manufacturing costs, including injection molding tooling, a need to be environmentally friendlier to the environment. Embodiments of tThe inventions herein address the aforementioned. Such a disk shipper should take advantage of the now common place practice of vacuum bagging disk shippers.

## SUMMARY OF THE INVENTION

In a first aspect, there is provided a universal disk shipper for shipping memory disks in combination with a plurality of memory disks of a variety of thicknesses, the shipper comprising a cassette having opposing side walls and opposing end walls, an open top, and an open bottom, a top cover to cover the open top, a bottom cover to cover the bottom, the opposing side walls of the cassette each having a vertical upper portion and an inwardly converging bottom portion, said sidewalls having a plurality of inwardly facing elongate vertical ribs with adjacent ribs defining slots to hold memory disks of a variety of thicknesses that are vertically positioned or near vertically positioned and in a spaced array, each rib being continuous from adjacent to the open top to adjacent the open bottom, each rib having a straight upper portion at the vertical upper portion of the side wall and a converging lower portion at the converging bottom portion of the side walls, in cross-section each rib having a thickened portion that is nearer the open bottom than the open top, the thickened portions narrowing the slots defined by adjacent ribs.

In a second aspect, there is provided a universal disk shipper for shipping memory disks, the shipper comprising a cassette having opposing side walls and opposing end walls, an open top, and an open bottom, a top cover to cover the open top, a bottom cover to cover the bottom, the opposing side walls of the cassette each having a vertical upper portion and an inwardly converging bottom portion, said sidewalls having a plurality of inwardly facing elongate vertical ribs with adjacent ribs defining slots to hold memory disks; and wherein the top cover has an engagement portion that contacts each of the disks in the cassette when said disk are seated therein, and the top cover is attached to the cassette, the top cover not having discrete locators that individually engage each disk whereby the top cover may be utilized on cassettes with different thicknesses of disks and different numbers of disks, and wherein there are two engagement portions of the top cover running parallel with each other and each is planar and continuous the entire length of the respective engagement portion.

In a third aspect, there is provided a disk shipping system comprising: an inventory of cassettes sized for a specific diameter of disks, the cassettes each having slots that will accommodate at least two of .025, .0315, .040, .050, .069 inch thick disks, wherein each cassette has a pair of opposing side walls, each side wall having a vertical upper portion and an inwardly converging bottom portion, each cassette further having a plurality of slots defined by a plurality of ribs on the pair of opposing sidewalls, and wherein each rib has a straight upper portion at the vertical upper portion of the sidewall and a converging lower portion at the converging bottom portion of the sidewalls, each rib having a thickened portion that is nearer the open bottom than the open top, the thickened portions narrowing the slots at said thickened portions; an inventory of a universal top cover that has a top edge disk engagement portion and does not have discrete locators for individual disks; an inventory of bottom covers; and an inventory of vacuum bags for sealing assembled and loaded cassettes.

In a fourth aspect, there is provided a disk shipping method comprising the steps of: providing an inventory of cassettes sized for a specific diameter of disks, the cassettes each having slots that will accommodate at least two of .025, .0315, .040, .050, .069 inch thick disks; filling one of said cassettes with a load of disks; attaching a top cover that does not have discrete locators sized to constrain any of the disks in the cassette; attaching a bottom cover to the cassette; vacuum bagging the loaded cassette with top cover and bottom cover attached under sufficient vacuum to secure the disks in place in the cassette, and providing an inventory of a universal top cover that has a linear or planar top edge disk engagement portion with no discrete locators, such that slight tilt of the thinner disks when seated is accommodated. The container is vacuum bagged under sufficient vacuum such that the cover and sidewalls of the disk shipper are drawn into the disks fixing them in position.

In a fifth aspect, there is provided a disk shipping method for shipping disks of specific diameter and at least two different sizes of disk thicknesses, the thicknesses selected from of .025 inch, .0315 inch, .040 inch, .050 inch, and .069 inch, the method comprising the steps of: providing an inventory of single sized cassettes with a single sized slot, the cassette sized for the specific diameter of disks, the cassettes each having slots that will accommodate the at least two thicknesses of .025 inch, .0315 inch, .040 inch, .050 inch, and .069 inch disks; filling a plurality of the cassettes of the inventory with loads of disks; providing an inventory of top covers and attaching a top cover to each of said filled cassettes and utilizing a top cover that accommodates each of the at least two thicknesses of .025 inch, .0315 inch, .040 inch, .050 inch, .069 inch disks; and attaching a bottom cover to each of the cassette.

In a sixth aspect, there is provided a disk shipper for shipping substrates, the shipper comprising a cassette having opposing side walls and opposing end walls, an open top, and an open bottom, a top cover to cover the open top, a bottom cover to cover the open bottom, the two side walls of the cassette each having a vertical upper portion, said sidewalls have a plurality of inwardly facing elongate teeth defining slots to hold the substrates in a vertical position or in a near vertical position and in a spaced array, each tooth being continuous from adjacent to the open top to adjacent the open bottom, each tooth having an upper portion at the vertical upper portion of the side wall and a converging lower portion at the converging bottom portion of the side walls, the teeth defining a plurality of slots and wherein the teeth are configured to narrow the slot as the teeth approach the open bottom thereby providing a stabilizing support area for the disks.

In a seventh aspect, there is provided a method of shipping memory disks in a three piece disk shipper, comprising a cassette, a top cover and a bottom cover, the method comprising allowing the disks to tilt in the disk cassette before installation of the top cover, the tilt of each disk being between 90° and 92.1, maintaining the tilt as and after the top cover is applied, and vacuum bagging the shipper to secure the disks within the cassette.

In an eighth aspect, there is provided a method of shipping memory disks in a three piece disk shipper, comprising a cassette, a top cover and a bottom cover, the method comprising allowing the disks to tilt in the disk cassette before installation of the top cover, maintaining the tilt as and after the top cover is applied, and vacuum bagging the shipper to secure the disks within the cassette.

In a ninth aspect, there is provided a disk shipper for shipping substrates, the shipper comprising: a cassette having opposing side walls and opposing end walls, an open top, and an open bottom, the cassette adapted to receive disks of at least two different thicknesses of the disk thicknesses of .025 inch, .0315 inch, .040 inch, .050 inch, and .069 inch; a top cover to cover the open top, the top cover having means to accommodate tilted disks without urging the disks to an untilted position; and a bottom cover to cover the open bottom.

In a tenth aspect, there is provided a disk shipper for shipping substrates, the shipper comprising: a cassette having opposing side walls and opposing end walls, an open top, and an open bottom, the cassette having means for accommodating disks of at least two different thicknesses of the thicknesses of .025 inch, .0315 inch, .040 inch, .050 inch, .069 inch; a top cover to cover the open top, the top cover not having discrete locators for individual disks.

In an eleventh aspect, there is provided a universal disk shipper system for shipping memory disks, the shipper system comprising: a plurality of cassettes each having opposing side walls and opposing end walls, an open top, and an open bottom, a plurality of top covers to cover the open tops of the plurality of cassettes, a plurality of bottom covers to cover the bottoms of the plurality of cassettes, a means for accommodating different loads of disks, the loads varying either in different disk thicknesses or in different capacities, wherein the means for accommodating different loads of disks comprises loads varying in different disk thicknesses and wherein each of the plurality of cassettes is configured to accommodate loads of at least two different disk thicknesses, a thinner thickness and a thicker thickness, and each cassette has ribs defining slots that are configured to allow the disk loads of the thinner thicknesses to be tilted in the slots and not contact one another.

In a twelfth aspect, there is provided a universal disk shipper system for shipping memory disks, the shipper system comprising: a cassette having opposing side walls and opposing end walls, an open top, and an open bottom, a top cover to cover the open top, the top cover has means for accommodating differing loads of disks, the loads varying either in different disk thicknesses or in different capacities, a bottom cover to cover the bottom, a means for accommodating different loads of disks, the loads varying either in different disk thicknesses or in different capacities.

Embodiments of the invention are an improved disk container for use in transporting, storing and processing data storage disks or other disk-shaped articles; an inventory system and method for shipping that allows stocking a minimal number of components while still allowing packaging and shipment of different thickness of disks, and different capacities of disks in a container; components that present universality while still minimizing particulate generation and disk damage and providing ease of assembly. An embodiment of the invention is a universal disk cassette configured for handling different disks of the same diameter but different thicknesses. An embodiment of the invention is a universal top cover configured for a cassettes loaded with different thicknesses of disks, i.e., a cassette loaded with .025 inch disks, or the cassette loaded with .050 inch disks. The universal top cover is configured for use interchangeably on both. Also the universal top cover configured for use on different capacity disk cassettes, that is a 65 mm disk cassette with a 25 capacity or a 65 mm cassette with a 35 capacity. The universal top cover, according to an embodiment, is configured for use interchangeably on both.

In an embodiment of the invention, a disk shipping system provides an inventory of cassettes for a certain diameter of disks, the cassettes each accommodating more than a single size thickness, e.g., .025, .0315, .040, .050, .069 inches. The system also provides an inventory of a universal top cover that has a linear or planar top edge disk engagement portion with no discrete locators, such that slight tilt of the thinner disks when seated is accommodated. The container may be vacuum bagged under sufficient vacuum such that the cover and sidewalls of the disk shipper are drawn into the disks fixing them in position.

In an embodiment of the invention, an disk shipping system provides a multiplicity of cassettes for a certain diameter of disks, the multiplicity comprising cassettes of differing capacities, e.g., 25, 35, and 50, and a universal top cover that disk top edge engagement portion that is non-specific with respect to disk capacities. The top cover

disks during shipping. An embodiment of the~~The~~ invention includes utilizing a top cover that does not engage the top of the disks and utilizing vacuum bagging that pulls in the sidewalls of the cassette to lock the disks in the shipper without downward constraint to the disks being provided by the top cover. The sides of the cassette may be pulled in such that there is a tilt of the upper portions of the sidewalls. In certain embodiments the tilt may be 1 to 2 degrees from vertical, in other embodiments 2 to 3 degrees from vertical, in other embodiments more than .5 degrees, in some embodiments, more than 3 degrees. In such a conditions the top opening may be reduced to a width that is less than the width of the diameter of the disks thus locking them in position. Thus a top cover may be utilized in certain embodiments where is does not contact the individual disks. Use of such a non engagement universal top cover was not heretofore practical or, to applicants understanding, known. In other embodiments, the top cover only may be deflected sufficiently by vacuum bagging to engage and fix the disks in position for shipping.

Another feature and advantage of embodiments of the invention is that the advantages of vacuum bagging of disk shippers is optimally utilized for securing disks whilst allowing use of a universal cassette that can accommodate different thicknesses of disks, different cassettes of different capacities, and a universal top cover that can accommodate different quantities of disks and different thicknesses of disks. Applicants have discovered that such a securement permits use of a universal top cover that does not have discrete locators for individual disks, said use of and configuration of the universal top cover without discrete locators was not heretofore practical or, to applicants understanding, known.

Another advantage of embodiments of the present invention is to provide an improved disk cassette which minimizes the area of contact between each disk and the disk cassette so as to reduce the opportunity for abrasion.

Another advantage of embodiments of the present invention is to provide an improved disk cassette which helps prevent the generation of particulation which can contaminate or damage the memory media on data storage disks, or contaminate or damage other disk-shaped articles.

Another advantage of embodiments of the present invention is to provide an improved disk cassette with improved disk stabilization to remove the need for cushion/retainer mechanisms in the top cover.