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Vander Mey

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[54] **SILICON SEMI-CONDUCTOR WAFER CONSTRAINT**

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[52] **U.S. Cl.** ..... **294/33,** 206/328, 220/94 R, 224/46 T, 294/16, 294/99 R

[51] **Int. Cl.** **A47j 45/07**

[58] **Field of Search** ..... 294/99 R, 16, 33, 274, 294/28, 86 H, 1 R, 3, 31, 22, 87 R; 206/1 R, 328; 220/94 R; 224/46 T, 46 R, 48 R

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[57] **ABSTRACT**

A handle and retainer for engagement with a carrier for an article, said handle and retainer comprising at least two legs, means for changing the distance between the lower portion of said legs, means for engaging and disengaging the carrier which engaging and disengaging means operates upon the change in distance between the lower portion of the legs and at least one retaining bar for retaining the article in the carrier, which retaining bar is connected by one end to one of the legs, the other end of said retaining bar being unsecured.

8 Claims, 8 Drawing Figures

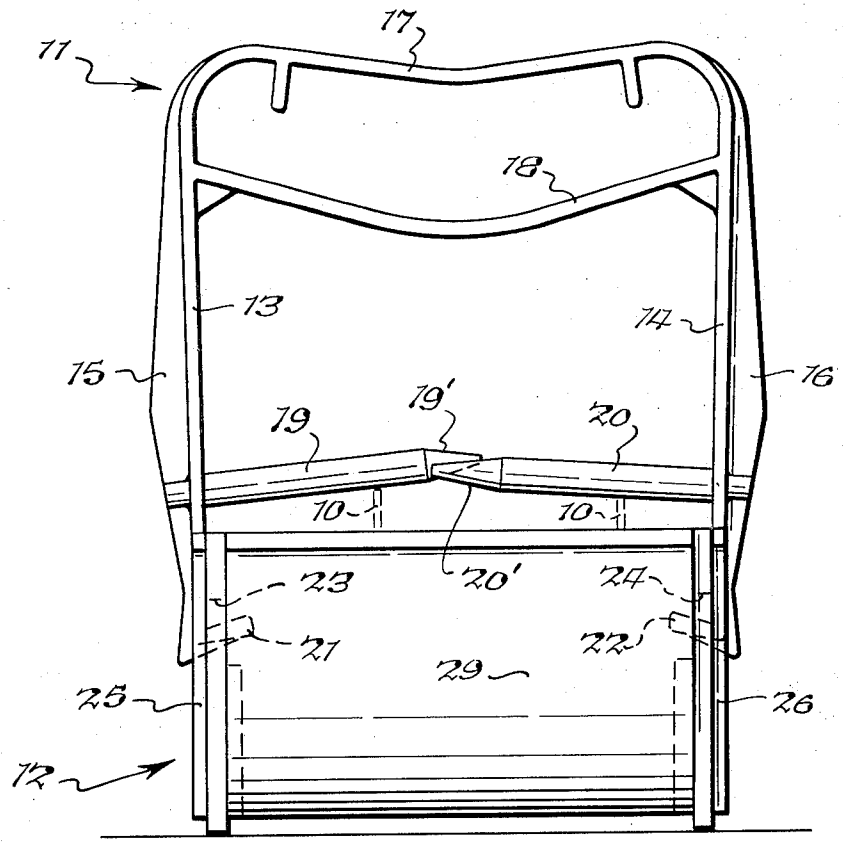


Fig. 1.

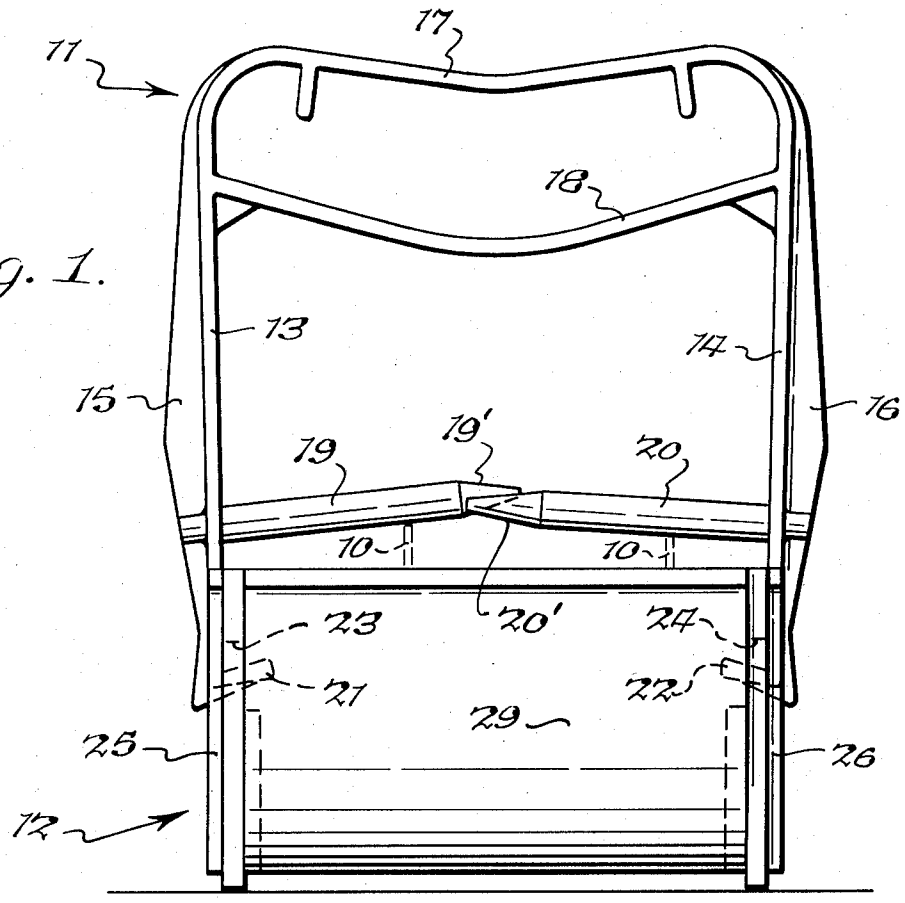
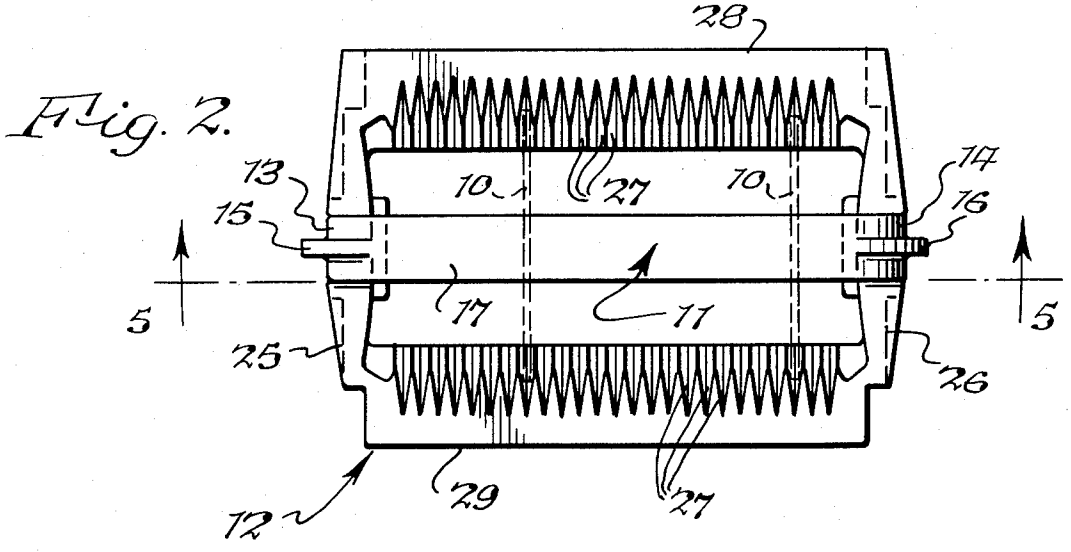

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Fig. 2.


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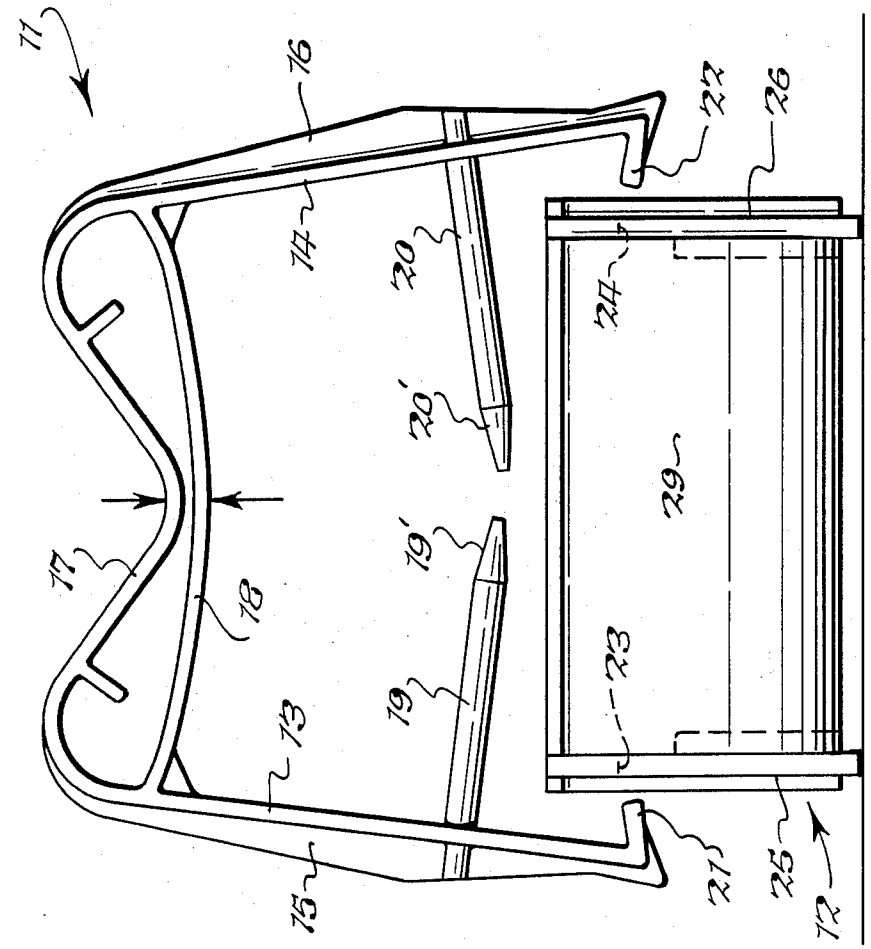

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Fig. 4.

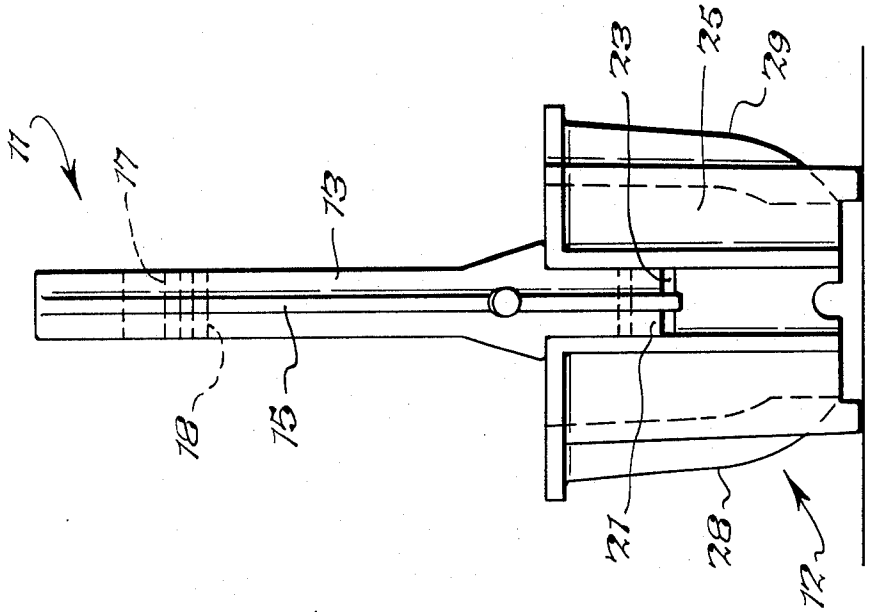

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Fig. 3.

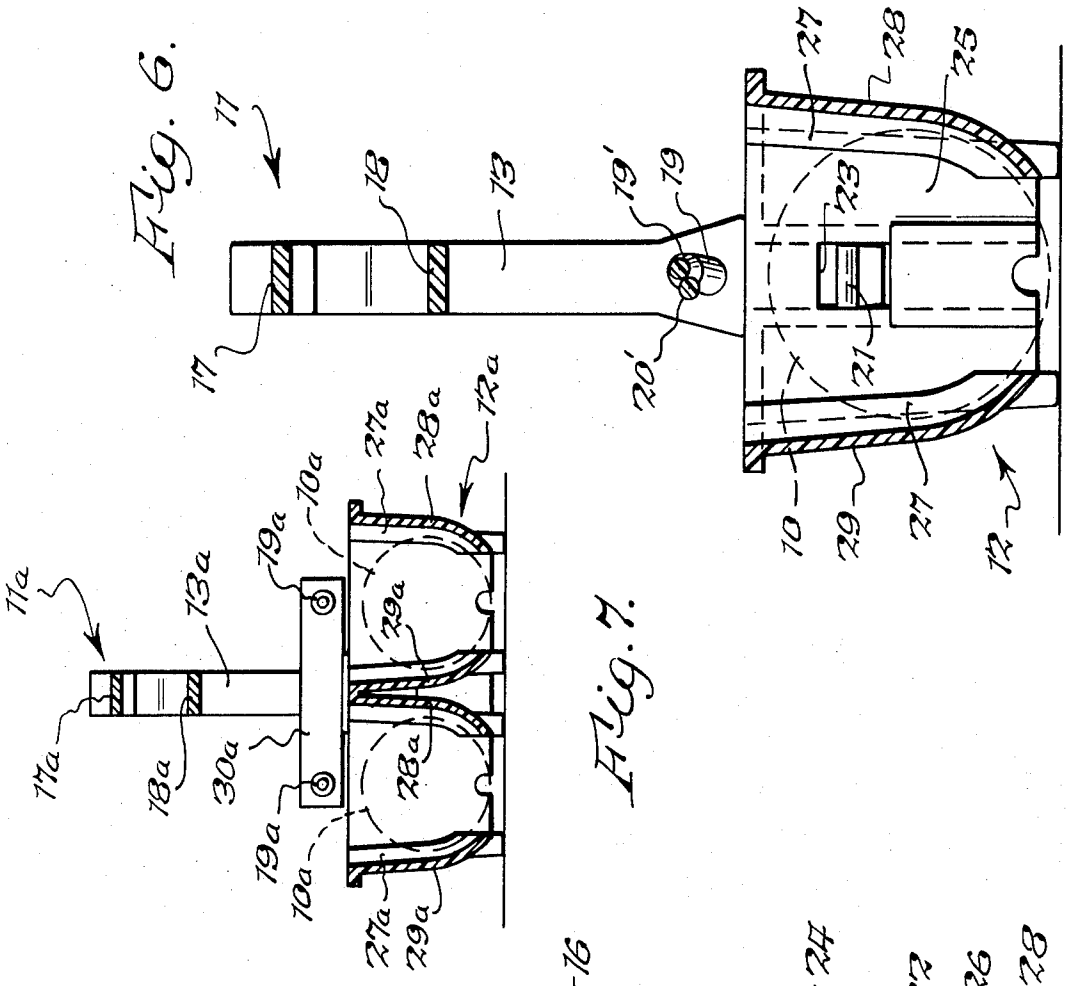


Fig. 6.

Fig. 7.

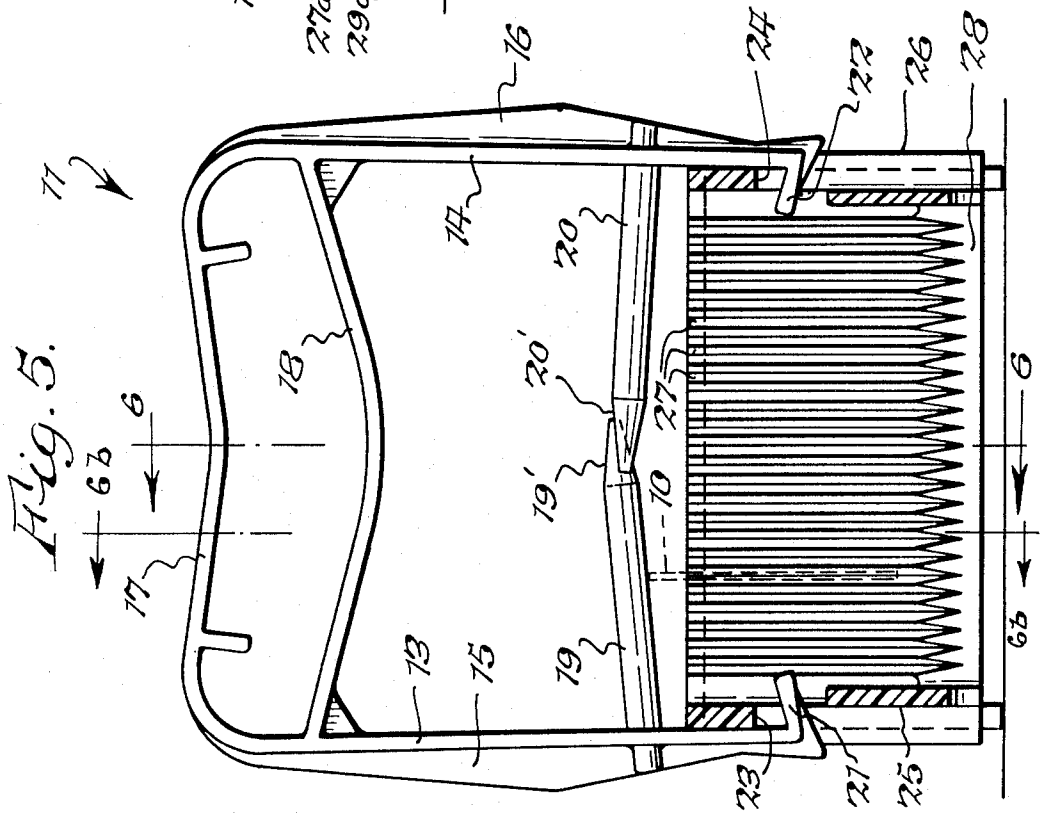


Fig. 5.

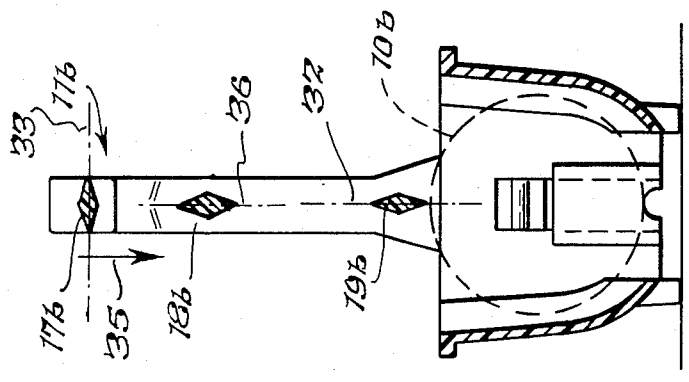


Fig. 6b.

SILICON SEMI-CONDUCTOR WAFER CONSTRAINT

BACKGROUND OF THE INVENTION

This invention relates to an apparatus for retaining articles in a carrier while the carrier is immersed in a liquid.

Numerous methods for retaining articles in a carrier while the carrier is immersed in liquid may occur to one skilled in the art such as placing a weight upon the articles or confining the articles by means of a plate which rests upon the carrier. Upon further consideration however it becomes apparent that when it is desirable to contact the articles with the liquid in which they are immersed from all directions and particularly when the articles are to be sprayed with a liquid in a prior or subsequent operation that solid weights and retaining devices would restrict the flow of liquid to the article.

Perforating the weight or retaining device assists in permitting the liquid to pass through the retaining device to the article however the flow of liquid to the article is still unacceptably hindered.

In addition the use of weights or perforated holding devices requires that the weights or holding devices be stored in a convenient location for application to the carrier for the article. Both the requirement of storing the retainer and the requirement of applying the retainer to the carrier in a separate step cause inconvenience and consumes time of an operator prior to immersion of the article into the liquid.

In addition the weighted retainer whether solid or perforated can be jarred from the carrier thus permitting the articles to float from the carrier causing inconvenience and loss of production time in recovering the articles. In addition loss of the articles from the carrier to the liquid may cause irreparable damage to the article through prolonged contact with the liquid or through physical contact with the container for the liquid.

When the article is lost from the carrier to the liquid, prolonged contact with the liquid may result, in that, the specific time period during which the article is contacted with the liquid is normally controlled by removing the carrier for the articles from the liquid after elapse of the specific time period.

The carrier is generally removed from the liquid by means of a handle which is attached to the carrier. An example of an acceptable prior art handle for removing the carrier from the liquid comprises two substantially parallel legs, the upper portion of each leg being connected together by a fulcrum bar and by a flexible bar removed from and not connected directly to the fulcrum bar. Each of the legs between the fulcrum bar and the flexible bar are rigid so that application of a force to the central portion of the flexible bar in a direction parallel to the longitudinal axis of the legs causes a bending of the flexible bar thus changing the distance between the legs where the legs are connected to the flexible bar relative to the distance between the legs where the legs are connected to the fulcrum bar. The change in relative distance causes a change in the distance between the lower portion of each of the legs which lower portions of the legs are provided with a means for engaging and disengaging the carrier. The engaging and disengaging means operates upon the change in distance between the lower portion of the

legs. Thus the carrier may be simply engaged by the handle by applying pressure to the central portion of the flexible bar causing an increase in distance between the lower portion of the legs of the handle. The lower portion of the legs of the handle are then permitted to stradle the carrier so that when the pressure upon the flexible bar is released the distance between the lower portion of the legs decreases causing the engaging and disengaging means to engage the carrier. The carrier may then be removed from the liquid by lifting the handle.

BRIEF DESCRIPTION OF THE INVENTION

In accordance with this invention a handle and retainer is provided for retaining articles to be washed in an open topped carrier. A retaining bar is attached to a handle which can be easily locked upon or removed from the carrier. The handle and retainer for engagement with the carrier comprises two legs and means for changing the distance between the lower portion of the legs. The lower portion of each of the legs is provided with means for engaging and disengaging the carrier which engaging and disengaging means operates upon the change in distance between the lower portion of the legs. The handle is provided with at least one retaining bar connected by one end to one of the legs, the other end of the retaining bar being unsecured i.e. removable in relation to the other leg. The retaining bar extends over an access opening in the carrier and has a small diameter or radial axis relative to the size of the access opening in the carrier. The retaining bar retains the article in the carrier when the handle is engaged with the carrier. More than one retaining bar may be connected to the handle in accordance with this invention. For example the handle may be provided with two retaining bars, a first of which is connected to one leg of the handle and the second of which is attached to the other leg of the handle. The handle may be provided with one or more cross bars to which the retaining bars are attached.

In addition it has been discovered that when the handle and retaining bar is formed with a diamond-shaped cross section the handle and retaining bar readily drips dry thus preventing removal of liquid from the container holding the liquid. Removal of liquid from the container by the handle and retaining bar is to be avoided since such liquid removal can result in inefficiency due to the loss of such liquid which has to be replaced and since removed liquid which clings to the handle and retaining bar can result in a source of contamination of the article.

The handle and retainer described above for retaining articles in an open topped carrier permits a handle and retainer to be simultaneously and easily engaged with and permits the handle and retainer to be easily removed from the carrier in a simple one step operation. The handle and retainer is of simple construction, and securely retains the article in the carrier.

In addition the handle and retainer of the invention permits washing through the retainer with a minimum of interference by the retainer since the retaining bar has a small radial axis relative to the size of the access opening in the carrier.

When the combined retainer and handle of the invention is used, the requirement for separate storage of carrier handles and retainers such as weights is elimi-

nated and the step of separate application of the retainer to the carrier is not required.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is an elevational view of the handle and two retaining bars connected with a carrier.

FIG. **2** is a top view of the handle and retaining bars connected to the carrier as shown in FIG. **1.**

FIG. **3** is an end elevational view of the handle and retaining bars connected with the carrier shown in FIG. **1.**

FIG. **4** is a side elevational view of the handle and retaining bars showing how application of pressure to the flexible portion of the handle permits removal of the handle and retaining bars from the carrier.

FIG. **5** is a cross sectional elevational view taken on lines **5—5** of FIG. **2.**

FIG. **6** is a cross sectional elevational end view taken on lines **6—6** of FIG. **5.**

FIG. **6***b* is a cross sectional end view taken on lines **6***b*—**6***b* of FIG. **5.**

FIG. **7** is a cross sectional end view showing a handle having retaining bars connected at one end to a cross bar which handle is engaged with a carrier having dual compartments.

DETAILED DESCRIPTION OF THE INVENTION

"Handle" as used herein is any means which can be engaged with a carrier for holding, lifting or moving the carrier. The legs of the handle are any projections of suitable strength for lifting the carrier and of suitable chemical and corrosion resistance to be partially immersed in the particular liquid with which the article is contacted. The handle for the carrier to which the retainer is attached is a handle which can readily be engaged and disengaged with the carrier.

"Carrier" as used herein is any means having an access opening for holding an article, which means is dependent upon the weight of the article to prevent the article from being removed from or escaping through the access opening. The access opening is an opening in the carrier which permits an article to enter and leave the carrier.

The engaging and disengaging means is any suitable means for engaging and disengaging the carrier upon a change in distance between the lower portion of the legs, the engaging means preferably operating upon reducing the distance between the lower portions of the legs and the disengaging means preferably operating upon increasing the distance between the lower portions of the legs. The engaging and disengaging means in the preferred embodiment are hooks which are attached to and may be integral with the lower portions of the legs, which hooks are adapted to fit into holes or slots in the end walls of the carrier to securely hold the carrier. The lower portions of the legs can be separated by a sufficient distance to permit the hooks to pass around the sidewalls of the carrier. The distance between the legs can then be reduced so that the hooks engage the slots in the sidewalls of the carrier. The means for changing the distance between the lower portions (the portions below the center) of the legs may be any suitable means for moving the lower portions of the legs relative to each other and is preferably a means for pivoting or partially rotating the lower portion of one of the legs relative to the lower portion of the other of the legs.

"Retainer" as used herein is any means for preventing an article from leaving the carrier through the access opening and in the preferred embodiment is a retaining bar. The retaining bar is a bar of any suitable cross section and of sufficient length to extend over the access opening far enough to prevent escape or removal of an article from the carrier through the access opening.

The article to be contacted with the liquid may be of any size and shape such as a silicon semi-conductor wafer and the purposes for contacting the article may vary widely. It may be desirable for example to wash the article with the liquid, to etch the article with the liquid or to coat the article with the liquid.

In the preferred embodiment of the invention the handle and retainer comprises two legs. The upper portions of each leg are connected together by a fulcrum bar and by a flexible bar removed from and not connected directly to the fulcrum bar. The flexible bar is made of any material which will return to its original shape after being bowed and may be made of plastic or steel. The fulcrum bar is preferably, though not necessarily rigid with respect to the flexible bar and may be made of a completely rigid material or may be made of a material which will return to its original shape after being bowed. The terminal ends of the fulcrum bar are made of a flexible material which permits the angle between the legs and the fulcrum bar to change as the distances between the upper portions of the legs and between the lower portions of the legs change. Each of the legs are rigid between the fulcrum bar and the flexible bar, so that application of a force to the central portion of the flexible bar in a direction substantially parallel to the longitudinal axis of the legs causes a bending of the flexible bar thus changing the distance between the legs where the legs are connected to the flexible bar relative to the distance between the legs where the legs are connected to the fulcrum bar. This change in relative distance causes a change in the distance between the lower portion of each of the legs. The fulcrum bar may for convenience be used as a grip so that a force can be more easily applied to the flexible bar.

When the fulcrum bar is flexible and is used as a grip the pressure applied by the grip will cause the fulcrum bar to bend or bow causing a change in distance between the legs where the fulcrum bar is connected with the legs; therefore, for most efficient operation when a flexible fulcrum bar is used the fulcrum bar is provided with a biasing bow which will cause a force applied by a hand grip to change the distance between the legs where the fulcrum bar is connected with the legs in a direction opposite the direction in which the distance between the legs is changed where the flexible bar is connected with the legs.

The lower portion of each of the legs is provided with means for engaging and disengaging the carrier which engaging and disengaging means operates upon the change in distance between the lower portion of the legs.

Referring now to the drawings as best seen in FIG. **6***b* the cross sections of the flexible bar **17***b*, fulcrum bar **18***b* and retaining bar **19***b* preferably have a diamond-shape so that liquid is not retained on either the flexible bar, fulcrum bar or retaining bar. In a preferred embodiment of the invention the longest radial axis **33** of the diamond shaped cross section of the flexible bar extends perpendicularly to the force **35** applied to the

flexible bar so that flexibility is retained while the longest radial axis **36** of the fulcrum bar extends in the same direction as the force **35** applied to the flexible bar so that the rigidity of the fulcrum bar is retained. The retaining bar has its longest radial axis **32** in a direction which provides the most rigidity in preventing articles from leaving the carrier.

As seen in FIGS. **1** through **6** handle and retainer **11** in the preferred embodiment is provided for securely engaging carrier **12** which is adapted to hold an article **10.** Handle and retainer **11** as best seen in FIGS. **1, 4** and **5** is provided with substantially parallel legs **13** and **14** which are reinforced for increased rigidity by flanges **15** and **16.** The upper portions of legs **13** and **14** are connected to each other by flexible bar **17** and fulcrum bar **18.** Retaining bars **19** and **20** are connected at one of each of their ends to parallel legs **13** and **14** respectively and are preferably provided with tapers **19'** and **20'** to permit overlap when the handle and retainer is engaged with the carrier.

Legs **13** and **14** are provided with hooks **21** and **22** respectively proximate their lowermost portions, which hooks are adapted to engage holes **23** and **24** in end walls **25** and **26** respectively of carrier **12.** Carrier **12** may be of any suitable size or shape for holding an article **10** to be immersed in a liquid and as shown in the drawings may be provided with grooves **27** in sidewalls **28** and **29** of carrier **12** when article **10** is in the shape of a wafer or disc.

As best seen in FIG. **4** the distance between the lower portions of legs **13** and **14,** and between hooks **21** and **22** may be increased by applying a force to the central portion of flexible bar **17** causing flexible bar **17** to bow. Bowing flexible bar **17** causes a reduction in distance between legs **13** and **14** where flexible bar **17** is connected to the legs. The reduction in distance between the legs above fulcrum bar **18** causes the distance between the lower portions of legs **13** and **14** to increase thus permitting the lower portions of legs **13** and **14** to pass over end walls **25** and **26** of carrier **12.**

Releasing the pressure on flexible bar **17** permits flexible bar **17** to return to its original shape thus causing the distance between legs **13** and **14** to increase which causes the distance between the lower portions of legs **13** and **14** to decrease. The decrease in distance between the lower portions of legs **13** and **14** permits hooks **21** and **22** to securely engage holes **23** and **24.**

As best seen in FIGS. **1** and **5** when handle and retainer **11** is engaged with carrier **12,** retaining bars **19** and **20** prevent article **10** from escaping through the access opening in the top of carrier **12** when carrier **12** and article **10** are immersed in a liquid.

Handle and retainer **11** may be easily removed from carrier **12** simply by applying a force to the central portion of flexible bar **17** to create a bow in flexible bar **17.** Hooks **21** and **22** then become disengaged from holes **23** and **24** in end walls **25** and **26** of carrier **12** permitting handle and retainer **11** to be lifted away from carrier **12** and permitting article **10** to be removed from carrier **12.**

FIG. **7** shows an alternative embodiment of the handle and retainer **11***a* wherein a cross bar **30***a* is attached to and may be integral with leg **13***a* and a plurality of retaining bars **19***a* are provided which are attached to cross bar **30***a*. The alternative embodiment of the handle and retainer is suitable for retaining articles **10***a* in a carrier **12***a* which has a plurality of compartments defined by sidewalls **28***a* and **29***a*. The alternative embodiment of the handle is also provided with a flexible bar **17***a* and a fulcrum bar **18***a* and operates in the same way as the first embodiment of the handle previously discussed.

What is claimed is:

1. A handle and retainer for engagement with a carrier for an article, said handle and retainer comprising at least two legs, means for changing the distance between the lower portion of said legs, means for engaging and disengaging the carrier which engaging and disengaging means operates upon the change in distance between the lower portion of the legs and at least one retaining bar for retaining the article in the carrier, which retaining bar is connected by one end to one of the legs, the other end of said retaining bar being unsecured.

2. The handle and retainer as claimed in claim **1** wherein said means for changing the distance between the lower portion of said legs comprises a fulcrum bar and a flexible bar connecting the upper portions of said legs, said flexible bar and said fulcrum bar not being directly connected, so that application of a force to the central portion of said flexible bar in a direction substantially parallel to the longitudinal axis of said legs causes a bending of the flexible bar thus changing the distance between said legs where said legs are connected to said flexible bar relative to the distance between said legs where said legs are connected to said fulcrum bar, which change in relative distance causes a change in the distance between the lower portions of said legs thus operating said engaging and disengaging means.

3. The handle and retainer in claim **2** wherein said handle is provided with two retaining bars one end of a first said retaining bars being connected to one of said legs and one end of the second of said retaining bars being connected to the other of said legs the remaining ends of said retaining bars being unsecured.

4. The handle and retainer claimed in claim **2** wherein two cross bars are provided, one of which is secured to one of said legs and the other of which is secured to the other of said legs, a plurality of retaining bars each of which is secured at one end to one of said cross bars, each of said retaining bars being unsecured at its other end.

5. The handle and retainer claimed in claim **2** wherein the flexible bar, the fulcrum bar and the retaining bar have a diamond-shaped cross section.

6. The handle and retainer claimed in claim **5** wherein the longest radial axis of the diamond-shaped cross section of the flexible bar is in a direction perpendicular to the direction of force applied to the flexible bar.

7. The handle and retainer claimed in claim **6** wherein the longest radial axis of the retaining bar is oriented in a direction giving maximum rigidity for retaining the article in the carrier.

8. The handle and retainer claimed in claim **3** wherein the unsecured ends of the retaining bars are tapered.

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