, 245, 246

**(56) References Cited**

U.S. PATENT DOCUMENTS

5,247,634 A 9/1993 Cline et al.  
 5,535,361 A 7/1996 Hirata et al.  
 5,600,596 A 2/1997 Shirakihara

**19 Claims, 14 Drawing Sheets**



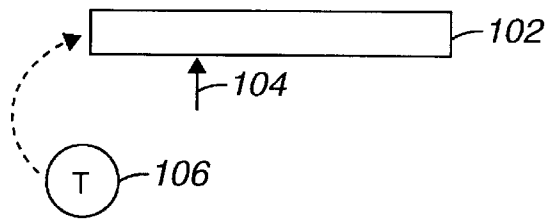


Figure 1a  
(Prior Art)

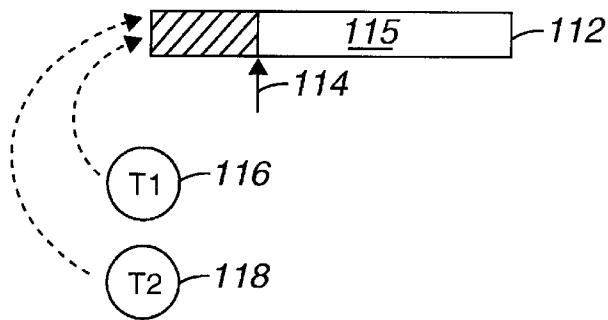


Figure 1b  
(Prior Art)

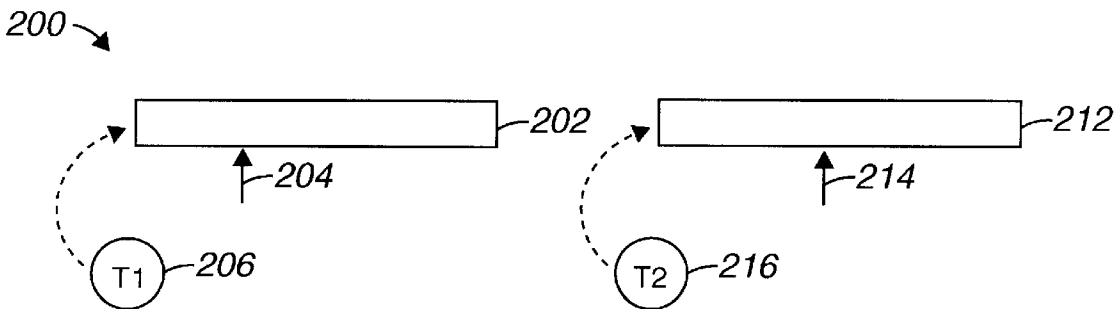


Figure 2a  
(Prior Art)

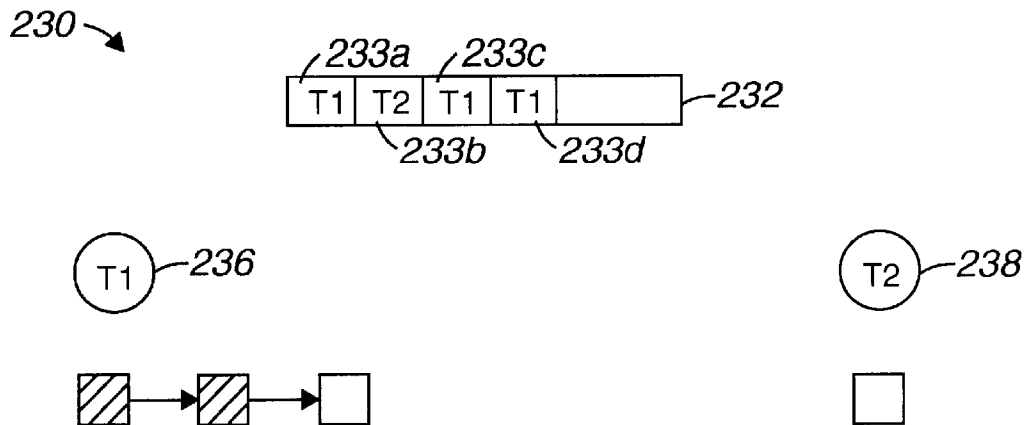


Figure 2b  
(Prior Art)

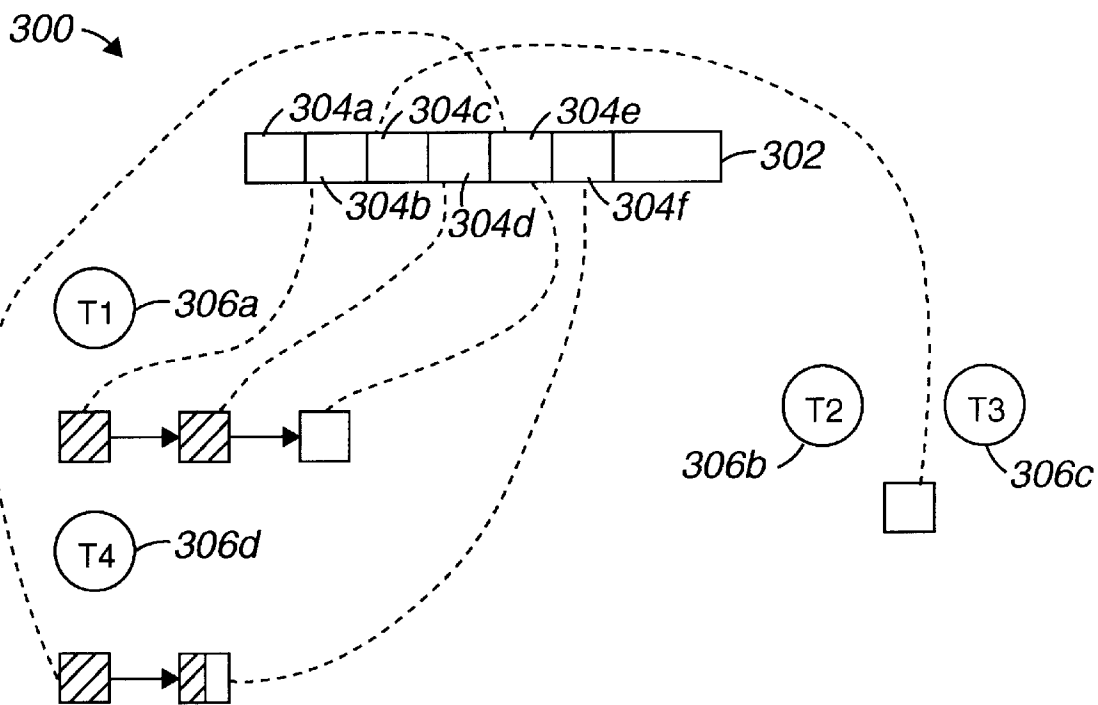


Figure 3

Figure 4

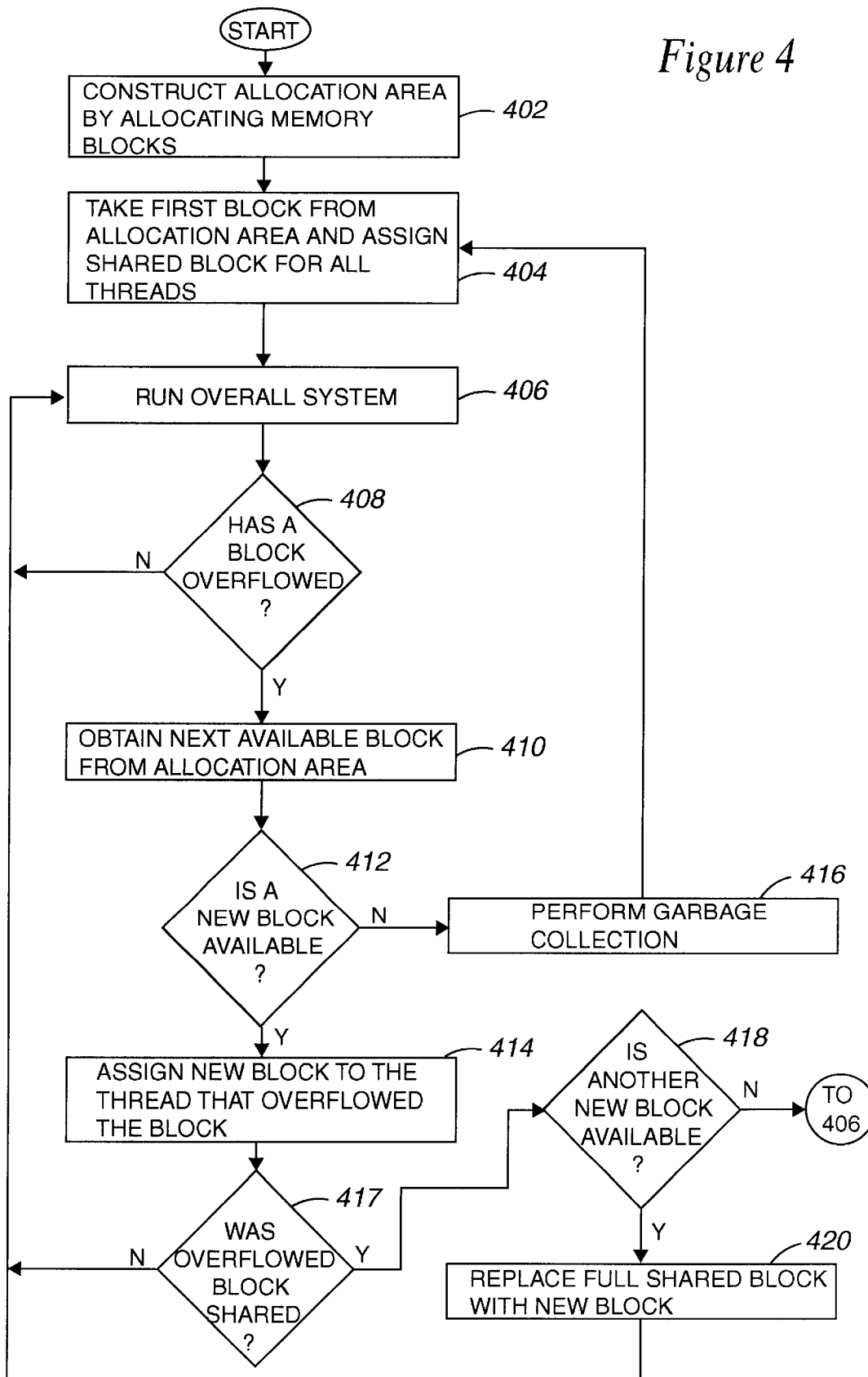
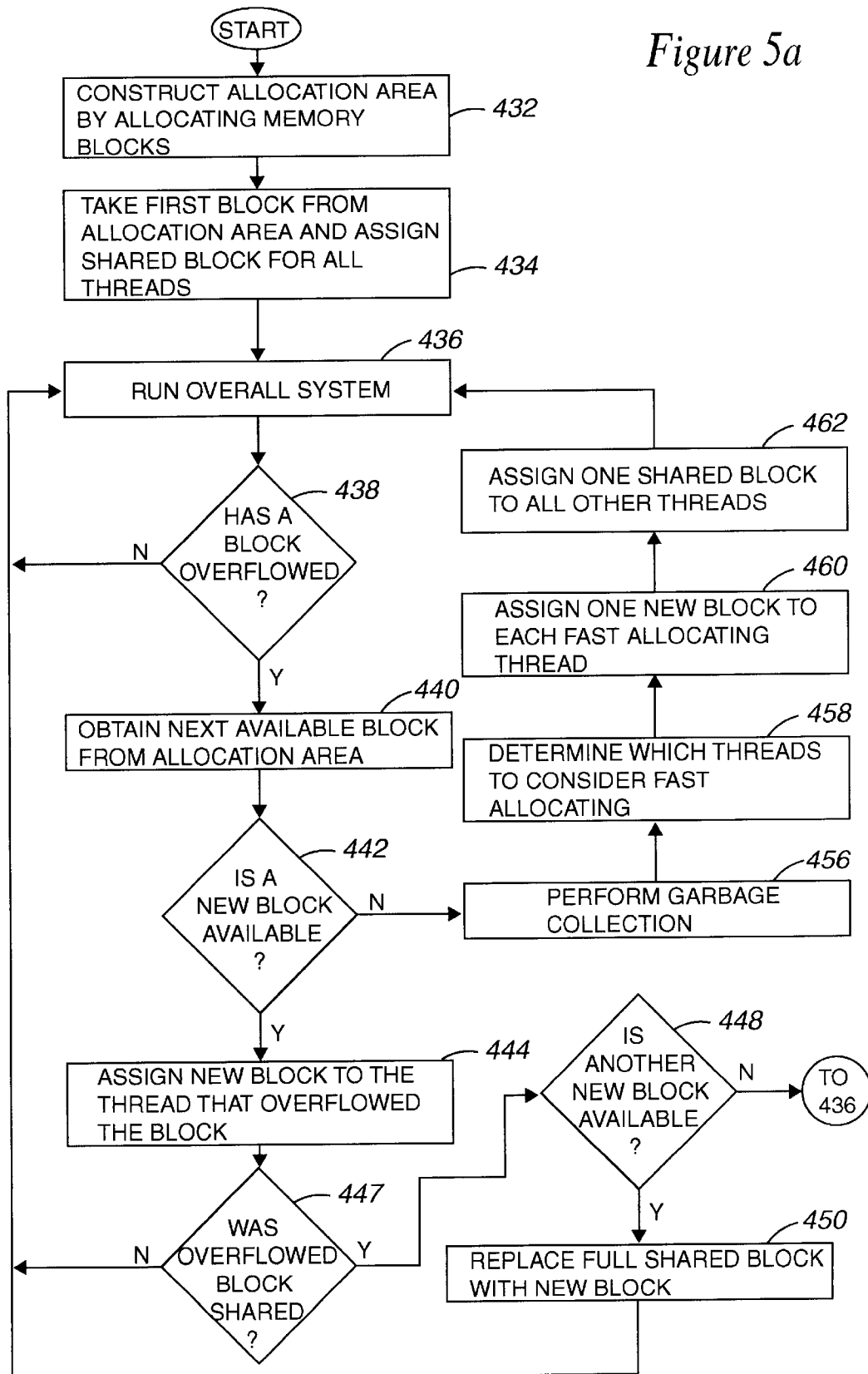


Figure 5a



# Explore Litigation Insights

Docket Alarm provides insights to develop a more informed litigation strategy and the peace of mind of knowing you're on top of things.

## Real-Time Litigation Alerts



Keep your litigation team up-to-date with **real-time alerts** and advanced team management tools built for the enterprise, all while greatly reducing PACER spend.

Our comprehensive service means we can handle Federal, State, and Administrative courts across the country.

## Advanced Docket Research



With over 230 million records, Docket Alarm's cloud-native docket research platform finds what other services can't. Coverage includes Federal, State, plus PTAB, TTAB, ITC and NLRB decisions, all in one place.

Identify arguments that have been successful in the past with full text, pinpoint searching. Link to case law cited within any court document via Fastcase.

## Analytics At Your Fingertips



Learn what happened the last time a particular judge, opposing counsel or company faced cases similar to yours.

Advanced out-of-the-box PTAB and TTAB analytics are always at your fingertips.

## API

Docket Alarm offers a powerful API (application programming interface) to developers that want to integrate case filings into their apps.

## LAW FIRMS

Build custom dashboards for your attorneys and clients with live data direct from the court.

Automate many repetitive legal tasks like conflict checks, document management, and marketing.

## FINANCIAL INSTITUTIONS

Litigation and bankruptcy checks for companies and debtors.

## E-DISCOVERY AND LEGAL VENDORS

Sync your system to PACER to automate legal marketing.