

[54] PACKAGING EPITAXIALLY COATED SEMICONDUCTOR DISKS

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[58] Field of Search.....206/1 R, 46 R, 46 FR, 60 R, 206/62 R, 65 R, 65 F, 65 K, 72; 220/4 R, 23.6, 97 R

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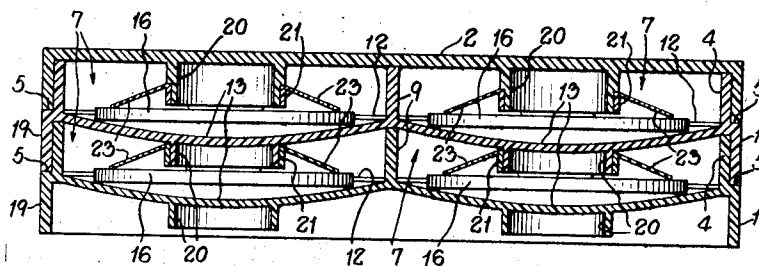
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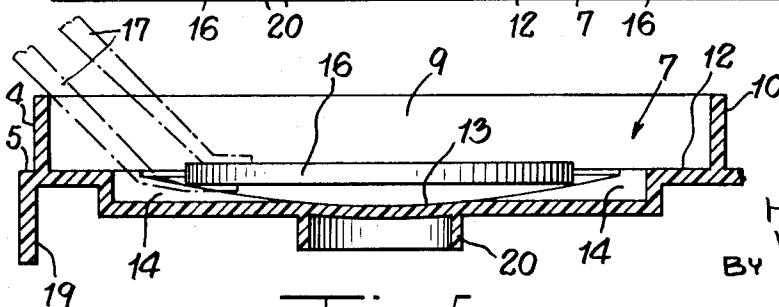
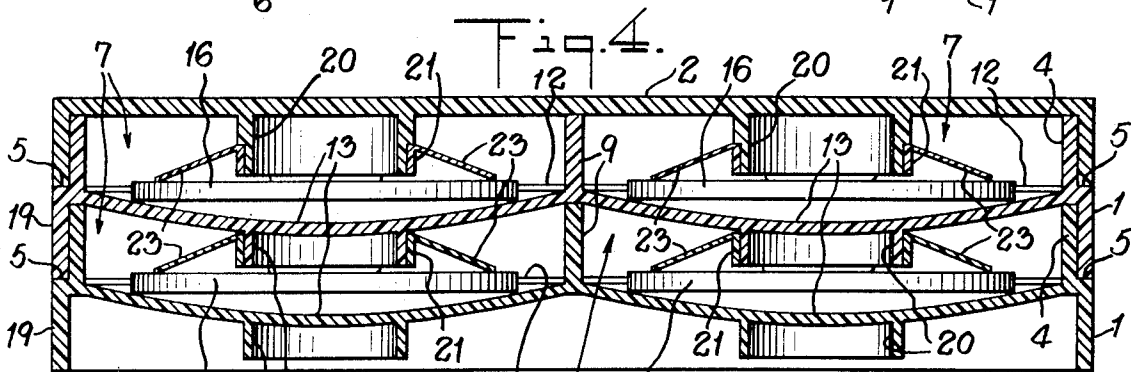
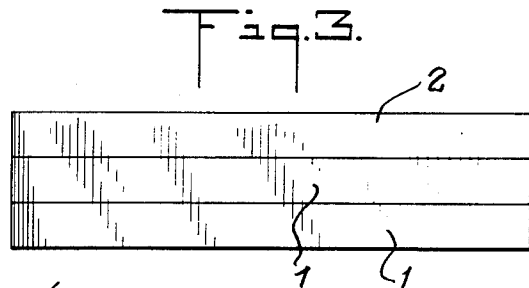
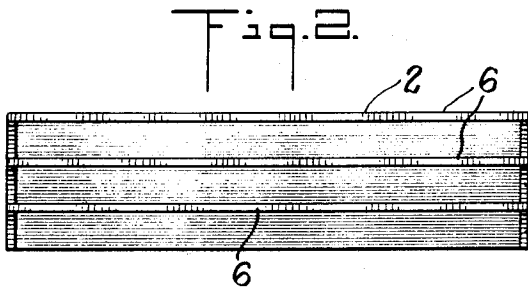
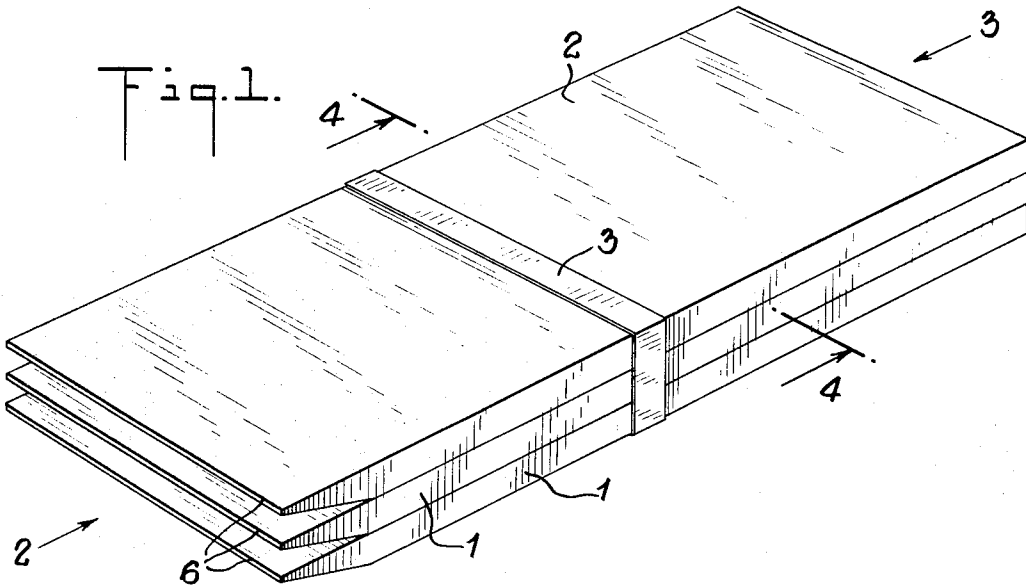
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[57]**ABSTRACT**

A package for storing and shipping epitaxially coated semiconductor disks comprising a plurality of similar trays which are adapted to be nested one on top of the other. An upstanding vertical rim extends about the upper face of each of the trays and a narrow horizontal ledge extends about each of said trays beneath said rim. A second rim projects vertically downward from the outer edge of the horizontal ledge of each tray, and this rim fits snugly over and frictionally engages the upstanding rim of the tray which is stacked therebeneath. The upper face of each tray contains upstanding partitions which form a plurality of similar storage compartments in the tray. Each of said compartments has a flat horizontal floor and a circular dished portion for storing a semiconductor disk within such compartment. The said dished portion, which constitutes most of the floor of each compartment, has an outer rim sunk slightly below the outer flat part of the floor to restrain the semiconductor disk from being dislodged when said tray is placed on an incline. A cover is provided for the topmost tray, and a plurality of downwardly curved resilient petals are provided on the bottom of each tray for resiliently holding each semiconductor disk in its assigned storage compartment. Means are also provided to facilitate the insertion of forceps or tongs into the various compartments, when the nested trays are unstacked, to permit the semiconductor disks to be readily removed.

2 Claims, 16 Drawing Figures



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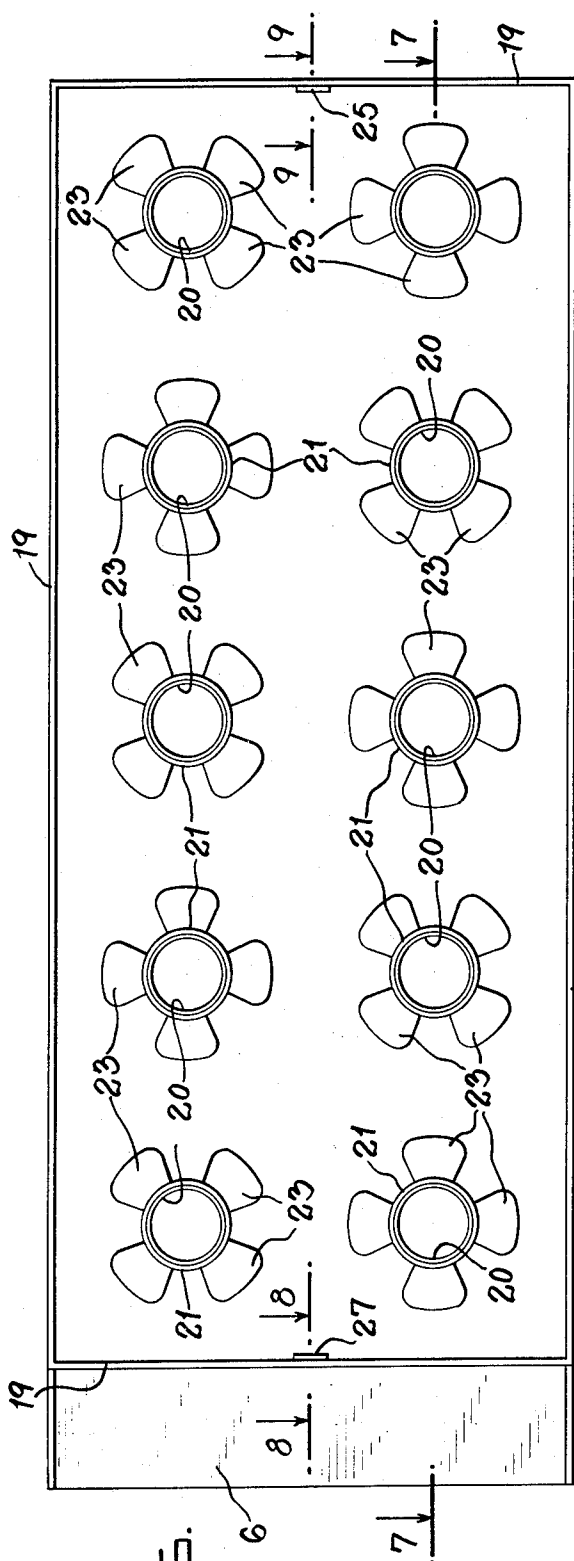


Fig. 6.

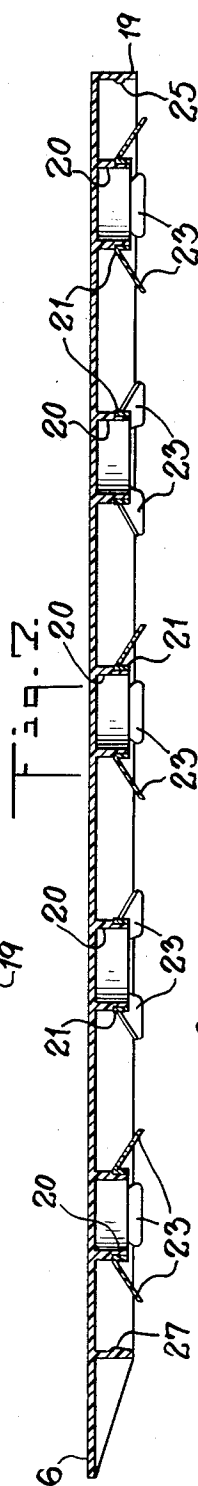


Fig. 7.

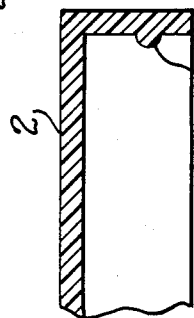


Fig. 8.

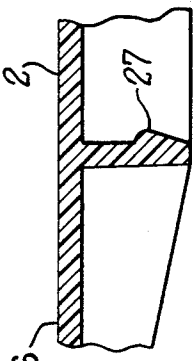


Fig. 9.

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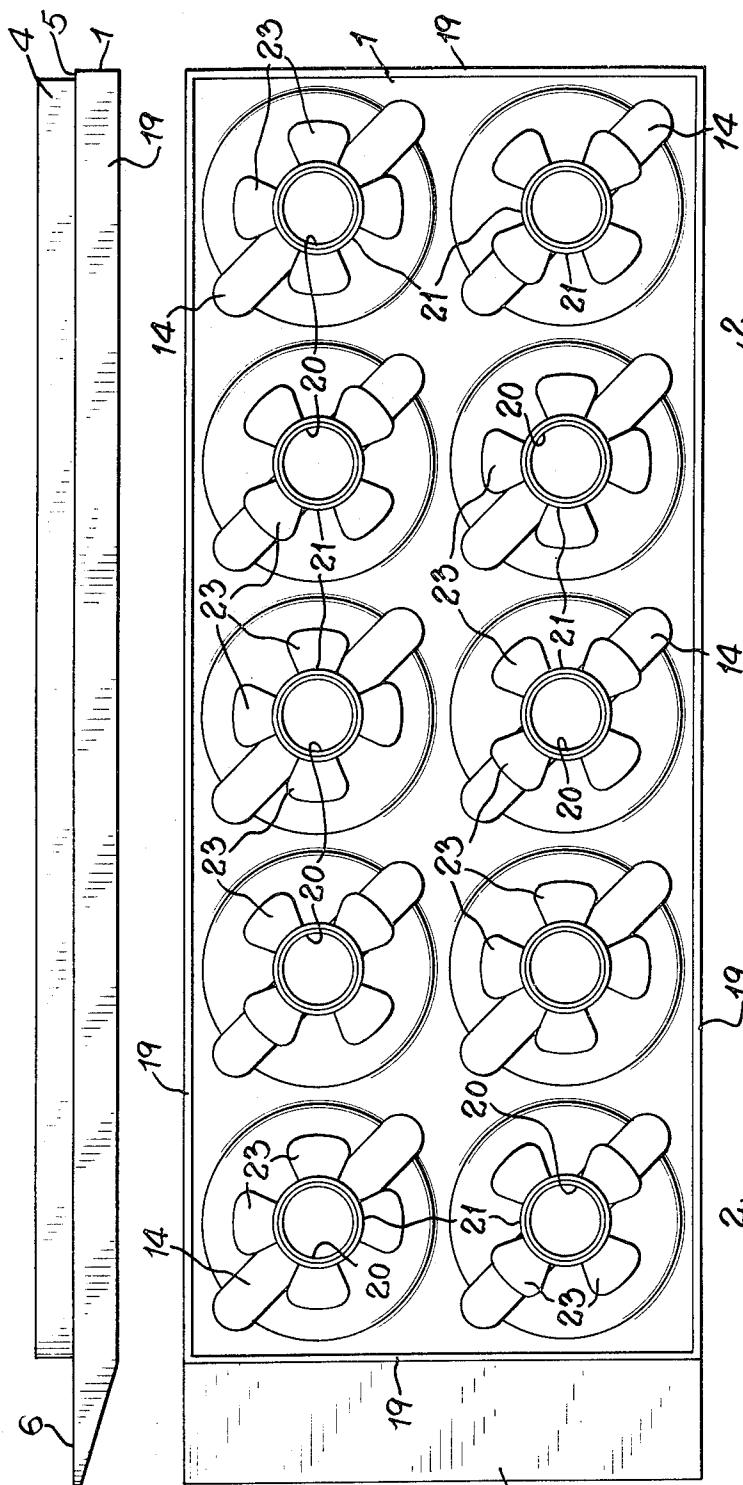


Fig. 13.

Fig. 14.

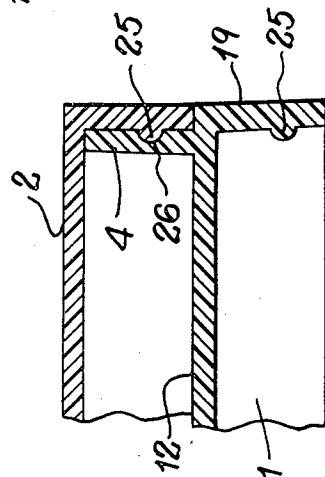


Fig. 15.

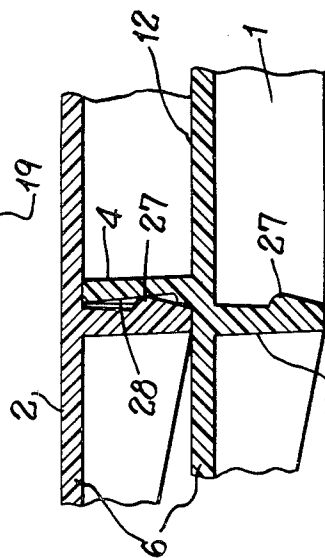


Fig. 16.

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PACKAGING EPITAXIALLY COATED SEMICONDUCTOR DISKS

The semiconductor industry faces unusual problems when it comes to packing and shipping epitaxially coated semiconductor disks. Since such disks are very brittle, they are sensitive to any mechanical stress. Because of that, there is always the danger of breaking in shipment if the disks are packed improperly. Next, the disks scratch very easily, for instance when they come into contact with or rub against each other. Furthermore, even minute quantities of dust in the air may cause barely visible scratches which, nonetheless, make the disks unfit for use. Finally, the high-purity disks must never be contaminated by the packing material itself.

We have now developed a novel packing for epitaxially coated semiconductor disks, which comprises an assembly of a number, preferably two to 20 trays each containing a plurality of storage compartments with a tightly fitting partition separating each storage compartment from the bottom up, with each tray stacked on top of the other so that every tray serves also as the lid for the tray below, down to the very bottom tray, while means such as downwardly curved resilient petals or fingers on the bottom of each tray keep the semiconductor disks in place in the storage compartments of the tray immediately beneath it; and finally, a cover or lid, also with such resilient petals mounted on it, serves as the closure of the stack of trays. Means are also provided to facilitate separation of the trays when desired.

The invention is described in connection with a preferred embodiment illustrated in the accompanying drawings, in which:

FIG. 1 is a perspective view of a package consisting, by way of example, of two trays and a cover stacked one on top of the other, ready for shipment;

FIG. 2 is an end elevational view looking in the direction of the arrow 2 in FIG. 1;

FIG. 3 is an end elevational view looking in the direction of the arrow 3 in FIG. 1;

FIG. 4 is a vertical sectional view of the assembled package, taken on line 4—4 of FIG. 1;

FIG. 5 is a sectional view taken on line 5—5 of FIG. 10, illustrating tongs gripping a semiconductor disk for the purpose of removing said disk from the tray;

FIG. 6 is a bottom plan view of the cover;

FIG. 7 is a longitudinal sectional view of the cover, taken on line 7—7 of FIG. 6;

FIG. 8 is an enlarged detail section taken on line 8—8 of FIG. 6, illustrating a detent for snap-locking one end of the superimposed trays together;

FIG. 9 is an enlarged detail section taken on line 9—9 of FIG. 6, showing a detent which is used for pivotally securing the other end of the superimposed trays together;

FIG. 10 is a top plan view of the upper face of a tray, showing the individual disk-storage compartments therein;

FIG. 11 is an enlarged detail section taken on line 11—11 of FIG. 10, showing the locking means at one end of the tray;

FIG. 12 is an enlarged detail section taken on line 12—12 of FIG. 10, showing the pivotal locking means at the other end of the tray;

FIG. 13 is a side elevational view of a tray;

FIG. 14 is a bottom plan view of a tray;

FIG. 15 is an enlarged vertical section showing a detail of the cover locked in position upon a tray; and

FIG. 16 is an enlarged vertical section showing a detail of the other end of the cover locked in position upon said tray.

The assembly shown in FIG. 1 consists of a plurality of superimposed trays 1, here shown to be two in number, and a top lid or cover 2, all nested together, as hereinafter more fully described.

The assembled package may contain any suitable number of trays (for example, from two to twenty such trays) and, of course, one cover 2. In shipping such a package, a band of scotch tape 3 or the like may be wrapped securely around the assembly to prevent accidental separation.

The trays 1 and the cover 2 are preferably composed of a suitable synthetic thermoplastic material, for example, polystyrol. The thermoplastics may be dyed to give the package a pleasing appearance. They may also be given a brush-frosted or stippled surface by using rough-surfaced manufacturing tools. In this manner it is possible to avoid any mirror effect of the package on the semiconductor disks which are stored therein.

The upper face of each tray 1 has an upstanding rim 4 rising above the narrow outer horizontal ledge 5, and at one end of the tray a flat extension or shelf 6, level with the ledge 5, extends outwardly as a convenient handle for lifting and carrying the tray, as well as for facilitating the separation of the trays and cover.

The upper face of each tray 1 is partitioned into a plurality of square storage compartments 7 by a central longitudinal partition 9 and a plurality of equally spaced transverse partitions 10 which are the same height as the rectangular rim 4 and extend to the ends and sides of said rim as illustrated in FIG. 10.

Each tray 1 has a flat floor 12 which, of course, constitutes the floor of each storage compartment 7. The floor of each such compartment is depressed to provide a shallow circular dished portion 13. The diameter of each dished portion 13 is the same as the length or width of each storage compartment 7; hence the partitions 9 and 10, which constitute the walls of the storage compartments 7, are tangent to the circular periphery of the dished portion 13 of each storage compartment. The annular margin of the flat floor of the compartment 7 is about 0.2 to 1.5 mm higher than the periphery of the dished portion 13.

The bottom of each storage compartment 7 contains two axial depressed grooves 14, aligned diametrically, which extend outwardly through the flat floor 12 for the purpose of facilitating the removal of the stored semiconductor disks with forceps. Now, when a semiconductor disk 16 (FIGS. 5 and 10) is housed within any given storage compartment 7, nested within the depressed outer annulus of the dished portion 13 the surrounding raised annular margin of the flat floor 12 of said compartment 7 will prevent the semiconductor disk from falling out when a tray is placed on an incline. But when it is desired to remove the semiconductor disk from the compartment (after the trays have been separated) forceps or tongs 17 (FIG. 5) are inserted in one of the depressed axial grooves 14 in the bottom of the compartment, grasping the semiconductor disk and enabling same to be lifted out.

The bottom face of each tray 1 has a rectangular rim 19 which projects downwardly from the edge of the horizontal outer ledge 5 of the tray. Consequently, when one tray is fitted on top of another tray, the rectangular rim 19 on the bottom of the top tray will fit snugly about the upstanding rectangular rim 4 of the bottom tray. In fact, the two trays fit together so snugly that they cannot readily be separated accidentally.

On the bottom face of each tray 1 there is a small annular collar 20 projecting centrally beneath each of the dished portions 13 of the compartments 7, and upon each of said collars 20 there is a "spider" such as shown in FIGS. 4 and 14. In the embodiment illustrated, said spiders each consist of an annular ring 21 which fits over and frictionally grips one of the collars 20 beneath one of the dished portions 13 of the compartments 7, and four equally spaced laminas or petals 23. The said petals 23 all curve downwardly (as viewed in FIGS. 4 and 6) and, since they are made of any suitable resilient thermoplastic material such as polypropyls, they contact the semiconductor disks 16 which are housed in the tray immediately below them and hold them tightly in the dished portions 13 of the respective storage compartments 7.

The cover 2, as shown in FIGS. 1-4, 6 and 7, is flat on top and its marginal rectangular rim fits snugly over the upstanding rim 4 of the top tray 1. The bottom face of cover 2 has annular collars 20 supporting the rings 21 with their laminas or petals 23 exactly as described above in connection with the trays 1 (see FIGS. 4, 6 and 7).

The inner end wall of each tray 1 (and the cover 2) at the end remote from the extension or shelf 6, has a detent 25 which is adapted to fit into a hole or socket 26 on the upstanding rim 4 of any tray 1 as shown in FIGS. 12 and 16. And the inner end wall of each tray, and the cover, at the other end (adjacent the extension or shelf 6) has a lip 27 which is engageable with a cam surface 28 on the outer end wall of each tray and the cover, as shown in FIGS. 11 and 15.

In assembling the trays and cover, the right-hand ends (as viewed in FIGS. 1, 6, 7 and 10) are first brought together and the detents 25 and sockets 26 (see FIGS. 12 and 16) mated. Said detents 25 and sockets 26 serve as pivots when the left-hand end of the trays 1 and cover 2 (as viewed in FIGS. 1, 6, 7 and 10) are snapped together so that the lips 27 slide over and become locked in the cam surfaces 28, as shown in FIG. 15.

When it is desired to unpack the stacked trays and cover, one simply grasps the topmost shelf or handle 6 and raises same from the stack, thereby removing the cover 2 and exposing the semiconductor disks 16 in the topmost tray, permitting said disks to be removed as described above. If less than all of the disks in the top tray are to be used at once, the cover may be replaced.

The invention claimed is:

1. A package for storing and shipping epitaxially coated semiconductor disks comprising a plurality of similar trays nested one on top of the other, an upstanding vertical rim extending about the upper face of each of said trays and a narrow horizontal outer ledge extending about each tray beneath said rim, a second rim projecting vertically downward from the outer edge of said horizontal outer ledge adapted to fit snugly over and frictionally engage the upstanding rim of a tray nested therebeneath, partitions in the upper face of each tray forming a plurality of individual storage compartments in

said tray, each of said compartments having a flat horizontal floor and a circular dished portion for storing a semiconductor disk, the said dished portion having an outer circular rim slightly below said flat floor to restrain the semiconductor disk from being dislodged when said tray is placed on an incline, and a cover for the topmost tray of the package, and a plurality of equally spaced downwardly curved resilient petals carried on the bottom of each tray and said cover to engage and lightly restrain the semiconductor disk housed within the storage compartments of the tray therebeneath.

2. A package for storing and shipping epitaxially coated semiconductor disks comprising a plurality of similar trays nested one on top of the other, an upstanding vertical rim extending about the upper face of each of said trays and a narrow horizontal outer ledge extending about each tray beneath said rim, a second rim projecting vertically downward from the outer edge of said horizontal outer ledge adapted to fit snugly over and frictionally engage the upstanding rim of a tray nested therebeneath, partitions in the upper face of each tray forming a plurality of individual storage compartments in said tray, each of said compartments having a flat horizontal floor and a circular dished portion for storing a semiconductor disk, the said dished portion having an outer circular rim slightly below said flat floor to restrain the semiconductor disk from being dislodged when said tray is placed on an incline, a cover for the topmost tray of the package, a flat handle extending outwardly from said ledge on one end of each tray, cooperating latch members on the abutting ends of each tray below said handle for snap-locking superimposed trays together, and cooperating detent and socket elements on the abutting ends of said trays remote from said handle to secure said remote ends of said trays pivotally together.

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