

Packaging Apparatus for Disc Cartridge

Field of the Invention

[0001] The present invention relates to a packaging apparatus. For specifically, the present invention relates to a system and method for vacuum packing articles, such as

5

Background

[0002] Hard disk drive cartridges or caddies are well known in the art adapted for transporting hard drive disks from the point of manufacture to the point of installation into a disk drive in bulk. U.S. Pat. No. 4,557,382 discloses a disk cassette adapted for loading a plurality of disks or other substrates in a secure manner.

10 [0003] Once the disks are loaded and covered under the cartridge, the whole cartridge is being vacuum packed in antistatic bag to further protect the disks from contaminations. Typically, the vacuum packed cartridges are further vacuum packed in another layer of polybag or PU bag.

[0004] The antistatic bags are usually made up of weldable and/or heat-sealable
15 thin film. The thin film is typically fabricated in a roll and then cut to the appropriate size for forming a bag with at least one open end. As the bags are not fabricated as a seamless unibody, the welded or heat sealed side typically formed a seam with a certain width to ensure that the sealed seam is durable enough to avoid leaking. Such seam projected out from the bag, which require additional handling when packing them.

Summary

[0005] In one aspect of the present invention, there is provided a packaging apparatus for packaging caddy or disc cartridge. The packaging apparatus comprises a conveying rail where the caddy is conveyed along the rail during packaging; a vacuum
5 nozzle mounted on a sliding arm; a bag sealer for handling and sealing a bag for containing the caddy, the bag sealer comprises grippers and a heat sealer, wherein the grippers extended into edges of opened end of the bag and operationally lifts the bag to open the opened end of the bag for receiving the caddy, and seals the opened end with the heat sealer; and a folder for folding side seams and corner folds of the bag vacuum
10 packed with caddy. Operationally the vacuum nozzle pushes the caddy on the conveying rail into the bag, the vacuum nozzle vacuumed the inner space of the bag, and seals the bag with the heat sealer, and once the caddy is vacuum packed in the bag, the folder folds the side seams of the bag and then the corner folds against the vacuum packed caddy.

[0006] In one embodiment, the vacuum nozzle comprises a flat nozzle. The
15 apparatus comprises a second vacuum nozzle, a second bag sealer for packing the packed vacuum caddy with the seams and corner folds folded in a second layer bag. The apparatus may further comprises heat tag tips for heat bonding the folded corner folds.

Brief Description of Drawings

[0007] **FIG. 1** illustrates a schematic diagram of a packing system in accordance
20 with an embodiment of the present invention;

[0008] **FIG. 2** illustrates a partial view of a packaging apparatus in accordance with an embodiment of the present invention;

[0009] FIG. 3 shows the bag sealing apparatus of FIG. 2 whereby the fresh new bag 202 is fed in accordance with an embodiment of the present invention;

[0010] FIGs. 4A-4C show a caddy packaging sequence in accordance with an embodiment of the present invention;

5 [0011] FIGs. 5A-5C shows the subsequent packaging process in accordance with an embodiment of the present invention;

[0012] FIG. 6 illustrates a second heat sealer of the packaging apparatus in accordance with an embodiment of the present invention;

[0013] FIG. 7 illustrates a flat vacuum nozzle in accordance with an embodiment
10 of the present invention; and

[0014] FIG. 8 illustrates a downstream of the bag sealing apparatus showing a heat tag seal 802 in accordance with an embodiment of the present invention.

Detailed Description

[0015] Embodiments of the present invention shall now be described in detail,
15 with reference to the attached drawings. It is to be understood that no limitation of the scope of the invention is thereby intended, such alterations and further modifications in the illustrated device, and such further applications of the principles of the invention as illustrated therein being contemplated as would normally occur to one skilled in the art to which the invention relates.

20 [0016] FIG. 1 illustrates a schematic drawing of a packaging apparatus 100 in accordance with an embodiment of the present invention. The packaging apparatus 100

is adapted for vacuum packing disk caddy **102** with two layers, i.e. the first layer (also referred to as inner layer) is an antistatic bag **104** and the second layer (also referred to as outer layer) is a polybag **106**. For simplicity, **FIG. 1** is illustrated based on its packaging flow, which comprises an upstream **110**, a midstream **120** and a downstream **130**.

5 **[0017]** The upstream **110** of the packaging apparatus **100** comprises a vacuum nozzle **112**, a bag sealer **116** and a bag handler **114**, adapted for sealing one or more caddy **102** to be vacuum packed in an antistatic bag. The vacuum nozzle **112** is mainly adapted for providing a vacuum suction to remove air from the bag before it is sealed. The vacuum nozzle **112** may be installed on a sliding arm (now shown), which doubles the
10 vacuum nozzle **112** as a pushing arm to push the caddy **102** forward (i.e. towards the midstream **120**). The bag sealer **116** is mainly adapted for handling the antistatic bag **104** welding or heat sealing. The bag sealer **116** also automates opening the opened end of the antistatic bag **104** for receiving the caddy **102**, and closing and welding/heat sealing the antistatic bag **104**. The bag handler **114** is adapted for picking an antistatic bag and
15 placing the same with its opened end disposed on the bag sealer **116** for sealing. At the end of the upstream, the caddy **102** is vacuum packed within an antistatic bag, i.e. the first layer.

[0018] Still referring to the upstream **110**, the bag handler **114** picks up a fresh new antistatic bag via vacuum means. These antistatic bags are pre-fabricated with three
20 sides being sealed up or welded up leaving one side opened. The sealed/welded sides form a seam usually has a seam defined along the sides. The bag handler **114** moves the antistatic bag before bag sealer **116**, and disposed it thereon with the opened end of the antistatic bag extended across the bag sealer **116**. The bag sealer **116** opens up the opened end of the antistatic bag **104** wide enough for receiving the caddy **102**.

[0019] The nozzle **112** may be installed on the sliding arm allowing the nozzle **112** to maneuver as required. At start of the packaging process, the caddy **102** is loaded between the nozzle **112** and the bag sealer **116**. Loading of the caddy **102** can be carried out manually or through machinery means, such as robot arm, or simply a motorized rail or the like. As the nozzle **112** is pushing the caddy **102** into the antistatic bag **104** when the opened end of the antistatic bag **104** is widely opened, the nozzle **112** enters right into it for carrying out the vacuum operation.

[0020] When the caddy **102** is loaded right into the antistatic bag **104**, the bag sealer **116** grapes the two sides of the antistatic bag **104**, usually corner edges of the seam of the bag at the opened end, and pull them outwardly away from each other to flatten the opened end, while having the nozzle **112** disposed therein. As the vacuum nozzle **112** is withdrawing the air from the loaded antistatic bag **104**, the bag sealer **116** begins to seal the antistatic bag **104**.

[0021] The midstream **120** is provided to automate folding the seams and folds that are unsightly projected around the vacuum packed bag. The midstream **120** of the packaging apparatus **100** comprises a conveying rail **122**, a side-seam fold arm **124**, a rear folder **126** and a front folder **128**. The conveying rail **122** is extended lengthwise for conveying the vacuum packed caddy from the first sealer **116** to a second sealer **136** of the downstream **130**. During which, the seams of the bag and the corner folds that formed by the projected excess are being folded against the vacuum packed caddy for better handling later. The conveying rail **122** is adapted with a width of about the size of the caddy whereby when the caddy is vacuum packed, the seams along the sides of the vacuum packed caddy **102a** that are projected outside of the rail. A major length towards the end of the rail **122** has a vertical sidewall (not shown) provided on both sides adapted

for guiding the vacuum-packed caddy **102a**. The front sides of the two sidewalls relative to the entrance of the conveying rail **122** are curved out to form a funnel for receiving the vacuum packed caddy. Besides guiding the vacuum packed caddy **102a** to the next bag sealer **136**, the side walls also effectively holds the folded seams and corner folds of the vacuum-packed caddy until it is inserted into the next bag.

[0022] The upstream of the conveying rail **122**, near the first bag sealer **116** is provided with the side-seam fold arm **124**. The side-seam fold arm **124** is disposed below the rail **122**, and it has two vertically upright panels mounted on each side of the rail **122**. The side-seam arm **124** is elevatable push the seams projected beyond the rail on both sides of the vacuum-packed caddy **102a**.

[0023] Right next to the bag sealer **116**, there is provided a front-seal folding arm **128** for folding the front sealing end. The length of the front-seal is relatively long compare with the pre sealed seams, in that case, it front seal would require bi-fold or zigzag fold. Accordingly, in one embodiment, the folding arm **128** comprises an upper folding plate, a lower plate, and a holding guide for handling the front folding. The upper folding plate and the lower folding plate are upright but in parallel to bag opening. While folding the front, the upper folding plate is first lowered down to urge only the mid section of the sealed end of the vacuum pack, and the lower folding plate is raised to fold the remaining portion up to form a bi-fold front end. The holding guide adapted for travelling along the middle of the conveying rail, the holding guide includes a holding arm for holding the folded font end of the vacuum-packed caddy to keep the bi-fold folded. The holding arm is also used to urge the vacuum-packed caddy toward the second heat sealer **136** along the conveying rail **122**.

[0024] The midstream **120** further comprises the rear folder **126** for folding the two rear corner folds. The rear folder **126** folds the two corner folds (rear) before it is being conveyed into the conveying rail **122** guide wall.

[0025] The downstream **130** also includes a vacuum nozzle **132**, a bag sealer **136**
 5 and a bag handler **134**. At the downstream **130**, the vacuum-packed caddy **102a** is further vacuum-packed within a polybag **106**. For packing the vacuum-packed caddy with in the polybag **106**, the vacuum-packed caddy **102a** is transported to the front of the bag sealer **136** of the downstream **130**. At this point, the side seams and the four corner folds remain folded and held by the sidewalls of the conveying rail **122**.

10 [0026] As the vacuum-packed caddy **102a** reaches before the bag sealer **136**, the vacuum nozzle **132** at the downstream **130** is lowered down at the other side of the vacuum-packed caddy **102a**.

[0027] Similarly, the bag handler **134** at the downstream **130** picks a fresh new polybag **106** via vacuum means. Similarly, these polybags **106** are pre-fabricated with
 15 three sides being sealed up or welded up leaving one side opened. The bag handler **134** places the same with its opened end disposed on the bag sealer **136** in a similar way described above. As the opened end of the polybag **106** open, the vacuum nozzle **132** at the downstream **130** may push the vacuum-packed caddy **102a** into the polybag **106**. As the polybag **106** provides tight space therein, the side seams and the corner folds remains
 20 folded on the vacuum-packed caddy **102a** as it is inserted into the polybag **106**. Similarly, the bag sealer **136** grabs the two sides of the polybag **106**, usually corner edges of the seam of the polybag **106**, and pull them outwardly away from each other to flatten (or closed) the opened end, while having the nozzle **132** disposed therein. As the vacuum

nozzle is withdrawing the air from the loaded polybag, the bag sealer **136** begins to seal the polybag **106**. Once the loaded poly bag is vacuumed and sealed, the double layer vacuum packed caddy **102b** is completed.

[0028] **FIG. 2** illustrates a partial view of a packaging apparatus **200** in

5 accordance with an embodiment of the present invention. The partial view of the packaging apparatus **200** shows a bag sealing apparatus, a bag handler **222** and a conveying rail **240**. The bag sealing apparatus is a type of hot bar sealer **212**, which is well known in the art. The bag handler **222** comprises an array of vacuum nozzles **224** mounted on a frame **226**, and a sliding arm **228** adapted for supporting and maneuvering
10 the frame **226** to convey the bag. The array of vacuum nozzles **224** are provided for picking up a bag from a bag tray, and through the sliding arm **228**, and feeds the bag to a hot bar sealer **212**.

[0029] The conveying rail **240** is disposed right in front of the hot bar sealer **212**

leading towards to another bag sealer (not shown in **FIG. 2**). Right beneath conveying
15 rail **240**, next to the sealer **212**, there is provided a seam folder **232**. The seam folder **232** comprises folding arms, which are in a form of upright standing panels projected on each sides of the conveying rail **240**. The seam folder **232** is built on an elevatable structure allowing the seam folder **232** moves up and down relative to the conveying rail.

[0030] Further, the major length towards the end of the conveying rail **240** is

20 provided with two sidewalls that are served as a guiding means. One end of the sidewalls are outwardly curved to form a funnel.

[0031] As shown in **FIG. 2**, the bag handler **222** has conveyed a fresh new bag **202** and fed the same to the hot bar sealer **212**.

[0032] **FIG. 3** shows the bag sealing apparatus of **FIG. 2** whereby the fresh new bag **202** is fed thereon with the opened end wide opened through the mechanical means of the bag sealing apparatus. To open up the opened end of the bag, the bag sealing apparatus includes seam holders **354**, vacuum cups **356**, and grippers **352**. As a fresh new bag loaded thereon, the seam holders **354** that located on both sides of the bag first grasp on to the seams of the bag. Following that, the suction cups **356** disposed near the edge of the opening on both sides of the bag are activated and the each side of the bag is attracted to the suction cups creating a small slit at the opened end. The small slit allows the grippers **352** be hooked on to the opening edges of the bag, and once the grippers **352** properly grasp on the respective edges of opening, and the top grippers **352** are lifted away from the bottom grippers **352** to open up the opening of the bag to reveal the inner space **204**. Depending on the placement of the grippers **352**, the bag sealing apparatus is able to make a rectangular opening as shown in **FIG. 3**. At this stage, the vacuum cups' **356** suction is no longer require and therefore be turned off, whereby the grippers **352** are used to maintain the opening of the bag. In one embodiment, the grippers **352** may be an L-shaped flat hook pivoted near the nozzles.

[0033]

[0034] **FIGs. 4A-4C** show a caddy packaging sequence in accordance with an embodiment of the present invention. **FIG. 4A** shows a vacuum nozzle apparatus **400** and a caddy loader **405**, and the bag sealing apparatus of **FIG. 3** with the bag loaded and opened as described above. The vacuum nozzle apparatus **400** comprises a flat vacuum nozzle **410** and a nozzle rail **420**. The caddy loader **405** can be any machinery arm or loading means configured to automatically picking up a caddy **401** and load it between the bag sealing apparatus and the vacuum nozzle apparatus **400**. The flat vacuum nozzle

410 is moveably mounted on the nozzle rail **420** allowing the flat vacuum nozzle **410** to be able to travel back and forth along the nozzle rail **420**. As the nozzle rail **420** is oriented in line with the travelling path for loading the caddy **401** into the bag, the flat vacuum nozzle **410** can be used to push the caddy **401** into the space **204**. More details of the flat nozzle will be described later.

[0035] In one embodiment, the flat vacuum nozzle **410** movement is controllable to adjust the depth that the nozzle extends into the bag through the nozzle rail **420**. In general, it is desired that the nozzle is inserted as deep as possible to ensure that the air within the bag are drawn out as much as possible while not affecting the sealing operation.

A person skilled in the art would appreciate that improper depth placement of the nozzle would effect the vacuum and seal operations, for example, placing the nozzle too close to the edge of the opening leaving too much excessive length from the opening to the caddy, the front end of the bag may suffer a vacuum chock before the air inside the bag is drawn out. Accordingly, movement controllable nozzle of the present invention offers an advantage over the conventional system. Further, the nozzle is also used for urging the caddy into the bag.

[0036] **FIG. 4B** shows that the caddy **401** has been pushed into the bag **202** by the flat vacuum nozzle **410** when the nozzle **410** slid forward along the nozzle rail **420**.

[0037] **FIG. 4C** shows that bag **202a** loaded with a caddy, and the holders **352** releases the rim of the bag, and the seam holders **354** are pulling the two corner edges of the bag apart thereby closing the opening of the bag. At this stage, as it can be seen, the flat vacuum nozzle **410** remains extended into the bag.

[0038] Following the packing process above, **FIGs. 5A-5C** shows the subsequent packaging process in accordance with an embodiment of the present invention. As mentioned above, once the caddy **401** is loaded into the bag, the seam holders **354** pulls the two corner edges to close and flatten the opening. Subsequently, a heating bar, preferably an impulse heating bar, of the heat sealer **212** is lowered down and the flat vacuum nozzle starts withdrawing air therefrom. At the same time, the seam folder **232** is elevated whereby the two side panels of the seam folder **232** push the side seams that projected beyond the conveying rail **240** to fold against the loaded bag **202a**. As the air within the bag is drawn out, the vacuum advantageously keeps the seams upwardly folded. Once the loaded bag is vacuumed, the heat sealer **212** simultaneously seals/welds the opening of loaded bag **202a** and withdraw the flat vacuum nozzle from the bag to complete the sealing process.

[0039] In **FIG. 5B**, the seam folder **232** is lowered down, and subsequently, a rear corner-fold folder **234** is lowered to push the two corner folds against the vacuum-packed caddy **202a**. In the present embodiment, there is further provided a front folder **238** that positioned between the heat sealer **212** and the conveying rail **240** for folding the front bag seam. The front folder **238** also maintain the front bag seam folded and it is capable of pushing the vacuum-packed caddy **202a** toward the other end of the conveying rail **240**.

[0040] As shown in **FIG. 5C**, the vacuum packed caddy **202a** with the side seams and the rear corner-folds folded is slightly pushed toward the guided rail **242** by the front folder **238**, and before the vacuum packed caddy **202a** fully enters the guided rail **242**, the seam folder **232** is elevated again. At this stage, the two corner-folds of the front bag seam projected beyond the two side folding panels of the seam folder **232**. Then, the

vacuum packed caddy **202a** is pushed back towards the heat sealer **212** urging the two corner-folds of the front bag seam against the vacuum-packed caddy **202a**. By now, the two side seams, the two rear corner-folds and the two front corner folds are all folded against the vacuum-packed caddy **202a** on the two sides. With proper handling of the distance between the seam folder **232** and a funnel **246** of the guided rail **242**, all the folds and seams shall remain folded as it travels through the guiding walls of the guided rail **242** until it enters a second bag at the second heat sealing apparatus at the downstream of the packaging apparatus of the present invention.

[0041] **FIG. 6** illustrates a second heat sealer **632** of the packaging apparatus in accordance with an embodiment of the present invention. The second heat sealer **632** operates in a similar way as the heat sealer **212** described above.

[0042] In the above illustrations, “front” of the bag or vacuum packed bag is taken with reference to the opening of the bag that requires sealing through out the packing process, while the “rear” shall be taken oppositely.

[0043] **FIG. 7** illustrates a flat vacuum nozzle **702** in accordance with an embodiment of the present invention. The flat vacuum nozzle **702** is mounted on a slider rail **704** allowing the nozzle to be movable back and forth in a controlled manner.

[0044] **FIG. 8** illustrates a downstream of the bag sealing apparatus showing a heat tag seal **802** in accordance with an embodiment of the present invention. The heat tag seal **802** is deploying next to a heat sealer of the bag sealing apparatus. The heat tag seal **802** is adapted to heat-bond the corner folds of the packaging against the packaging so as to keep the folds folded. The heat tag seal **802** comprises a support **806** and at least two heat tag tips **804**. The support **806** extends across the conveying rail of the apparatus

underneath with two side arms extending upwardly to an appropriate height. The two heat tag tips **804** are mounted on the top of the side arm on each side. Operationally, as described above, the vacuum packed caddy with the front corner folds folded and these corner folds are temporary held folded. The two heat tag tips **804** are being elevated to an appropriate high and the tips are extended and applied heat to bond the corner folds onto the main bag body. Once it is bonded, the corner folds remains folded for later handling.

[0045] While specific embodiments have been described and illustrated, it is understood that many changes, modifications, variations, and combinations thereof could be made to the present invention without departing from the scope of the invention.

CLAIMS

1. A packaging apparatus for packaging caddy or disc cartridge, the packaging apparatus comprising:

a conveying rail where the caddy is conveyed along the rail during packaging;

5 a vacuum nozzle mounted on a sliding arm;

a bag sealer for handling and sealing a bag for containing the caddy, the bag sealer comprises grippers and a heat sealer, wherein the grippers extended into edges of opened end of the bag and operationally lifts the bag to open the opened end of the bag for receiving the caddy, and seals the opened end with the heat sealer;

10 a folder for folding side seams and corner folds of the bag vacuum packed with caddy;

wherein operationally the vacuum nozzle pushes the caddy on the conveying rail into the bag, the vacuum nozzle vacuumed the inner space of the bag, and seals the bag with the heat sealer, and once the caddy is vacuum packed in the bag, the folder folds
15 the side seams of the bag and then the corner folds against the vacuum packed caddy.

2. The packaging apparatus of Claim 1, wherein the vacuum nozzle comprises a flat nozzle.

3. The packaging apparatus of Claim 1, wherein the apparatus comprises a second vacuum nozzle, a second bag sealer for packing the packed vacuum caddy with the
20 seams and corner folds folded in a second layer bag.

4. The packaging apparatus of Claim 1, further comprises heat tag tips for heat bonding the folded corner folds.