

DISK HOLDING DEVICE

BACKGROUND OF THE INVENTION

This invention generally relates to a disk holding device, and more particularly
5 to a locking mechanism for a disk holding device.

Hard drive disks typically are manufactured in one location and packaged in
disk holding devices, which are subsequently placed in a container for shipment to
another location. The disk holding devices eventually are removed from the
containers and used to store the hard drive disks during distribution in a production
10 process. The hard drive disks must be protected during all phases of a normal
production cycle.

A variety of disk holding devices have been developed for packaging,
shipping and distributing disks. Typical disk holding devices include a cassette
portion, a cover and a latch to lock the device closed. As is known, hard drive disks
15 are received within a plurality of slots within the cassette portion interior. One
example is shown in U.S. Patent No. 6,902,059. Other disk holding devices are also
known.

During the production process, it is often necessary to remove the cover from
the cassette portion of the disk holding device to access the hard drive disks stored
20 within. Automated machinery is often utilized to unlock and remove the cover of the
disk holding device. To achieve this result, and because of the locking design of the
latch arm of known disk holding devices, the automated machinery must manipulate
the latch arm by applying an outward pulling force on the latch arm in a direction
away from the interior of the disk holding device to unlock and remove the cover.
25 The manipulation applied by the automated machinery may fail to unlock the latch
arm in a relatively large number of instances. Disadvantageously, this may result in
decreased production efficiency and increased manufacturing complaints concerning
the disk holding devices.

As such, there is a need for an improved arrangement for locking a disk
30 holding device that achieves improved interaction with automated machinery used in
the distribution process. This invention provides an improved latch arm that satisfies
that need.

SUMMARY OF THE INVENTION

A disk holding device for packaging hard drive disks includes a base, a cassette that is received against the base and a cover that is received over the cassette. The base includes a first locking surface. The cover includes a latch arm near an end of the cover. The latch arm has a second locking surface against which the first locking surface is received to secure the base and the cover together. At least one of the first locking surface or the second locking surface is moveable in an inward direction toward an interior of the cassette to unlock the locking surfaces so that the base and cover can be separated to open the disk holding device.

In one example, the first locking surface is part of a protruding tab on the stem. The second locking surface in one such example is a surface near a slot on the latch arm. The tab is at least partially received into the slot for securing the base and the cover together.

The various features and advantages of this invention will become apparent to those skilled in the art from the following detailed description. The drawings that accompany the detailed description can be briefly described as follows.

BRIEF DESCRIPTION OF THE DRAWINGS

Figure 1 schematically shows a disk holding device including a latch arm designed according to one embodiment of this invention.

Figure 2 is a side view of the cover for the disk holding device of Figure 1.

Figure 3 illustrates the disk holding device of Figure 1 in an assembled condition.

Figure 4 illustrates a second example disk holding device.

Figure 5 illustrates an assembled view of the second example disk holding device illustrated in Figure 4.

Figure 6 illustrates a front view of an example locking surface configuration of the disk holding device shown in Figure 4.

Figure 7 illustrates a front view of another example locking surface configuration of the disk holding device shown in Figure 4.

Figure 8 illustrates a front view of yet another example locking surface configuration of the disk holding device shown in Figure 4.

Figure 9 illustrates a front view of yet another example locking surface configuration of the disk holding device shown in Figure 4.

Figures 10A and 10B schematically show a process for unlocking the example disk holding devices.

5 Figure 11 illustrates another example disk holding device designed according to an embodiment of this invention.

Figure 12 schematically shows a process for unlocking the example disk holding device of Figure 11.

10 Figure 13 schematically shows selected portions of another example embodiment.

DETAILED DESCRIPTION OF A PREFERRED EMBODIMENT

Figure 1 schematically shows an example disk holding device 10 for housing a plurality of disks 12. The example disk holding device 10 includes a cassette portion 14, an example base portion 16 and an example cover 18. The cassette portion 14 includes two side walls 20, 22 and two end walls 24, 26 which are configured to form an interior 28 for safely packaging the plurality of disks 12. The side walls 20, 22 are aligned generally parallel to one another and are designed to minimize contact between and provide support to the plurality of disks 12, keeping them spaced apart from one another and in a generally stable position within the disk holding device 10. The disks 12 are received in a plurality of slots 30 formed in the side walls 20, 22 of the cassette portion 14.

At least one of the opposing end walls 24, 26 includes a channel 34. In one example, both end walls 24, 26 include a channel 34. In the illustrated example, the channel 34 is generally U-shaped. The channel 34 is provided on at least one end wall 24, 26 for access to the hard drive disks 12 when packaged in the cassette portion 14.

In the illustrated example, the base portion 16 is secured on one side of the cassette portion 14 using an interference fit, for example. In another example, the base portion 16 is formed as a single piece, integral with the cassette portion 14. The cover 18 is received against an opposite side of the cassette portion 14 from the base portion 16. The cover 18 includes a latch arm 32 for locking the disk holding device 10 that extends toward the base portion 16 and is selectively secured to a locking

surface 36 of the base portion 16. In one example, the cover 18 includes two latch arms 32, with one latch arm 32 positioned at each end of the cover 18.

Figures 1 and 2 illustrate the latch arm 32A positioned near one end 38 of the cover 18. The latch arm 32A extends transversely from the cover 18 (i.e., toward the
5 base portion 16). A first surface 40 of the latch arm 32A faces generally toward an end 42 of the cover 18 which is opposite the end 38. The latch arm 32A includes a second surface 44 which faces opposite the first surface 40. In other words, the second surface 44 faces away from the end 42 of the cover 18.

The example latch arm 32 includes a locking tab 46 that protrudes from the
10 second surface 44 away from the cover 18. In one example, the locking tab 46 is positioned at a distal end of the latch arm 32. The latch arm also includes a lifting ledge 48 and at least one finger grip 50. The lifting ledge 48 may assist automated removal of the cover 18 as described below. In the disclosed example, two finger grips 50 are included on the latch arm 32. The finger grips 50 may assist a user in
15 manually manipulating the cover 18 relative to the disk holding device 10.

In one example, the lifting ledge 48 and at least one finger grip 50 extend in substantially the same direction as the locking tab 46. The example lifting ledge 48 is positioned on the second surface 44 of the latch arm 32 between the finger grip 50 and the locking tab 46. Each of the locking tab 46, the lifting ledge 48 and the finger grip
20 50 protrude in a transverse direction away from the second surface 44 of the latch arm 32. The transverse direction faces away from the interior 28 of the disk holding device 10, for example. Having a latch arm 32 with features such as the locking tab 46 that face away from the interior 28 of the disk holding device 10 is the opposite of previous designs. The example embodiment facilitates improved interaction between
25 the disk holding device 10 and automated machinery used to manipulate the latch arm 32 during a production process.

An exemplary base portion 16 includes a locking surface 36 near one end wall
53. In one example, the end wall 53 includes arm portions 58 adjacent the locking surface 36 to provide support and rigidity. The locking surface 36 extends between
30 the two arm portions 58. A groove 60 exists between the end wall 53 and the locking surface 36. At least a portion of the latch arm 32 is received through the groove 60 when the cover 18, the cassette portion 14 and the base 16 are assembled as shown in Figure 3, for example.

A groove 52 is formed on the latch arm 32 between the two finger grips 50. The groove 52 on the surface 44 exists, in part, to establish a boss 54 that extends from the first surface 40 of the latch arm toward the interior of the device 10. The boss 54 selectively engages the channel 34 of an end wall 24, 26 to seal the disk holding device 10 when the cover 18 is received and locked on the cassette portion 14 (see figure 3, for example).

An assembled disk holding device 10 is illustrated in Figure 3. In this example, the cover 18 is secured to the disk holding device 10 in a locked position. The latch arm 32 at least partially extends through the groove 60 of the base portion 16. The locking tab 46 at least partially abuts the locking surface 36. The locking tab 46 is received against the locking surface 36 of the base portion 16 as the portion of the latch arm 32 moves through the groove 60. As best appreciated from Figure 2, the locking tab 46 has an angled surface 62 that facilitates inserting the tab through the groove 60. The locking tab 46 also has a locking surface 64 that contacts the locking surface 36 on the base portion 16.

Figures 4-8 schematically illustrate another example disk holding device 80 for housing a plurality of disks 12. The disk holding device 80 includes a cassette portion 82, a base portion 84 and a cover 86. The cassette portion 82 is substantially similar to the cassette portion 14 of the example disk holding device 10. However, the base portion 84 and the cover 86 include unique features different from the example base portion 16 and the example cover 18 of the disk holding device 10.

In this example, the cover 86 includes an end wall 88 having a latch arm 87 for locking the disk holding device 80 that extends toward the base portion 84 and is selectively secured to a locking surface 90 of the base portion 84. In one example, the cover 86 includes two end walls 88, with one latch arm 87 positioned at each end of the cover 86.

Figures 4 and 5 illustrate the end walls 88 extending transversely from the cover 86 and toward the base portion 84. The example end walls 88 include a channel engaging portion 91 and a locking tab 85 that protrudes from the latch arm 87 in a direction away from the cover 86 (i.e., away from the interior of the disk holding device 80). The locking tab 85 is positioned adjacent to a distal end 89 of the latch arm 87, in one example. The channel engaging portion 91 exists, in part, to establish a boss 93 that extends from the latch arm 87 toward the interior of the disk holding

device 80. The boss 93 selectively engages a channel 95 of the end walls 88 of the cassette portion 82 when the cover 86 is received and locked on the cassette portion 82 (see Figure 5, for example).

5 In one example, the locking tab 85 of the latch arm 87 includes two engaging surfaces 92 that are spaced apart and positioned at opposite edges of the latch arm 87 adjacent to the distal end 89. It should be understood that the actual number and positioning of the engaging surfaces 92 of disk holding device 80 will vary depending upon design specific parameters including the design of the locking surface 90 of the base portion 84. For example, the latch arm 87 may include only one engaging
10 surface 92 similar to the configuration shown in Figure 1.

The latch arm 87 also includes a lifting ledge 98. The lifting ledge 98 is offset from the engaging surfaces 92 of the latch arm 87 in a direction towards the end of the disk holding device 80 which includes the cover 86, in this example. The lifting ledge 98 may assist automated or manual removal of the cover 86, as described in greater
15 detail below.

In one example, the lifting ledge 98 protrudes from the latch arm 87 the same direction as the engaging surfaces 92 (i.e., transversely from the exterior surface of the latch arm 87). The lifting ledge 98 includes a curved portion 100 which is positioned between two ledge portions 102, in one example. The curved portion 100
20 mirrors a corresponding central portion 104 of the locking surface 90, for example, as is further discussed below.

A manipulating surface 106 is exposed between the engaging surfaces 92 and the lifting ledge 98 of the latch arm 87 when the cover 86 is locked in place. Having a latch arm 87 with features such as the engaging surfaces 92 that face away from the
25 interior of the disk holding 80 is the opposite of previous designs. The example embodiment facilitates an improved interaction between the disk holding device 80 and a human finger or automated machinery used to manipulate the latch arms 87 during a production process.

The example base portion 84 includes a locking surface 90 near one end wall
30 108. In one example, the base portion 84 includes arms 110 adjacent to the locking surface 90 to provide support and rigidity. The locking surface 90 extends between the arms 110. Each arm 110 includes a first portion 112 which extends toward the cover 86 and a second portion 114 which protrudes away from the interior of the disk

holding device 80 in a direction similar to the engaging surfaces 92 to at least partially sandwich the latch arms 87. A groove 116 exists between the end wall 108 and the locking surface 90 and extends between the second surfaces 114 of the arms 110. At least a portion of the latch arm 87 is received through the groove 116 when the disk holding device 80 is assembled in a locked position (see Figure 5). The second portions 114 of the arms 110 partially sandwich the latch arms 87 and prevent any inadvertent unlatching of the latch arms 87 during shipping, etc.

In one example, a central portion 104 of the locking surface 90 extends horizontally (i.e., straight across) between the arms 110 (See Figure 9). In another example, the locking surface 90 includes an “interrupted” central portion 104 disposed between flanges 97. “Interrupted” is intended to describe a locking surface that is not straight across the entire surface but, instead, varies in configuration or profile at the central portion 104. In one example, the central portion 104 is curved and mirrors the curved portion 100 of the lifting ledge 98 (See Figure 6). However, a person of ordinary skill in the art would understand that the central portion 104 could comprise other shapes and configurations. For example, the central portion 104 may be generally rectangular (See Figure 7). In yet another example, the flanges 97 of the locking surface 90 exclude the central portion 104 (i.e., the flanges 97 are not bridged by the central portion 104) (See Figure 8).

The curved central portion 104 (Figure 6) extends in a direction toward a bottom end of the disk holding device 80. In one example, the manipulating surface 106 mimics the shape of a human finger. The example central portion 104 leaves the manipulating surface 106 exposed, which allows the contact point of the manipulating surface 106 to be moved more toward the bottom end 118 of the disk holding device 80. This provides improved leverage such that a reduced force is required to manipulate the latch arm 87 to open the disk holding device 80.

The engaging surfaces 92 of the locking tab 85 abut the flanges 97 of the locking surface 90 to attach the cover 86 to the base portion 84 when the disk holding device 80 is assembled as shown in Figure 6, for example. The manipulating surface 106 is unobstructed by the central portion 104 of the locking surface 90 in the area adjacent to the engaging surfaces 92.

The engaging surfaces 92 in this example are offset from a distal end 89 of the latch arm 87 a first distance D1 as shown in Figure 6. The central portion 104 of the

locking surface 90 is offset from the distal end 89 of the latch arm 87 a second distance D2. The first distance D1 is greater than the second distance D2, in one example (See Figure 6). This arrangement includes the feature exposing the manipulating surface 106 toward the bottom end 118 of the disk holding device 80.

5 Figure 10A schematically shows a machine 70 that manipulates the latch arm 32 of the cover 18 by applying a force F on the latch arm 32 in a direction toward the interior 28 of the disk holding device 10. Although the present example is illustrated in terms of the disk holding device 10, a similar process would also apply for manipulating the latch arm 87 of the second example disk holding device 80. In the
10 illustrated example, the force F is applied to the surface 44 below the lifting ledge 48 (Or, the manipulating surface 106 of the second example disk holding device 80). The example machine 70 has an arm 72 that contacts the surface 44 to apply the force F. The arm 72 moves the distance sufficient to push the locking surface 64 clear of the locking surface 36 so that the locking tab 46 is aligned with the groove 60. The
15 resiliency of the latch arm 32 biases the locking tab 46 away from the interior 28 of the cassette portion 14 such that the locking surfaces 36 and 64 cooperate to keep the device 10 closed. The force F is sufficient to overcome that bias. While maintaining the force F on the latch arm 32, the arm 72 moves in an opening direction D2 to remove the cover 18 from the disk holding device 10, as is illustrated in Figure 10B.
20 In the illustrated example, the second direction D2 is transverse to the direction of the force F. The lifting ledge 48 (or the lifting ledge 98 of the disk holding device 80) may assist arm 72 in lifting the cover 18 off of the base portion 16 and the cassette 14.

 In another example, the latch arm 32 and the cover 18 are manually manipulated to remove a cover 18. For example, an individual may press against the
25 surface 44 and use the finger grip 50 to manipulate the cover as desired. In yet another example, an individual may press against the manipulating surface 106 to release the latch arm 87 of the example disk holding device 80.

 The illustrated examples include various features that provide improved interaction between production machinery or a human hand and a disk holding device
30 to achieve a more simple method of unlocking a latch arm, for example. The illustrated examples include combinations of improved latch arms and base portion features. For example, the position of the latch arm 32 within the groove 60 of the example disk holding device 10 provides more security compared to previous

arrangements where a latch arm engaged a base from the outside edge of the base. In another example, the improved design of the latch arm 87 and the locking surface 90 of the example disk holding device 80 results in a lower contact point on the latch arm and provides improved leverage such that less force is needed to release the latch arm
5 87. Those skilled in the art having the benefit of this description will be able to utilize a latch arm having a locking tab, a base portion with a locking surface, a lifting ledge or finger grips or any combination of these features to meet the needs of their particular situation.

Figure 11 shows another example disk holding device 200. This example
10 includes a base 202, a cassette 204 and a cover 206. A portion of the cassette 204 along one side (the lower side according to the drawing) is received in an interior 208 of the base 202. The cover 206 is received over an opposite side (the upper side according to the drawing) of the cassette 204. When the cover 206 is secured to the base 202 with the cassette 204 between them, an interior of the device is sealed off to
15 prevent any contamination of disks or wafers held in slots 210 within an interior of the cassette 204.

This example includes cooperating locking surfaces for securing the cover 206 to the base 202. The base 202 includes a first locking surface 212 that engages a second locking surface 214 on the cover 206. The illustrated base 202 includes a tab
20 216 on a stem 218. The first locking surface 212 is on the tab 216. The second locking surface 214 is a surface along one edge of a slot 220 on a latch arm 222 of the cover 206. When the three components of the device 200 are properly aligned and received against each other, the tab 216 is at least partially received into the slot 220 so that the first locking surface 212 is received against the second locking surface
25 214. When the locking surfaces are against each other in that position, the cover 206 cannot be separated from the base 202 and the cassette 204 remains securely between them.

Referring to Figure 12, the first locking surface 212 is shown in a locking position engaging the second locking surface 214. A machine 234 includes a mover
30 236 that applies a force to the stem 218 as schematically shown by the arrow 238. The mover 236 urges the tab 216 and a portion of the stem 218 toward the interior of the cassette 204. The stem 218 in this example is at least partially flexible and resilient so that absent a force applied by the machine 234 or a manual force applied

by an individual, the stem 218 remains in the position shown in solid lines in Figure 12, which is the same orientation of the stem 218 in Figure 11.

As shown in phantom in Figure 12, as the mover 236 causes sufficient movement of the tab 216, the first locking surface 212 moves clear of the second locking surface 214 to unlock the device, which allows the cover 206 to be separated from the base 202 for exposing the interior of the cassette 204 to provide access to any disks or wafers contained in the cassette 204. The illustrated example includes a holding surface 240 on the stem 218 to facilitate separation of the cover 206 and the base 202. In this example, the holding surface 240 is a raised surface. Other holding surface configurations are included in other examples. The holding surface 240 interrupts a face of the stem 218 to provide the ability to resist or cause movement of the base 202 when it is being separated from the cover 206.

The mover 236 in this example contacts a face on the stem 218 between the first locking surface 212 and the holding surface 240 as can be appreciated from the drawing. As the cover 206 is moved away from the base 202 (e.g., the cover is moved upward or the base is moved downward) the mover 236 can contact the surface 240 to either prevent the base 202 from moving in the same direction that the cover 206 is moving as they are being separated or to facilitate moving the base 202 away from the cover (e.g., if the mover 236 moves downward according to the drawing).

One feature of the example of Figures 11 and 12 is that the movement of the tab 216 occurs in an inward direction toward an interior of the cassette 206 for unlocking the device. During that movement the tab 216 and some of the stem 218 are received into a recess 250 between an end wall 252 and side supports 254 on the cassette 206. This takes advantage of space that is available within the outer envelope of the device 200 and does not require any clearance outside of that envelope for manipulating any portions of the device 200 during unlocking and handling procedures..

Another feature of the example of Figures 11 and 12 is that the cover 206 has a channel 224 along an edge of the latch arm 222. Edge walls 226 and 228 establish sides of the channel 224. The edge walls 226 and 228 overlap a complementary portion 230 of the cassette 204 when the container 200 is closed. The complementary portion 230 of the cassette 204 is received at least partially into the channel 224 when

the cassette 204 and the cover 206 are brought together. This arrangement provides a tortuous path between the interior of the cassette 204 and the surrounding environment that is operative to prevent outside contaminants from entering the container and contacting a surface on the disks inside the container. This feature adds
5 further security to the integrity of the disks or wafers within this example container.

Figure 13 shows another example arrangement in which the tab 216 protrudes in an inward direction toward the interior of the cassette 204. The first locking surface 212 is on the tab 216. The second locking surface 214 is on one side of the slot 220. In this example, the latch arm 222 is received inside of the stem 218 when
10 the cover 206 is secured to the base 202, which is different than the example of Figures 11 and 12 in which the latch arm 22 is received outside of the stem 218. In this example, the latch arm 222 is moveable inwardly to release the first and second locking surfaces and unlock the cover 206 from the base 202.

The foregoing description shall be interpreted as illustrative and not in any
15 limiting sense. A worker of ordinary skill in the art would recognize that certain modifications would come within the scope of this invention. For that reason, the following claims should be studied to determine the true scope and content of this invention.

CLAIMS

1. A disk holding device, comprising:
 - a base that includes a first locking surface;
 - 5 a cassette that is received against the base; and
 - a cover that is received at least partially over the cassette, the cover includes a latch arm near an end of the cover, the latch arm has a second locking surface against which the first locking surface is received to secure the base and the cover together, at least one of the first locking surface or the second locking surface is moveable in an
 - 10 inward direction toward an interior of the cassette to unlock the locking surfaces so that the base and cover can be separated to open the disk holding device.
2. The device of claim 1, wherein,
 - the base includes a stem near an end of the base,
 - 15 the first locking surface is on a tab on the stem,
 - the second locking surface is near a slot on the latch arm, and
 - the tab is at least partially received into the slot for securing the base and the cover together.
- 20 3. The device of claim 2, wherein the tab faces in an outward direction away from the interior of the cassette and the stem is moveable inward to unlock the locking surfaces.
4. The device of claim 2, wherein the tab faces in an inward direction toward the
- 25 interior of the cassette and the latch arm is moveable inward to unlock the locking surfaces.
5. The device of claim 1, comprising a holding surface on the stem spaced from the first locking surface, the holding surface interrupting a face of the stem.
- 30 6. The device of claim 5, wherein the holding surface comprises a raised surface on the stem that protrudes in a direction facing outward away from the interior of the cassette.

7. The device of claim 1, wherein
the latch arm comprises a channel and
the cassette comprises a complimentary portion that is at least partially
received in the channel, the channel and the complimentary portion establishing a
5 tortuous path between an interior of the cassette and a surrounding environment.
8. The device of claim 1, wherein the cassette comprises a recess at an end of the
cassette and a portion of the stem is received in the recess as the stem moves in the
inward direction for unlocking the first and second locking surfaces.
- 10
9. The device of claim 1, wherein the base and the cover comprise distinct
components from the cassette portion.
10. The device of claim 1, wherein
15 the base includes a slot near an end of the base,
the first locking surface is near the slot,
the second locking surface is on a tab on the latch arm, and
the tab is at least partially received in the slot for securing the cover and the
base together.