(54) Title: METHOD OF WRITING DATA TO NON-VOLATILE MEMORY
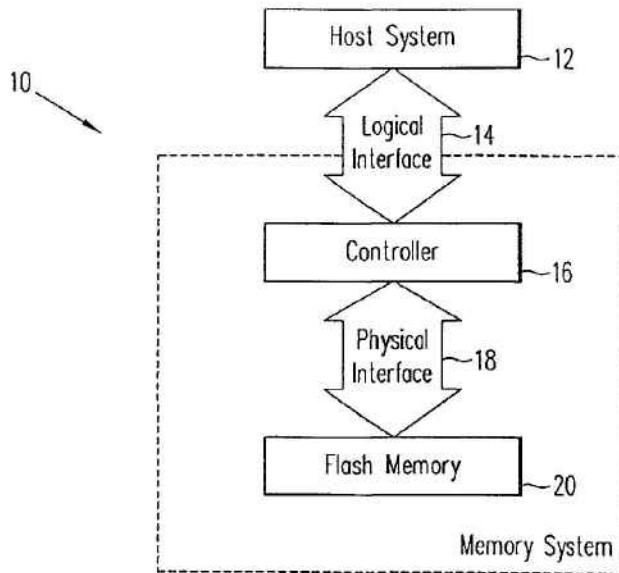
(57) Abstract: According to a first aspect of the invention, there is provided a controller connected to a non-volatile memory and including a volatile memory, wherein the controller maintains lists in volatile memory of blocks in the non-volatile memory allocated for storage of logical sector data and of blocks recently erased in the non-volatile memory.

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METHOD OF WRITING DATA TO NON-VOLATILE MEMORY

The present invention relates to a method of writing data to non volatile memory and in particular to a method of writing data to flash memory in order to ensure the uniform distribution of use over a prolonged period of operation.

In known memory systems it is common for non volatile memory such as the flash memory of the memory systems to have wear out mechanisms within their physical structures which mean that a block within the flash memory may experience failure after a cumulative number of operations. However, known data management methods typically do not perform block erasure in Flash memory in real time leading to the accumulation of blocks in Flash memory which contain obsolete versions of sectors. It is also the case that in known systems the physical address for writing a sector is dependant on the logical address of the sector thus logically non-contiguous sectors are written in non-contiguous physical address and logical to physical.

In particular an object of the present invention is to reduce the number of read and write accesses to the

non-volatile memory for control data structures, thereby
increasing the write speed of the memory system for host
data.

A second object of the invention is to obtain even
use of blocks in the non-volatile memory for storage of
data over a long period of operation, and to avoid "hot-
spots" in non-volatile memory usage, thereby increasing
the reliability of the memory system.

According to a first aspect of the invention, there
is provided a controller connected to a non-volatile
memory and including a volatile memory, wherein

the controller maintains lists in volatile memory of
blocks in the non-volatile memory allovated for storage
of logical sector data and of blocks recently erased in
the non-volatile memory

the controller transfers information from the lists
in volatile memory to control data structures in the non-
volatile memory less frequently than the contents of the
lists in volatile memory are changed

such that the lists in volatile memory can be
reconstructed at any time from existing informaion in the
non-volatile memory.

Preferably, information from the lists in volatile
memory is transferred to control data structures in the
non-volatile memory concurrently with logical to physical

mapping information for sectors from other lists in volatile memory.

According to a second aspect of the invention, there is provided a controller connected to a non-volatile memory and including a volatile memory, wherein

the controller maintains a first list of all blocks in the non-volatile memory which are in the erased state and which are not included in other lists

the controller maintains a second list of blocks in the non-volatile memory which have been recently erased.

These and other aspects of the invention will become apparent from the following description taken in combination with the following drawings in which is shown:

Figure 1 - a host system and flash memory system arrangement which the present invention is implemented;

Figure 2 - the hardware architecture of the controller of the system of Figure 1 in which the present invention is implemented;

Figure 3 - the layered firmware structure which performs the media management operations according to the present invention;

Figure 4a - schematic representation of the write operation according to the present invention;

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