

# EXHIBIT 9



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(54) **METHODS AND APPARATUS FOR INFORMATION STORAGE AND RETRIEVAL USING A HASHING TECHNIQUE WITH EXTERNAL CHAINING AND ON-THE-FLY REMOVAL OF EXPIRED DATA**

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**G06F 17/30** (2006.01)

(52) **U.S. Cl.** ..... **707/999.001; 707/999.1; 707/999.101; 707/999.202; 707/999.206; 707/E17.036**

(58) **Field of Classification Search** ..... None  
See application file for complete search history.

(Continued)

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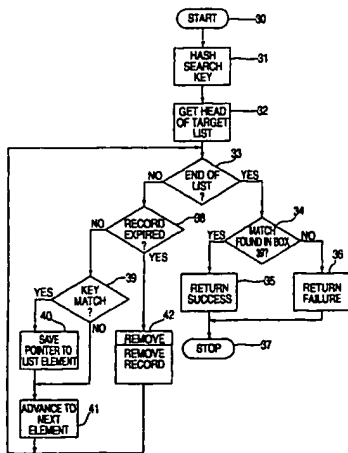
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(57) **ABSTRACT**

A method and apparatus for performing storage and retrieval in an information storage system is disclosed that uses the hashing technique with the external chaining method for collision resolution. In order to prevent performance deterioration due to the presence of automatically expiring data items, a garbage collection technique is used that removes all expired records stored in the system in the external chain targeted by a probe into the data storage system. More particularly, each insertion, retrieval, or deletion of a record is an occasion to search an entire linked-list chain of records for expired items and then remove them. Because an expired data item will not remain in the system long term if the system is frequently probed, it is useful for large information storage systems that are heavily used, require the fast access provided by the hashing, and cannot be taken off-line for removal of expired data.



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**EX PARTE  
REEXAMINATION CERTIFICATE  
ISSUED UNDER 35 U.S.C. 307**

THE PATENT IS HEREBY AMENDED AS  
INDICATED BELOW.

**Matter enclosed in heavy brackets [ ] appeared in the patent, but has been deleted and is no longer a part of the patent; matter printed in italics indicates additions made to the patent.**

AS A RESULT OF REEXAMINATION, IT HAS BEEN DETERMINED THAT:

The patentability of claims 1, 2, 5 and 6 is confirmed.

Claims 3 and 7 are determined to be patentable as amended.

Claims 4 and 8, dependent on an amended claim, are determined to be patentable.

New claims 9-12 are added and determined to be patentable.

3. A method for storing and retrieving information records using a linked list to store and provide access to the records, at least some of the records automatically expiring, the method comprising the steps of:

accessing the linked list of records *to search for a target record,*

identifying at least some of the automatically expired ones of the records *while searching for the target record,* and

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removing at least some of the automatically expired records from the linked list when the linked list is accessed.

5 7. A method for storing and retrieving information records using a hashing technique to provide access to the records and using an external chaining technique to store the records with same hash address, at least some of the records automatically expiring, the method comprising the steps of:

10 accessing a linked list of records having same hash address *to search for a target record,*

identifying at least some of the automatically expired ones of the records *while searching for the target record,*

15 removing at least some of the automatically expired records from the linked list when the linked list is accessed, and

inserting, retrieving or deleting one of the records from the system following the step of removing.

20 9. *The method of claim 3, further comprising: deallocating memory of the at least some of the automatically expired records.*

25 10. *The method of claim 9, further comprising: inserting the target record into the linked list if the target record was not found during the searching.*

11. *The method of claim 7, further comprising: deallocating memory of the at least some of the automatically expired records.*

30 12. *The method of claim 11, wherein the inserting, retrieving or deleting includes inserting the target record into the linked list if the target record was not found during the searching.*

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