

TRAY USED FOR HOLDING HARD DISK DRIVE HEADS

FIELD OF THE INVENTION

The present invention relates to a tray used for transporting a plurality of heads used in
5 hard disk drives (HDDs). The head is hereinafter referred to as the "HDD head".

BACKGROUND ART

An HDD head is a precision part which is a thin plate member of a few to several centimeters in length and is composed of a magnetic read/write head, a holding base and a
10 suspension arm. The suspension arm connects the read/write head and the holding base, and a fine wiring is applied on its surface or surfaces. Being so precise and fragile, when the HDD head is handled carelessly, the wiring is damaged or stained. Accordingly, in the production site of HDD heads, the HDD heads are put in a tray designed for holding a number of HDD heads, and necessary treatments, such as washing, are carried out on the HDD heads in that state.
15 After the treatments, a plurality of the trays with the HDD heads are stacked and vacuum-packed to prevent them from air-born contaminants, etc. The stacked trays are hereinafter referred to as "tray assembly".

While the tray assembly is being vacuum-packed, or when the vacuum-packed tray assembly is being transported, the trays vibrate. When the vibration occurs, the wire-applied
20 surface of the HDD head comes in frictional contact with a part of the tray, which often causes damage of or faults in the wiring. In light of the problem, one object of the present invention is to propose a tray designed so that the above-described damage or the like of HDD heads due to the friction is prevented.

25 DISCLOSURE OF THE INVENTION

For solving the above-described problem, the present invention proposes a tray for holding a plurality of hard disk drive heads each having a wire-applied surface, the tray having a plurality of positioning parts each for holding each of the hard disk drive heads, characterized in that each of the positioning part is provided with a small-projection on a part of its surface

which contacts the wire-applied surface of the hard disk drive head.

The tray according to the present invention has the positioning parts for holding HDD heads, and each of the positioning parts is provided with a small-projection formed on a part of its surface which contacts the wire-applied surface of the HDD head. The small-projection may be designed variously in form and size. An example is a hemispherical projection of about a few to several hundreds of micrometers in height or diameter. Another example is a linear elevation, or ridge, of about one to several hundreds of micrometers in width and about a few millimeters in length. When the small-projection is formed as a ridge, the ridge may be preferably designed to extend in substantially the same direction as the length of the suspension arm of the HDD heads set at the positioning part. It is also preferable to form the small-projection at such a position that it contacts the wire-applied surface of the HDD head at a plain area where no wiring is applied.

In the tray according to the present invention, the friction between the wire-applied surface of the HDD head and the positioning part of the tray is minimized because they contact only at the top of the small-projection. Thus, various troubles caused by the friction, such as damage of or faults in the wiring, are assuredly prevented.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is a perspective view of a tray embodying the present invention.

Fig. 2 is a plan view of the tray.

Fig. 3 is a left side view of the tray.

Fig. 4 is a front view of the tray.

Fig. 5 is a bottom view of the tray.

Fig. 6 is a cross sectional view of the tray at line VI-VI in Fig. 2.

Fig. 7 is a cross sectional view of the tray at line VII-VII in Fig. 2.

Fig. 8 is an enlarged view of part A in Fig. 2.

Fig. 9 is a right side view of the part.

Fig. 10 is an enlarged view showing an example of a modification of part A in Fig. 2.

Fig. 11 is a right side view of the part.

Figs. 12 and 13 show a preferred form of a linear elevation, wherein Fig. 12 is an enlarged view of a part of the tray corresponding to part A shown in Fig. 2, and Fig. 13 is a right side view of the part.

5 Fig. 14 is a plan view of another form of the positioning part of the tray.

Fig. 15 is a perspective view of a tray set consisting of a plurality of the trays shown in Fig. 1.

Fig. 16 is a front view of the tray set shown in Fig. 15.

Fig. 17 is a plan view of another tray embodying the present invention.

10 Fig. 18 is a cross sectional view of the tray at line B-B in Fig. 17.

BEST MODE FOR CARRYING OUT THE INVENTION

Preferred embodiments of the present invention are described below, referring to the drawings.

15 Figs. 1-5 show a tray embodying the present invention, where Fig. 1 is a perspective view, Fig. 2 is the plan view, Fig. 3 is the left side view, Fig. 4 is the front view and Fig. 5 is the bottom view. It should be noted that the right side view of the tray 10 is a mirror image of the left side view, and the rear view of the tray 10 is a mirror image of the front view, which are not shown in the drawing.

20 Referring to Figs. 1-5, the tray 10 mainly consists of: a pair of plates 12, each having a plurality of positioning pins (which is referred to as pins hereinafter) 11 provided in a row on its top; a pair of bars 15, each having a plurality of positioning projections 13, 14 provided in a row on its top; a number of crossbeams extending across and sustaining from below the plates 12 and the bars 15; and a frame 17 for supporting the plates 12, the bars 15 and the crossbeams 16.

25 Here, the pins 11 of the plate 12 and the projections 13, 14 of the bar 15 constitute the positioning parts according to the present invention, which determine the positions of HDD heads. The HDD head 30 to be put in the tray 10 is composed of a holding base 31 having a hole 32 for fixing the HDD head 30 in a hard disk drive with a screw; a suspension arm 33; and a magnetic head attached to the end of the arm 33. When the HDD head 30 is put in the tray

10 so that one of the positioning pins 11 is inserted into the hole 32 and the arm 33 is set between a neighboring pair of the projections 13, 14, the position of the HDD head 30 is determined. As shown in Fig. 1, each plate 12 has twelve pins 11, so that the tray 10 as a whole is capable of containing twenty-four pieces of the HDD heads 30.

5 The structure of the tray 10 for holding the HDD head 30 is described below.

Referring to Figs. 6 and 7, the plate 12 is provided with a plurality of cylindrical sleeves 18 aligned in a row on its back face, where each of the sleeves 18 is positioned right at the back of each of the pins 11. The sleeve 18 cooperates with the pin 11 to hold the HDD heads 30 as follows. First, it is put in a first tray 10A as described above referring to Figs. 1-5, where the
10 wired-surface of the HDD head 30 is directed downwards. After that, a second tray 10B is stacked on the first tray 10A. In the stacked state, the pins 11 of the first tray 10A are inserted into the sleeves 18 of the second tray 10B, and a small gap is provided between the end of the sleeve 18 of the second tray 10B and the top of the plate 12 of the first tray 10A. Thus, the holding base 31 of the HDD head 30 is loosely held by the plate 12 of the first tray 10A and the
15 sleeve 18 of the second tray 10B, so that the HDD head 30 is prevented from being displaced.

Fig. 8 is an enlarged view of part A shown in Fig. 2, and Fig. 9 is a right side view of the part. Referring to Figs. 8 and 9, the bar 15 is provided with a hemispherical small-projection 20 formed on its top between each pair of the projection 13, 14. The diameter (or height) of the small-projection 20 is set to be a little larger than the thickness of a wiring applied on the
20 arm 33 of the HDD head 30 (e.g. about a few to several hundreds of micrometers). The small-projection 20 contacts the surface of the arm 33 of the HDD head 30 at a plain area of the arm 33 where no wiring 34 is applied. When the HDD head 30 is held in the tray 10 as shown in Fig. 9, there remains a gap or space between the arm 33 and the top of the bar 15. Accordingly, even when the tray 10 vibrates or trembles while the tray 10 is being vacuum-packed or the
25 vacuum-packed tray 10 is being transported, the wiring 34 does not contact the top of the bar 15 or any other part of the tray 10.

It should be noted that the small-projection may be formed other than hemispherical. Figs. 10 and 11 show another example of the small-projection, where Fig. 10 is an enlarged view of another form of the part A shown in Fig. 2, and Fig. 11 is a right side view of the part.

In the present example, the bar 15 is provided with ridges 21 on its top. The ridge 21 is designed to extend along the arm 33 of the HDD head 30 put in the tray 10 as described above. The height of the ridge 21 is determined to be slightly larger than the thickness of the wiring 34. Such a design of the small-projection also provides the same effect as obtained by the
5 hemispherical small-projection 20.

Figs. 12 and 13 show a preferred form of the ridge, wherein Fig. 12 is an enlarged view of a part corresponding to part A shown in Fig. 2, and Fig. 13 is a right side view of the part. In the bar 15 of the present form, each pair of ridges 21a, 21b neighboring across the projection 14 are designed to extend in symmetrical directions. According to such a design, the arm 33
10 of the HDD head 30 can be laid arbitrarily on either left or right side of the projection 14 because, in whichever case, the first ridge 21a or the second ridge 21b assuredly contacts the surface of the arm 33 at the plain area where no wiring is applied.

Though, in the above-described examples, the HDD head 30 is set in the tray 10 so that the arm 33 crosses the bar 15 obliquely, it is not essential to the present invention. Fig. 14 is a
15 plan view of another form of the positioning part, wherein a ridge 22 extending parallel to the crossbeam 16 is formed between each pair of the projections 13, 14 of the bar 15. The pin 11 is placed on an extended line of the ridge 22 so that the HDD head 30 is laid at right angles to the bar 15. Such a design also provides the same effect as described above.

Fig. 15 is a perspective view of a tray assembly 40 including a preset number (six, in
20 this example) of the trays 10 (shown in Fig. 1) with the HDD heads (not shown) held therein. The trays 10 are stacked up and are clamped by a pair of clamps 41, 42 at opposite sides. The top and bottom of the stacked trays are covered with a top cover 43 and a bottom cover 44. Such a tray assembly is constructed for ease of handling and transportation.

As for the tray assembly 40, the top cover 43 and the bottom cover 44 are identical in
25 size and form, and each cover is referred to as the top cover 43 or the bottom cover 44 merely according to whether it covers the top or bottom of the box-like body. Also, the number of trays included in one tray assembly is determined by the size of the clamps 41, 42. Accordingly, by using clamps of different sizes, the number of trays included in one tray assembly can be arbitrarily changed.

Fig. 16 is a front view of the stacked trays (viewed in the direction of arrow XIII in Fig. 15). As shown in Fig. 16, when the trays 10 are stacked up, the frames 17 of the trays 10 constitute a wall of the stacked trays, leaving a plurality of openings 45 in the front wall between each pair of the neighboring trays 10. Though not shown in the figure, the openings 45 are also formed in the rear wall of the stacked trays. By forming the openings 45 as described above, the washing performance of the HDD heads held in the tray assembly 40 is improved as follows. In a washing treatment using a washing liquid (e.g. pure water), when the tray assembly 40 holding the HDD heads contained therein and without the top and bottom covers 43, 44 is put into a flow of the washing liquid, the washing liquid flows through the tray assembly 40 and contacts the HDD heads held therein. Since the washing liquid flows into the tray assembly 40 not only through the top and bottom openings but also through the openings 45 of the front and rear walls, the washing liquid cannot stay in the tray assembly 40, but rather fresh liquid always contacts the HDD heads. Thus, the washing performance is improved.

Figs. 17 and 18 show another tray embodying the present invention, where Fig. 17 is a plan view, and Fig. 18 is a cross sectional view at line XVII-XVII in Fig. 17. In Figs. 17 and 18, the same numerals are used for similar elements so that the descriptions concerning the elements may be referred to in the corresponding descriptions given above.

As shown in Figs. 17 and 18, the positioning part of the tray 10C includes not only the plates 12 and the bars 15, but also a pair of second bars 25, each having a plurality of positioning projections 23, 24 provided in a row alternately on its top as in the bar 15. The second bars 25 are used for positioning and holding HDD heads having a ring part 35 at its rear end, like an HDD head 30a shown in Fig. 17. The HDD head 30a has a side extension 36 where a precision electronic circuit is to be printed. In the side extension 36, electric charges easily build up, which must be avoided in electronic parts. In view of this problem, the tray 10C is designed so that the crossbeam 16 supporting the second bar 25 from below is raised to form a step 26 on the top of the crossbeam 16. The step 26a contacts the side extension 36 of the HDD heads 30a. By virtue of this design, the build-up of electric charges in the side extension 36 is assuredly prevented because any electric charge in the side extension 36 is liberated to the tray 10C through the step 26. It is further preferable to apply conductive

coating on the surface of the tray 10C, whereby the build-up of electric charges in the side extension 36 is prevented more assuredly. It should be noted that the conductive coating is preferably applicable to not only the tray 10C of the present embodiment but also any form of trays according to the present invention.

5 Also, the tray 10C is featured by the structure for containing and holding heads of a large size, like the HDD head 30a shown in Fig. 17. That is, the tray 10C is provided with a pair of beam-like ribs 27 at its bottom, each rib extending in parallel to and between the plate 12 and the second bar 25. When the HDD head 30a is put in the tray 10C at the preset position and another tray 10C is stacked on it, the rib 27 of the upper tray 10C slightly contacts the top
10 face of the rear part of the HDD head 30a contained in the lower tray 10C. Thus, since the movement of the HDD head 30a contained therein is restricted appropriately, the damage or the like of the wiring is prevented effectively.

CLAIMS



1. A tray for holding a plurality of hard disk drive heads each having a wire-applied surface, the tray comprising a plurality of positioning parts each for holding each of the
5 hard disk drive heads, characterized in that each of the positioning part is provided with a small-projection on a part of its surface which contacts the wire-applied surface of the hard disk drive head.

2. The tray for holding a plurality of hard disk drive heads according to claim 1,
10 characterized in that the small-projection contacts the wire-applied surface at a plain area where no wiring is applied when the hard disk drive head is positioned by the positioning part.

3. The tray for holding a plurality of hard disk drive heads according to claim 1, characterized in that the positioning part comprises a contacting part which contacts the hard
15 disk drive head at a part where no wiring is applied and where a build-up of electric charges easily occurs so that a liberation of the electric charges from the part is promoted.

4. The tray for holding a plurality of hard disk drive heads according to claim 1, characterized in that a conductive coating is applied thereto.

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5. The tray for holding a plurality of hard disk drive heads according to claim 1, characterized in that the tray comprises a frame for stacking a plurality of the trays.

6. The tray for holding a plurality of hard disk drive heads according to claim 5,
25 characterized in that the frame is provided with at least one notch and that the notch constitutes an opening for passing fluid through a wall of a structure constructed by stacking a plurality of the trays.

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REPLACED