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## SECURITY-PROTECTED HARD DISK APPARATUS



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### Technical Field of the Invention

The present invention relates to a security-protected hard disk apparatus that disables reading of information stored in a magnetic storage medium of a hard disk apparatus when attempt was made to obtain such information in an illegal manner, etc. and the like.

### Description of the Related Art

In terminal devices such as personal computers and the like in these days, users can use various contents easily through those preinstalled in a hard disk apparatus, or by downloading the contents which they need into the hard disk apparatus via the Internet or the like. Therefore, in association with prevalence of those contents, it is increasingly required to prevent illegal usage of these contents.

Hitherto, in order to prevent such illegal usage, an ID number and a password are preset so that only a contractor can use such contents. However, there are cases in which the contractor leaks his ID number and the password to the third party, and the third party uses the content illegally. Therefore, as a new countermeasure, there is proposed a

system in which an ID is embedded individually into the storage medium and the contents can be used only when a contents key required for using the contents is produced based on the ID, as disclosed in Patent JP-A-2000-298942, is proposed. With this arrangement, illegal usage of the contents not only by amateurs, but also by maniacs can be completely prevented unless the ID embedded in the medium is stolen.

#### Problems to be Solved by the Invention

However, even when the countermeasure for preventing illegality described above is taken, those having special knowledge can steal the contents key or the ID in theory by disassembling the hard disk apparatus, reading the stored contents on the storage surface of the storage medium by using a magnetic head, and performing signal processing or the like, and thus extracting only information about the contents, which is protected by a copyright or the like, is not impossible for specialists.

Therefore, in order to further enhance diffusion of contents delivery via the Internet or the like, a highly reliable system, in which a copyright or the like of the contents supplier is completely protected, is required.

An object of the present invention is to provide a security-protected hard disk apparatus which satisfies the requirement described above.

Another object of the present invention is to provide a security-protected hard disk apparatus that does not carry any risk.

#### Means for Solving the Problems

A security-protected hard disk apparatus according to an embodiment of the present invention that satisfies the requirements described above characterized by an enclosure in which a magnetic storage medium and a magnetic head enclosed therein, a container provided in the enclosure for containing a substance that can melt at least a storage layer of the aforementioned magnetic storage medium, and an injection unit for injecting the content of the aforementioned container at least onto the storage layer of the magnetic storage medium in response to opening of the aforementioned enclosure.

The aforementioned injection unit may be constructed in such a manner that the aforementioned enclosure is tightly sealed, and the pressure in the enclosure is substantially the same as that in the aforementioned

container and held at a value higher than the ambient pressure.

The aforementioned injection unit may be constructed in such a manner that the aforementioned enclosure is tightly sealed in terms of the pressure, and includes a movable portion, which is capable of pressing the aforementioned container, on part of a wall surface thereof, and an outer enclosure being tightly sealed for covering the aforementioned enclosure, and that the pressure in the enclosure is substantially the same as that in the aforementioned container, and the pressure in the aforementioned enclosure and the pressure in the aforementioned outer enclosure are set to values lower than the ambient pressure.

The aforementioned injection unit may be interlocked with a screw, which secures a lid of the aforementioned enclosure, and constructed by a latchet mechanism that can press the aforementioned container when the screw is removed.

Preferably, the aforementioned container includes an injection port facing the storage layer of the aforementioned magnetic storage medium, and the injection

port includes a sealing device that is opened by the pressure difference.

The aforementioned injection unit may include a sensor for detecting that the aforementioned enclosure is opened, and a valve actuating unit for actuating a valve provided on the aforementioned container, which is higher than the aforementioned enclosure in pressure, according to the signal from the sensor.

The aforementioned container may include the substance that can melt at least the storage layer of the aforementioned magnetic storage medium as well as fine particles to be attached at least onto the storage layer of the aforementioned magnetic storage medium.

According to an embodiment of the present invention, when the hard disk apparatus is opened, the substance that can melt at least the storage layer of the magnetic storage medium is injected from the injection unit, and the contents stored on the magnetic storage medium is erased. Accordingly, information about the contents cannot be read out correctly, and thus reading of the contents is prevented.

The security-protected hard disk apparatus according to

another embodiment of the present invention that satisfies the requirements described above is characterized by an enclosure in which a magnetic storage medium and a magnetic head enclosed therein, an acidic solution container provided in the enclosure for containing an acidic solution that can melt at least a storage layer of the aforementioned magnetic storage medium, an alkaline solution container provided in the enclosure for containing an alkaline solution that neutralizes the aforementioned acidic solution, an acidic solution injection unit for injecting the acidic solution in the aforementioned acidic solution container at least onto the storage layer of the aforementioned magnetic storage medium in response to opening of the aforementioned enclosure, and an alkaline solution injection unit for injecting the alkaline solution in the aforementioned alkaline solution container at least onto the storage layer of the aforementioned magnetic storage medium in response to opening of the aforementioned enclosure.

The aforementioned acidic solution container and the aforementioned alkaline solution container may be double-walled containers and contain the aforementioned acidic solution and alkaline solution in internal containers thereof at a pressure of 1 ATM or higher, respectively, and may be provided with heaters at least at

outlets of the internal containers, respectively.

The aforementioned acidic solution injection unit may include a nozzle pipe having a plurality of nozzles opening toward at least the storage layer of the aforementioned magnetic storage medium, and piping for connecting the nozzle pipe and an outlet of an external container of the aforementioned acidic solution container, and the aforementioned alkaline solution injection unit may include piping for connecting the aforementioned nozzle pipe and an outlet of an external container of the aforementioned alkaline solution.

The aforementioned acidic solution container and the aforementioned alkaline solution container may be formed of a selected one of glass, ceramic, and a group of polymer resin.

It is preferable that a sensor for detecting that the aforementioned enclosure is opened and an energizing unit for energizing heaters of the aforementioned acidic solution container and the aforementioned alkaline solution container according to signals from the sensor are provided, and that energization of the heater of the aforementioned alkaline solution container is delayed in comparison with

the energization of the heater of the aforementioned acidic solution container.

A security-protected hard disk apparatus according to still another embodiment of the present invention that satisfies the requirements described above is characterized by an enclosure in which a magnetic storage medium and a magnetic head enclosed therein, an acidic solution container provided in the enclosure for containing an acidic solution that can melt at least a storage layer of the aforementioned magnetic storage medium, an alkaline powder container provided in the enclosure for containing an alkaline powder that neutralizes the aforementioned acidic solution, an acidic solution injection unit for injecting the acidic solution in the aforementioned acidic solution container at least onto the storage layer of the aforementioned magnetic storage medium in response to opening of the aforementioned enclosure, and an alkaline powder injection unit for injecting the alkaline powder in the aforementioned alkaline powder container at least onto the storage layer of the aforementioned magnetic storage medium in response to opening of the aforementioned enclosure.

The aforementioned acidic solution container may be a double-walled container and contains the aforementioned

acidic solution in its internal container at a pressure of 1 ATM or higher, the aforementioned alkaline powder container is a single-walled container and contains alkaline powder at a pressure of 1 ATM or higher, and the aforementioned internal container and an outlet of the aforementioned alkaline powder container may be provided with heaters, respectively.

The aforementioned acidic solution injection unit may include a nozzle pipe having a plurality of nozzles opening toward at least the storage layer of the aforementioned magnetic storage medium and piping for connecting the nozzle pipe and the outlet of an external container of the aforementioned acidic solution container.

The aforementioned alkaline powder injection unit may include piping for connecting the nozzle pipe and the outlet of the aforementioned alkaline powder container.

The aforementioned acidic solution container and the aforementioned alkaline powder container may be formed of selected one of glass, ceramic, and a group of polymer resin.

It is preferable that a sensor for detecting that the aforementioned enclosure is opened and an energizing unit

for energizing heaters of the aforementioned acidic solution container and the aforementioned alkaline powder container according to signals from the sensor are provided, and that energization of the heater of the aforementioned alkaline powder container is delayed in comparison with the energization of the heater of the aforementioned acidic solution container.

According to another embodiments of the present invention, when the hard disk apparatus is opened, the acidic solution that can melt at least the storage layer of the magnetic storage medium is injected from the acidic solution injection unit, and the contents stored on the magnetic storage medium is erased. Accordingly, information about the contents cannot be read out correctly, and thus reading of the contents is prevented. In addition, since alkaline solution or powder is injected for neutralization, security after destruction is ensured.

#### Brief Description of the Drawings

Fig. 1 is a cross-sectional view showing a hard disk apparatus according to a first embodiment of the present invention.

Fig. 2 is a cross-sectional view of an example of a solution container used in the present invention, in which

(A) shows a tightly sealed state, and (B) shows an opened state.

Fig. 3 is a cross-sectional view showing another example of the solution container used in the present invention.

Fig. 4 is a cross-sectional view of a hard disk apparatus according to a second embodiment of the present invention.

Fig. 5 is a construction of the part of the hard disk apparatus according to the second embodiment of the present invention in the vicinity of the solution container, wherein (A) is a cross-sectional side view, and (B) is a cross-sectional plan view.

Fig. 6 is a cross-sectional view of a hard disk apparatus according to a third embodiment of the present invention.

Fig. 7 is a cross-sectional view of an example of a latchet mechanism in the hard disk apparatus according to the third embodiment of the present invention.

Fig. 8 is a cross-sectional view of a hard disk apparatus according to a fourth embodiment of the present invention.

Fig. 9 is a cross-sectional view of a hard disk apparatus according to a fifth embodiment of the present invention.

Fig. 10 is a cross-sectional view showing an example of a double-walled solution container used in the present invention.

Fig. 11 is a time chart showing an example of energization timing to a heater according to an embodiment of the present invention.

Fig. 12 is a cross-sectional view of a hard disk apparatus according to a sixth embodiment of the present invention.

Fig. 13 is a cross-sectional view of a hard disk apparatus according to a seventh embodiment of the present invention.

Fig. 14 is a cross-sectional view showing an example of a single-walled powder container used in the present invention.

#### Mode for Carrying Out the Invention

Referring now to the attached drawings, the embodiments of the present invention will be described.

A cross-sectional structure of a hard disk apparatus 100 according to a first embodiment of the present invention is shown in Fig. 1. The hard disk apparatus 100 according to the first embodiment of the present invention includes a tightly sealed enclosure 120 that can be

maintained at a predetermined pressure, and enclosed therein are a hard disk 140 that corresponds to a magnetic storage medium, a head arm 142, a magnetic head 144, and so on. Reference numeral 146 designates a spindle motor for driving the hard disk 140, and reference numeral 190 designates a circuit board on which a circuit for controlling the hard disk apparatus 100 and so on is provided. In the enclosure 120, a solution container 180, in which a solution that can melt at least a storage layer of the aforementioned magnetic storage medium is sealed at a high pressure, is arranged at a position opposing a storage layer including a magnetic layer 140a and a lubricant layer 140b of the magnetic storage medium 140.

The container 180 is provided with an injection port 182 directed toward the storage layer side of the magnetic storage medium so that a solution is injected at least to the storage layer of the magnetic storage medium, and the injection port 182 is provided with a sealing film 184, which corresponds to a sealing device to be opened by the pressure difference, for sealing an extremity thereof during normal operation as shown in Fig. 2. When the hard disk apparatus is assembled, the pressure in the enclosure 120 is set to a pressure which is substantially the same as that in the solution container 180, and is higher than the ambient

pressure, so that the solution container 180 is prevented from being subjected to an internal pressure caused by the pressure difference.

In the hard disk apparatus 100 according to the first embodiment of the present invention constructed as described above, when the enclosure 120 of the hard disk apparatus 100 is opened for stealing the contents, the pressure in the enclosure 120 becomes the ambient pressure, and thus the sealing film 184 which is weak in terms of the pressure is opened by peeling or breakage due to the internal pressure of the solution container 180 which has been maintained at a higher pressure than the ambient pressure (See Fig. 2(B)). Then, the solution is spouted out and dispersed from the injection port 182, and is injected onto the storage layer of the magnetic storage medium 140, where the magnetic layer 140a or the lubricant layer 140b of the storage layer are melted or dissolved, so that information embedded in the magnetic layer cannot be read correctly. The solution may be chemicals of acidic and organic solvent (for example, hydrochloric acid).

Subsequently, referring to Fig. 4 and Fig. 5, a hard disk apparatus 200 according to a second embodiment of the present invention will be described. The hard disk

apparatus 200 according to the second embodiment of the present invention has a tightly sealed two-chamber structure. More specifically, a tightly sealed outer enclosure 220 for covering an inner enclosure 250, which corresponds to the enclosure in the first embodiment, is further provided. As a consequence, an inner pressure-sealed chamber 230 is formed in the inner enclosure 250, and an outer pressure-sealed chamber 210 is formed between the inner enclosure 250 and the outer enclosure 220. The inner enclosure 250 accommodates the components, such as the hard disk 140, the head arm 142, and the magnetic head 144, described in conjunction with the first embodiment therein, and parts having the same function as in the previous embodiment are represented by the same reference numerals, and will not be described again.

The inner enclosure 250 of the second embodiment is provided with a movable portion 260, which can press a solution container 280, on part of a wall surface thereof. The movable portion 260 has a bellows shape and is formed of rubber material or the like in order to ensure a large amount of displacement due to the pressure difference between the outer pressure-sealed chamber 210 and the inner pressure-sealed chamber 230, and in order to ensure a stable amount of displacement.

As shown in Figs. 4 and 5 in detail, a disk-shaped interlocking plate 270 having substantially the same size as a magnetic storage medium is fixed to the center of the movable member 260 via a main shaft 272 in a face-to-face relation with the storage surface of the hard disk 140, which corresponds to the magnetic storage medium, including the magnetic layer 140a. A guiding hole 272a is formed at the center of the main shaft 272, in which a shaft 147 of the spindle motor 146 is fitted. The reference numeral 140b is the lubricant layer covering the surface of the magnetic layer 140a. The interlocking plate 270 is mounted to the back surface of the solution container 280 supported by a fixed plate 276. The interlocking plate 270 may be adapted to be guided by a plurality of side columns 274 for smooth vertical movement thereof as shown in Fig. 5.

The solution container 280 is formed of a flexible material so as to be capable of being pressed by the movable portion 260 via the interlocking plate 270, and is formed with an injection port 282 facing the storage layer of the magnetic storage medium 140, and the injection port 282 is provided with a sealing film 284, which corresponds to a sealing device to be opened by the pressure difference. The hard disk apparatus 200 according to the second embodiment of the present invention is constructed in such a manner

that the pressure in the inner enclosure 250 is substantially the same as in the solution container 280, and the pressure in the inner enclosure 250 and the pressure in the outer enclosure 220 are maintained at values lower than the ambient pressure when they are assembled.

In the hard disk apparatus 200 constructed as described above, when the outer enclosure 220 is opened, the pressure in the outer pressure-sealed chamber 210 becomes the ambient pressure, and a force generated by the pressure difference is exerted to the movable portion 260 provided on the wall surface of the inner enclosure 250 to move the movable portion 260. Movement of the movable portion 260 presses the back surface of the solution container 280 in which a dissolved solution is encapsulated via the interlocking plate 270, so that the pressure therein increases. The injection port 282 provided at the extremity of the container, in which the dissolved solution is encapsulated, is opened by peeling or breakage of the sealing film 284. Then as in the first embodiment, the solution is spouted out and dispersed from the injection port 282, is injected onto the storage layer of the magnetic storage medium 140, where the magnetic layer 140a or the lubricant layer 140b of the storage layer is melted or dissolved, so that information embedded in the magnetic layer cannot be

read correctly.

Referring now to Fig. 6 and Fig. 7, a third embodiment of the present invention will be described.

In the first and the second embodiments, the solution injection unit is actuated by using variations in pressure in the hard disk apparatus. In contrast, in the third embodiment, a mechanical latchet mechanism, which is interlocked with a screw for securing a lid of the enclosure, is utilized.

More specifically, a hard disk apparatus 300 according to the third embodiment of the present invention, a lid 324 is fixed to an enclosure 320 with a fixed screw 326. The fixed screw 326 is provided with a latchet mechanism 330 at the extremity thereof. The latchet mechanism 330 in this embodiment is provided by being fitted loosely on the fixed screw 326, and is provided with a movable ring 332 formed with saw teeth including an upwardly inclined surfaces and upright surfaces on the side surface thereof. Fixation of the movable ring 332 to the fixed screw 326 is achieved by a retaining ring 334, so as to be free from rotation of the fixed screw 326. At the position facing the movable ring 332, there is provided a divided fixed ring 336 formed with

saw teeth including downwardly inclined surfaces and upright surfaces on the side surface thereof, which is restrained from its movement in the direction of movement of the fixed screw 326 by an upper and a lower walls 338 provided on a cylindrical frame 340 so as to project therefrom, and is free to move in the radial direction, which intersects with the direction of movement of the fixed screw 326, by a spring 342 provided on the backside thereof. With the latch mechanism 330 in this arrangement, when the fixed screw 326 is screwed for assembling the lid 324, the movable ring 332 is pressed inward, and thus the bevels of saw-teethed portions on the movable ring 332 and the fixed ring 336 abut against each other and move away from each other. Therefore, the fixed ring 336 only bows the spring 342 downward, and thus the cylindrical frame 340 cannot be moved.

In the present embodiment, a solution container 380 formed of a flexible film or the like is integrated under the cylindrical frame 340 and, as in the case of the previous embodiment, is formed with an injection port 382, and the injection port 382 is closed by the sealing film 384. The cylindrical frame 340 is supported at a predetermined position of the enclosure 320 by a guide member, not shown, in such a manner that the vertical movement is not restrained, but the rotational movement is restrained. The upper portion of the

solution container 380 formed of the flexible film or the like is held by a fixed frame 344. The enclosure 320 accommodates the components such as the hard disk 140, the head arm 142, the magnetic head 144, and the like as described in conjunction with the first embodiment therein, and parts having the same function as in the previous embodiments are represented by the same reference numerals, and will not be described again.

When an attempt is made to open the enclosure 320 of the hard disk apparatus 300 according to the third embodiment of the present invention, and thus to remove the lid 324 by rotating the fixed screw 326, the fixed screw 326 is moved upward. Then, the upright surfaces of the saw-toothed portions engage with each other, whereby the fixed ring 336 is moved upward and the cylindrical frame 340 is moved upward. Consequently, the solution container 380 integrated in the lower portion of the cylindrical frame 340 is pressurized with respect to the fixed frame 344. Therefore, in this embodiment as well, when the solution container 380 is pressurized via the latchet mechanism 330, the solution is spouted out and dispersed from the injection port 382, and is injected onto the storage layer of the magnetic storage medium 140, where the magnetic layer 140a or the lubricant layer 140b of the storage layer is melted or

dissolved, so that information embedded in the magnetic layer cannot be read correctly.

Referring lastly to Fig. 3 and Fig. 8, a fourth embodiment of the present invention will be described.

A hard disk apparatus 400 according to the fourth embodiment of the present invention, a pilfer sensor 430 detects that an enclosure 420 (or a lid) of the hard disk apparatus 400 is opened, and an electric valve provided on a solution container 480 is opened by using an output signal from the pilfer sensor 430. The solution container 480 is formed with an injection port 482 as shown in Fig. 3, is filled with a solution that can melt at least the storage layer of the magnetic storage medium at a high pressure, and is provided with an electric sealing valve 484 for sealing it in the normal operation. Since this system is operated by electricity, a primary or a secondary battery 440 must be provided in the hard disk apparatus 400.

The pilfer sensor 430 for detecting opening may be sensors as shown below.

1) Pressure Sensor

In this case, the enclosure 420 of the hard disk

apparatus 400 is tightly sealed, and the pressure in the enclosure 420 is maintained in the higher pressure or the reduced pressure sufficiently in comparison with the normal pressure, so that the fact that the pressure in the enclosure 420 is changed into the normal pressure is detected when the enclosure 420 is opened.

## 2) Oxygen Sensor

In this case as well, the enclosure 420 of the hard disk apparatus 400 is tightly sealed, and gas in the enclosure 420 is substituted by, for example, argon and kept in an oxygen-free state. When the enclosure 420 is opened, the fact that the amount of oxygen in the enclosure 420 has changed is detected.

## 3) Impact Sensor

In this case, the enclosure 420 of the hard disk apparatus 400 is completely sealed by, for example, ultrasonic welding or the like, and mechanical abnormal vibrations generated when attempt is made to open by using a tool are detected.

## 4) Light Receiving Sensor

In this case, the enclosure 420 of the hard disk apparatus 400 is completely light-shielded, and opening of

the enclosure 420 is detected by using the fact that outside light enters in the enclosure 420 when it is opened.

#### 5) Resistance Variation Sensor

In this case, an electric conductor having a specific resistance is provided on the surface of the enclosure 420 of the hard disk apparatus 400, electrodes for measuring resistance are disposed on the respective surfaces of the electric conductor, and variations in resistance value between the electrodes are measured, so as to determine that the enclosure 420 is opened when there is a significant variation in resistance value.

As described above, in the hard disk apparatus 400 according to the fourth embodiment of the present invention, when the fact that the enclosure 420 is opened is detected by the pilfer sensor 430, the electric sealing valve 484 is opened according to the signal from the sensor, and the solution is spouted out and dispersed from the injection port 482 of the solution container 480, which has been maintained at a higher pressure than in the enclosure 420, and injected onto the storage layer of the magnetic storage medium 140, where the magnetic layer 140a or the lubricant layer 140b of the storage layer is melted or dissolved, so that information embedded in the magnetic layer

cannot be read correctly.

The solution container according to the above-described embodiments may contain fine particles (for example, glass beads) to be attached at least on the storage layer of the aforementioned magnetic storage medium as well as the solution that can melt at least the storage layer of the magnetic storage medium. In this arrangement, information embedded in the magnetic layer can be prevented from being read correctly further reliably.

Subsequently, referring to Fig. 9 to Fig. 11, a hard disk apparatus 500 according to a fifth embodiment of the present invention will be described. The hard disk apparatus 500 according to the fifth embodiment of the present invention is provided in an enclosure 520, and includes an acidic solution container 580 containing an acidic solution that can melt at least the storage layer of the hard disks 140 (two in this embodiment), and an alkaline solution container 590 containing an alkaline solution for neutralizing the acidic solution. In order to inject the acidic solution in the acidic solution container 580 and the alkaline solution in the alkaline solution container 590 onto the storage layers of the hard disks 140 in response to opening of the enclosure 520, nozzle pipes 570 (three in this embodiment)

having a plurality of nozzles 571 opening toward the storage layers of the hard disks 140, and piping 572 and piping 574 formed of vinyl hose for connecting the nozzle pipes 570 with respect to the outlets of the acidic solution container 580 and the alkaline solution container 590 respectively are provided. The piping 572 and the piping 574 are provided with a check valve 573 and a check valve 575.

The acidic solution container 580 and the alkaline solution container 590 (reference number of the alkaline acid container is enclosed within parenthesis) are double-walled containers. An internal container 582 thereof (592) is filled with the acidic solution (the alkaline solution) at a pressure  $P_1$ , which is higher than 1 ATM, respectively. The internal container 582 (592) includes a heater 585 (595) at least at an outlet 584 (594) of the internal container 582 (592). An external container 586 (596) surrounds the internal container 582 (592) at a predetermined distance, and an outlet 588 (598) is connected to the aforementioned piping 572 (574).

In addition, as in the case of the fourth embodiment, a primary or a secondary battery is provided in the hard disk apparatus 500 as an energizing unit for the heater 585 (595), and the aforementioned pilfer sensor is provided. The

parts having the same function as in the aforementioned embodiment will be represented by the same reference numerals, and will not be described again.

In the hard disk apparatus 500 according to the fifth embodiment of the present invention, as shown in Fig. 11, the fact that the enclosure 520 of the hard disk apparatus 500 is opened is detected by the pilfer sensor, and the heater 585 provided at least at the outlet 584 of the internal container 582 of the acidic solution container 580 is energized by using the output signal from the pilfer sensor. Then, a stress due to the difference in thermal expansion coefficients between the heater 585 and the glass is generated in the acidic solution container 580 formed of glass due to abrupt heating by energization, whereby the outlet 584 is broken, and the acidic solution is sprayed from the nozzle 571 via the piping 572 and the nozzle pipe 570. Then, the storage layer (magnetic layer), and the lubricant layer of the magnetic storage medium are dissolved by the acidic solution. In the present embodiment, as shown in Fig. 11, the heater 595 of the alkaline solution container 590 is energized when a predetermined time period has elapsed after energization of the heater 585 of the acidic solution container 580, that is, when dissolution of the storage layer and the lubricant layer has almost completed, so that the

outlet 594 of the alkaline solution container 590 is broken and the alkaline solution is sprayed from the nozzle 571 through the piping 574 and the nozzle pipe 570 for neutralization. Therefore, detoxification is achieved and the safety is ensured.

Referring now to Fig. 12, a hard disk apparatus 600 according to a sixth embodiment of the present invention will be described. The only different point of the sixth embodiment is that alkaline powder is used instead of the alkaline solution used in the fifth embodiment. Since other constructions are almost the same as those in the fifth embodiment, the parts having the same function are represented by the same reference numerals and only the different point will be focused on. In other words, according to the sixth embodiment, the alkaline powder is encapsulated in an internal container (not shown) of an alkaline powder container 690, which is a double-walled container formed of glass, at a pressure higher than 1 ATM. An outlet of an external container is connected to the other end of a nozzle pipe 570, which is a different one from that for the acidic solution, via piping 674.

Referring now to Fig. 13 and Fig. 14 the hard disk apparatus 700 according to a seventh embodiment of the

present invention will be described. In the seventh embodiment, an alkaline powder container 790, which is a single-walled container formed of glass, as shown in Fig. 14, is used instead of the double-walled glass container used in the sixth embodiment, and a heater 795 is provided at an outlet 794. The alkaline powder container 790 is filled with gas pressurized to an air pressure higher than 1 ATM together with alkaline powder. The outlet 794 is not connected to the piping, and the direction thereof is determined so that the alkaline powder is dispersed in an enclosure 702.

In the sixth embodiment and the seventh embodiment, as in the fifth embodiment, when the pilfer sensor detected that the fact that the enclosures 620 and 720 are opened, the heater 585 provided at the outlet 584 of the internal container 582 of the acidic solution container 580 is energized according to the output signal from the pilfer sensor. When the outlet 584 is broken, the acidic solution is sprayed through the nozzle 571. Then, when a predetermined time period has passed after the heater 585 of the acidic solution container 580 is energized, the heater 695 (795) of the alkaline powder container 690 (790) is energized.

Then, in the sixth embodiment, the outlet 694 of the

alkaline powder container 690 is broken, and the alkaline powder is sprayed from the nozzle 571 through the piping 674 and the nozzle pipe 570, whereby homogeneous neutralization on the surface of the hard disk 140 is achieved. On the other hand, in the seventh embodiment, the outlet 794 of the alkaline powder container 790 is broken, and the alkaline powder is sprayed in the enclosure 720, so that not only the hard disk 140, but also the interior of the enclosure 720 is entirely neutralized. Therefore, detoxification is achieved and the safety is ensured.

Although the container described above is formed of glass, it may be a container formed of ceramic or polymer resin, as a matter of course.

#### Advantages Effect of the Invention

According to the present invention, even when an attempt is made to open the hard disk apparatus and read contents information stored in the hard disk, stored content in the magnetic storage medium is erased by a substance that can melt at least the storage layer of the magnetic storage medium, and thus reading of the contents is completely prevented, and thus a copyright of a contents supplier may be protected.

In addition, since the alkaline solution for neutralizing the acidic solution is added for spraying, detoxification is achieved and thus the safety is ensured.

## Claims

1. A security-protected hard disk apparatus comprising:

an enclosure in which a magnetic storage medium and a magnetic head enclosed therein;

a container provided in the enclosure for containing a substance that can melt at least a storage layer of the said magnetic storage medium; and

an injection unit for injecting the content of the aforementioned container at least onto the storage layer of said magnetic storage medium in response to opening of the said enclosure.

2. A security-protected hard disk apparatus according to Claim 1, characterized in that said injection unit is constructed in such a manner that said enclosure is tightly sealed, and the pressure in the enclosure is substantially the same as that in said container and held at a value higher than the ambient pressure.

3. A security-protected hard disk apparatus according to Claim 1 or 2, characterized in that said container comprises an injection port facing the storage layer of said magnetic storage medium, and the injection port

includes a sealing device that is opened by the pressure difference.

4. A security-protected hard disk apparatus according to Claim 1, characterized in that said injection unit is constructed in such a manner that said enclosure is tightly sealed in terms of the pressure, and comprises a movable portion, which is capable of pressing said container, on part of a wall surface thereof, and an outer enclosure being tightly sealed for covering said enclosure, and in that the pressure in the enclosure is substantially the same as that in the container, and the pressure in said enclosure and the pressure in said outer enclosure are set to values lower than the ambient pressure.

5. A security-protected hard disk apparatus according to Claim 4, characterized in that said container comprises an injection port facing the storage layer of said magnetic storage medium, and the injection port comprises a sealing device that is opened by the pressure difference.

6. A security-protected hard disk apparatus according to Claim 1, characterized in that said injection unit is interlocked with a screw, which secures a lid of the said enclosure, and constructed by a latchet mechanism that

can press said container when the screw is removed.

7. A security-protected hard disk apparatus according to Claim 6, characterized in that said container comprises an injection port facing the storage layer of said magnetic storage medium, and the injection port includes a sealing device that is opened by the pressure difference.

8. A security-protected hard disk apparatus according to Claim 1, characterized in that said injection unit comprises:

a sensor for detecting that said enclosure is opened;  
and

a valve actuating unit for actuating a valve provided on said container, according to signals from the sensor which is higher than said enclosure in pressure.

9. A security-protected hard disk apparatus according to any one of Claims 1 to 8, characterized in that said container comprises a substance that can melt at least the storage layer of said magnetic storage medium as well as fine particles to be attached at least onto the storage layer of said magnetic storage medium.

10. A security-protected hard disk apparatus

comprising:

an enclosure in which a magnetic storage medium and a magnetic head enclosed therein;

an acidic solution container provided in the enclosure for containing an acidic solution that can melt at least a storage layer of said magnetic storage medium;

an alkaline solution container provided in the enclosure for containing an alkaline solution that neutralizes said acidic solution;

an acidic solution injection unit for injecting the acidic solution in said acidic solution container at least onto the storage layer of said magnetic storage medium in response to opening of said enclosure; and

an alkaline solution injection unit for injecting the alkaline solution in said alkaline solution container at least onto the storage layer of said magnetic storage medium in response to opening of said enclosure.

11. A security-protected hard disk apparatus according to Claim 10, characterized in that said acidic solution container and said alkaline solution container are double-walled containers and contain said acidic solution and alkaline solution in internal containers thereof at a pressure of 1 ATM or higher, respectively, and are provided with heaters at least at outlets of the internal containers,

respectively.

12. A security-protected hard disk apparatus according to Claim 11, characterized in that said acidic solution injection unit comprises a nozzle pipe having a plurality of nozzles opening toward at least the storage layer of said magnetic storage medium, and piping for connecting the nozzle pipe and an outlet of an external container of said acidic solution container, and said alkaline solution injection unit comprises piping for connecting said nozzle pipe and an outlet of an external container of said alkaline solution.

13. A security-protected hard disk apparatus according to any one of Claims 10 to 12, characterized in that said acidic solution container and said alkaline solution container are formed of selected one of glass, ceramic, and a group of polymer resin.

14. A security-protected hard disk apparatus according to any one of Claims 11 to 13, further comprising: a sensor for detecting that said enclosure is opened; and an energizing unit for energizing heaters of said acidic solution container and said alkaline solution container according to signals from the sensor, characterized in that energization of the

heater of said alkaline solution container is delayed in comparison with the energization of the heater of said acidic solution container.

15. A security-protected hard disk apparatus comprising:

an enclosure in which a magnetic storage medium and a magnetic head enclosed therein;

an acidic solution container provided in the enclosure for containing an acidic solution that can melt at least a storage layer of said magnetic storage medium;

an alkaline powder container provided in the enclosure for containing an alkaline powder that neutralizes said acidic solution;

an acidic solution injection unit for injecting the acidic solution in said acidic solution container at least onto the storage layer of said magnetic storage medium in response to opening of the said enclosure; and

an alkaline powder injection unit for injecting the alkaline powder in said alkaline powder container at least onto the storage layer of said magnetic storage medium in response to opening of said enclosure.

16. A security-protected hard disk apparatus according to Claim 15, characterized in that said acidic

solution container is a double-walled container and contains said acidic solution in its internal container at a pressure of 1 ATM or higher, said alkaline powder container is a single-walled container and contains alkaline powder at a pressure of 1 ATM or higher, and said internal container and an outlet of said alkaline powder container may be provided with heaters, respectively.

17. A security-protected hard disk apparatus according to Claim 16, characterized in that said acidic solution injection unit comprises a nozzle pipe having a plurality of nozzles opening toward at least the storage layer of said magnetic storage medium, and piping for connecting the nozzle pipe and an outlet of an external container of said acidic solution container.

18. A security-protected hard disk apparatus according to Claim 17, characterized in that said alkaline powder injection unit comprises piping for connecting said nozzle pipe and the outlet of said alkaline powder container.

19. A security-protected hard disk apparatus according to any one of Claims 15 to 19, characterized in that said acidic solution container and said alkaline powder container are formed of selected one of glass, ceramic, and

a group of polymer resin.

20. A security-protected hard disk apparatus according to any one of Claims 15 to 19, further comprising:  
a sensor for detecting that said enclosure is opened; and

an energizing unit for energizing heaters of said acidic solution container and said alkaline powder container according to signals from the sensor,

characterized in that energization of the heater of said alkaline powder container is delayed in comparison with the energization of the heater of said acidic solution container.