SEMICONDUCTOR PACKAGE LOADING APPARATUS AND METHOD

BACKGROUND

(a) Technical Field

The present invention relates to a semiconductor package loading apparatus and method. More particularly, it relates to a semiconductor package loading apparatus and method, which can shorten time needed for a package loading process and improve the productivity, by reducing the total processing steps that are sequentially performed in a process of loading semiconductor packages transferred after previous processes such as sawing and vision inspection into a tube.

(b) Background Art

Generally, the fabrication of semiconductor packages includes a series of steps including manufacturing a semiconductor chip in which high density integrated circuits such as transistors and capacitors are formed on a semiconductor substrate formed of silicon, attaching the semiconductor chip to strip materials such as lead frames or printed circuit boards, electrically connecting between the semiconductor chip and the strip materials using wire, and then molding the semiconductor chip using epoxy resin to protect the semiconductor chip from external environments.

Semiconductor packages are packaged in the form of matrix-type arrangement in strip materials, and the packages in the strip materials are cut and

separated from each other. The packages separated into pieces are selected according to predetermined quality standards, and then loaded onto a tray to be transferred to subsequent processes.

The above process can be performed by a sawing & placement apparatus among semiconductor fabrication apparatuses, which performs a sawing process of cutting the strip materials into separated packages and a process of loading the separated packages onto a tray according to the predetermined quality standards. The sawing & placement apparatus includes an onloader for supplying strip materials, a chuck table for seating the strip materials that are supplied, a sawing unit for cutting the strip materials on the chuck table into individual pieces of packages, and a handler unit for loading the pieces of packages to the tray after vision inspection.

Here, the handler unit includes a turntable picker that transfers individual packages to a turntable, a turntable that transfers the packages to a working area of a sorting picker, a vision device for the package inspection, and a sorting picker that loads the packages from the turntable to the tray after the vision inspection.

After the sawing process, the vision inspection for the individual pieces of packages is performed in the handler unit, and then the packages are loaded onto a tray according to the predetermined quality standards to be transferred for the next process.

In this case, when the packages on the turntable are transferred to the location of the sorting picker, the sorting picker suctions the packages on the turntable and moves to the vision device, and the vision device inspects defects on the undersurface of the packages.

Once the vision inspection is completed, the sorting picker classifies the packages into good products and bad products according to the result of the vision inspection and then loads the packages onto the tray.

When the semiconductor packages after the sawing (or singulation) and the vision inspection are loaded into a tube for transfer and storage, a separate loading apparatus is needed in order to load the packages into the tube.

The above information disclosed in this Background section is only for enhancement of understanding of the background of the invention and therefore it may contain information that does not form the prior art that is already known in this country to a person of ordinary skill in the art.

SUMMARY OF THE DISCLOSURE

The present invention provides a semiconductor package loading apparatus and method, which can shorten time needed for a package loading process and improve the productivity, by reducing the total processing steps that are sequentially

performed in a process of loading semiconductor packages transferred after previous processes such as sawing and vision inspection into a tube.

In one aspect, the present invention provides a semiconductor package loading apparatus including: one or more transfer pickers for picking up a semiconductor package and transferring the semiconductor package in one direction; a transfer block having a package seating part where the semiconductor package picked up by the transfer picker is seated and one or more return spaces on an upper portion thereof, and orthogonally movable with respect to a transfer direction of the transfer picker; and a pusher loading the semiconductor package seated in the transfer block into a tube and linearly reciprocating, wherein the pusher loads the semiconductor package into the tube through the package seating part and moves backward through the return space as the transfer block moves after the semiconductor package is loaded into the tube.

In another aspect, the present invention provides a semiconductor package loading apparatus including: a vision device inspecting the quality of a semiconductor package according to certain quality criteria; one or more transfer pickers for picking up a semiconductor package and transferring the semiconductor package in one direction according to an inspection result; a transfer block having a package seating part where the semiconductor package picked up by the transfer picker is seated and one or more return spaces on an upper portion thereof, and orthogonally movable

with respect to a transfer direction of the transfer picker; a pusher loading the semiconductor package seated in the transfer block into a tube and linearly reciprocating; and a tray orthogonally movable with respect to the transfer direction of the transfer picker, wherein the pusher loads the semiconductor package into the tube through the package seating part and moves backward through the return space as the transfer block moves after the semiconductor package is loaded into the tube.

In an exemplary embodiment, while the pusher is moving backward through the return space, a semiconductor package picked up by the other transfer picker may be seated in the package seating part of the transfer block that is vacant.

In another exemplary embodiment, the transfer picker may include a first transfer picker and a second transfer picker, and the pusher may move backward through the return space when the semiconductor package seated in the package seating part by a first transfer picker is loaded into the tube and then the transfer block may move to a second transfer picker to seat the semiconductor package picked up by the second transfer picker in the package seating part of the transfer block.

In still another exemplary embodiment, a distance between the package seating part and the return space may be equal to or smaller than a distance between the transfer picker and the pusher.

In yet another exemplary embodiment, the semiconductor package loading apparatus may further include a clamp that selectively opens and closes all or a part of an upper portion of the semiconductor package seated in the package seating part of the transfer block to prevent separation of the semiconductor package seated in the package seating part.

In still yet another exemplary embodiment, the semiconductor package loaded into the tube may be a good product, and the semiconductor package temporarily loaded into the tray may be a rework product.

In a further exemplary embodiment, the return space may be formed parallel to a longitudinal direction of the package seating part at one or both sides of the package seating part.

In another further exemplary embodiment, the return space may be a recessed part or a stepped part formed in an upper surface of the transfer block such that the pusher moves therein.

In still another aspect, the present invention provides a semiconductor package loading method including: seating a semiconductor package picked up by one transfer picker in a package seating part of a transfer block having one or more return spaces; moving the transfer block in which the semiconductor package is seated to a loading position; loading the semiconductor package seated in the package seating part of the transfer block into a tube using a pusher that linearly

reciprocates; moving the transfer block to the other transfer picker after the semiconductor package is loaded into the tube; moving backward the pusher through the return space; and seating the semiconductor package picked up by the other transfer picker in the package seating part of the transfer block that is vacant.

In a further aspect, the present invention provides a semiconductor package loading method, including: loading a certain semiconductor package to a tray according to whether the semiconductor package is a good or bad product; picking up a residual semiconductor package to seat the semiconductor package in a package seating part of a transfer block having one or more return spaces; moving the transfer block in which the semiconductor package is seated to a loading position; loading the semiconductor package seated in the package seating part of the transfer block into a tube using a pusher that linearly reciprocates; moving the transfer block to the other transfer picker after the semiconductor package is loaded into the tube; moving backward the pusher through the return spaces; and seating the semiconductor package picked up by the other transfer picker in the package seating part of the transfer block that is vacant.

In an exemplary embodiment, while the pusher is moving backward through the return space, the semiconductor package picked up by the other transfer picker may be seated in the package seating part that is vacant.

In another exemplary embodiment, the return space may be formed parallel to a longitudinal direction of the package seating part at one side or both sides of the package seating part.

In still another exemplary embodiment, a distance between the package seating part and the return space may be equal to or smaller than a distance between the transfer picker and the pusher.

In yet another exemplary embodiment, the semiconductor package loaded to the tray may be a rework product, and the residual semiconductor package loaded into the tube may be a good product.

In still yet another exemplary embodiment, the return space may be a recessed part or a stepped part formed in an upper surface of the transfer block such that the pusher moves therein.

Other aspects and exemplary embodiments of the invention are discussed infra.

BRIEF DESCRIPTION OF THE DRAWINGS

The above and other features of the present invention will now be described in detail with reference to certain exemplary embodiments thereof illustrated the accompanying drawings which are given hereinbelow by way of illustration only, and thus are not limitative of the present invention, and wherein:

FIG. 1 is a plan view illustrating a semiconductor package loading apparatus according to an embodiment of the present invention;

FIG. 2 is a perspective view illustrating a transfer block of a semiconductor package loading apparatus according to an embodiment of the present invention;

FIG. 3 is a view illustrating a transfer block moving from a loading position to a first transfer position under a first transfer picker;

FIG. 4 is a view illustrating a stepped part formed as a return space according to an embodiment of the present invention;

FIGS. 5A and 5B are views illustrating a process in which semiconductor packages picked up by a transfer picker are seated in a package seating part of a transfer block according to an embodiment of the present invention;

FIGS. 6A through 6E are views illustrating a package loading process according to an embodiment of the present invention;

FIGS. 7A through 7E are views illustrating a package loading process using a semiconductor package loading apparatus according to another embodiment of the present invention; and

FIGS. 8A and 8B are views illustrating a comparison of an interval between a pusher and a transfer picker at other side and an interval between the end of a transfer block and a package seating part according to another embodiment of the present invention.

Reference numerals set forth in the Drawings includes reference to the following elements as further discussed below:

1 : semiconductor package	2 : storage box
3 : tray	11, 12 : vision device
20 : package transfer device	21 : first transfer picker
22 : second transfer picker	30 : tube supply device
31 : tube	40 : transfer device
41 : transfer block	42 : package seating part
43 : clamp	44 : suction aperture
45 : first return space	46 : second return space
47 : guide suit	48 : guide groove
50 : package loading device	51 : pusher

It should be understood that the appended drawings are not necessarily to scale, presenting a somewhat simplified representation of various preferred features illustrative of the basic principles of the invention. The specific design features of the present invention as disclosed herein, including, for example, specific dimensions, orientations, locations, and shapes will be determined in part by the particular intended application and use environment.

In the figures, reference numbers refer to the same or equivalent parts of the present invention throughout the several figures of the drawing.

DETAILED DESCRIPTION

Hereinafter reference will now be made in detail to various embodiments of the present invention, examples of which are illustrated in the accompanying drawings and described below. While the invention will be described in conjunction with exemplary embodiments, it will be understood that present description is not intended to limit the invention to those exemplary embodiments. On the contrary, the invention is intended to cover not only the exemplary embodiments, but also various alternatives, modifications, equivalents and other embodiments, which may be included within the spirit and scope of the invention as defined by the appended claims.

The above and other features of the invention are discussed infra.

Hereinafter, exemplary embodiments of the present invention will be described in detail with reference to the accompanying drawings.

The present invention relates to a semiconductor package loading apparatus and method, which can shorten time needed for a package loading process and improve the productivity, by reducing the whole process stages that are sequentially

performed to load semiconductor packages transferred after previous processes such as sawing and vision inspection into a tube.

A process time can be shortened by one cycle compared to a process in which a transfer stage and a return stage are separately performed, by returning a pusher for loading the semiconductor package into the tube to the original condition while the semiconductor package is being transferred from the transfer picker.

Hereinafter, one cycle operation means an operation processing including moving a transfer block from a loading position to a transfer position, seating packages on the transfer block by a transfer picker, again moving the transfer block to the loading position, and loading the packages delivered by the transfer picker into the tube through forward and backward movement of a pusher. When the pusher is withdrawn from the forward position after pushing the package to a waiting position before pushing the package, one cycle operation may be completed.

More specifically, when two transfer pickers are used at both sides of the transfer block, packages that are cut may be pushed from the first transfer picker to the pusher, and may be inserted into the tube, and the transfer block may move to the second transfer picker. Thereafter, the pusher may move backward and return to the waiting position through the return space while the packages are being seated from the second transfer picker to the transfer block.

Also, in the package loading process according to an embodiment of the present invention, one cycle operation may be repeated certain times to load the packages into the tube.

FIG. 1 is a plan view illustrating a semiconductor package loading apparatus according to an embodiment of the present invention. FIG. 2 is a perspective view illustrating a transfer block of a semiconductor package loading apparatus according to an embodiment of the present invention.

The semiconductor package loading apparatus may be achieved by improving a typical tube-type package loading apparatus for loading semiconductor packages 1 (see FIGS. 3 through 5) having undergone previous processes such as sawing and vision inspection into a tube 31. Particularly, return spaces 45 and 46 may be additionally formed in the upper surface of a transfer block 41. The return spaces 45 and 46 may serve as a withdrawal movement (return) path of the pusher 51. Thus, after the movement of the transfer block 41, the returning process of the pusher 51 and the package seating process by the transfer pickers 21 and 22 may be simultaneously performed.

Referring to FIG. 1, the loading apparatus for loading semiconductor packages into the tube 31 having undergone the transfer process, and vision devices 11 and 12 may be shown.

In a sawing and placement apparatus, semiconductor package having undergone a sawing (singulation) process may be transferred to an inspection region, and then may undergo vision inspection by vision devices 11 and 12. Thereafter, the semiconductor packages may be classified into two types of good products and bad products according to predetermined quality criteria in a sawing region, or may be classified into three types of good, bad, and rework needing additional processing.

In this case, the packages may be transferred to a loading position by transfer pickers 21 and 22 of a package transfer device 20 to load and store the packages by good, bad, and rework products. When packages are good products satisfying the quality criteria, the packages may be loaded into the tube 31 by a loading apparatus and method according to an embodiment of the present invention.

On the other hand, when the packages are bad products, the packages may be transferred by the transfer pickers 21 and 22 to be received in a storage box 2. When the packages are rework products, the packages may be loaded in a separate tray 3 orthogonally movable with respect to the transfer direction of the transfer pickers 21 and 22, and then may be carried out for a subsequent process.

Even when the packages are rework products, the packages may be temporarily loaded in the tray 3 for the subsequent process, and then may each be loaded into the tube 31 by the loading apparatus and method according to the embodiment of the present invention like the good products.

As described above, the loading apparatus may have one or more return spaces 45 and 46 in the upper surface of the transfer block 41, and may move in the vertical direction with respect to the transfer direction. The return spaces 45 and 46 may allow the pusher 51 to move backward to the waiting position.

The loading apparatus may include a package transfer device 20, a tube supply device 30, a transfer device 40, and a package loading device 50. The package transfer device 20 may transfer semiconductor packages to the loading position. The tube supply device 30 may supply the tube 31 receiving packages to the package loading position. The transfer device 40 may move packages loaded from the transfer pickers 21 and 22 to the loading position where the packages can be loaded into the tube 31. The package loading device 50 may push packages longitudinally aligned in the transfer device 40 into the tube 31. Here, the package transfer device 20 may include one or more transfer pickers 21 and 22 that suction and pick up packages to transfer the packages in one direction.

The transfer pickers 21 and 22 may be provided in plurality, and may pick up semiconductor packages to transfer the packages in one direction. The transfer pickers 21 and 22 may serve as a sorting picker for transferring good, bad, and rework products sorted by vision inspection. In the embodiment of FIG. 1, the transfer pickers 21 and 22 may be provided so as to move between the loading position of the sorting region and the inspection region. The transfer pickers 21 and

22 may move in the X-axis direction, that is, horizontal direction on the drawing, but may also move in the Y-axis direction according to the arrangement structure of the loading apparatus.

The tube supply device 30, which is a part that fixedly supports the tube 31 upon loading of packages while supplying tube 31 where the packages are loaded, may have a configuration similar to that of a typical tube supply device. The tube 31 may be longitudinally disposed at the package loading position in the tube supply device 30 along an extension line of a direction (loading and moving direction in the transfer device) in which the packages are pushed by the package loading device (pusher) 50 that can linearly reciprocate.

The tube supply device 30 may be configured to supply the vacant tube 31 and discharge the tube 31 holding a package, i.e., loaded with the package into a tube loading box.

The transfer device 40 may include the transfer block 41 on which packages transferred by the transfer pickers 21 and 22 of the package transfer device 20 after the vision inspection are put. The package seating part 42 that is a space in which the packages are seated in a row by the transfer pickers 21 and 22, and one or more return spaces 45 and 46 may be formed on the upper surface of the transfer block 41.

Particularly, the transfer block 41 of the transfer device 40 may have a mechanism in which the transfer block 41 sequentially moves to the positions of each

transfer pickers 21 and 22 to sequentially receive packages from the two transfer pickers (e.g., sorting picker) 21 and 22 by driving of an actuator.

In this case, the transfer block 41 may move in the vertical direction with respect to the transfer direction of the transfer pickers 21 and 22. The transfer block 41 may move in the Y-axis direction, i.e., the vertical direction in FIG. 1 to move to a position (hereinafter, referred to as transfer position) where packages can be delivered from the transfer pickers 21 and 22.

Although it is shown in the embodiment of FIG. 1 that the transfer pickers 21 and 22 move in the X-axis direction and the transfer block 41 moves in the Y-axis direction, the opposite (the transfer pickers 21 and 22 move in the Y-axis direction, and the transfer block 41 moves in the X-axis direction) may be implemented according to the arrangement structure of the loading apparatus.

The transfer block 41 may be configured to move between the two transfer pickers 21 and 22 such that packages can be sequentially loaded from the two transfer pickers 21 and 22 to the package seating part 42. During the operation, the location of the transfer block 41 may be controlled to be located at two transfer positions where packages can be delivered from the transfer pickers 21 and 22 and one loading position where packages are loaded into the tube 31.

Packages picked up by the first transfer picker 21 may be controlled to be located at a first transfer position (close to the first transfer picker) where the

packages can be loaded to the package seating part 42. Packages picked up by the second transfer picker 22 may be controlled to be located at a second transfer position (close to the second transfer picker) where the packages can be loaded to the package seating part 42. The packages loaded to the package seating part 42 may be controlled to be located at a loading position where the packages can be loaded into the tube 31 by the package loading device (pusher) 50.

In a typical configuration, since two transfer pickers (sorting picker) 21 and 22 are located at both sides of the transfer block 41, the loading position may be configured to be disposed between the first transfer position and the second transfer position.

FIG. 3 is a view illustrating the transfer block 41 moving from the loading position to the first transfer position under the first transfer picker 21.

The package seating part 42 in which the semiconductor packages 1 are inserted and seated may be formed to have a groove in the upper surface of the transfer block 41. The package seating part 42 may be longitudinally disposed in the movement direction of a pusher 51 described layer, i.e., the X-axis direction of FIG. 1. When the pusher 51 of the package loading device 50 moves forward and pushes the packages 1 aligned along the package seating part 42, the packages 1 may be loaded into the tube 31.

As shown in FIG. 1, the semiconductor package loading apparatus may further include a guide suit 47. The guide suit 47 may be disposed between the transfer block 41 and the tube supply device 30. The guide suit 47 may have a guide groove 48 that connects between the package seating part 42 and the inlet of the tube 31 of the tube supply device 30 at the loading position of the transfer block 41 on the upper surface thereof.

The guide suit 47 and the guide groove 48 in the upper surface thereof may serve to guide the packages 1 moved along the package seating part 42 of the transfer block 41 by the pusher 51 to the inlet of the tube 31, and may be configured such that the packages 1 moving along the guide groove 48 are inserted into the tube 31.

As described later, the pusher 51 may move from the fully-advanced position to the guide groove 48 of the guide suit 47 upon loading of the packages 1, and may be completely withdrawn from the package seating part 42.

FIGS. 5A and 5B are views illustrating a process in which semiconductor packages 1 picked up by the transfer pickers 21 and 22 are seated in the package seating part 42 of the transfer block 41 according to an embodiment of the present invention.

As shown in FIG. 2, a pair of clamps 43 may be further provided at both sides of the package seating part 42. The pair of clamps 43 may selectively open or close

all or a part of the packages 1 inserted and seated in the package seating part 42 to prevent separation of the packages 1.

Also, a plurality of suction apertures 44 for vacuum-suctioning the packages 1 may be disposed along the bottom surface of the package seating part 42. When the vacuum pressure is supplied through the suction aperture 44, the packages 1 inserted into the package seating part 42 may be suctioned and fixed to the bottom surface of the package seating part 42.

Hereinafter, operation of the clamps 43 and the suction aperture 44 will be described in detail. When the packages 1 are seated from the transfer pickers 21 and 22, as shown in FIG. 5A, the pair of clamps 43 may operate in an opened state. After the packages 1 are seated, as shown in FIG. 5B, the clamps may be closed to cover an upper portion of the packages 1 in the package seating part 42. The separation of the packages 1 may be prevented thereafter.

In this condition, a vacuum pressure may be applied to each suction aperture 44 to suction and fix the packages 1, and then the transfer block 41 may move to the loading position while the packages 1 are being suctioned and fixed.

Thereafter, when the package 1 are loaded into the tube 31 from the loading position, the vacuum pressure applied through the suction aperture 44 may be removed to release the suction state of the suction aperture 44, and the pusher 51 may passes between the closed clamps 43. In this case, the pusher 51 may push

the packages 1 along the package seating part 42 to load the packages 1 into the tube 31. During the loading, the packages 1 may be prevented from being separated.

When the loading of the packages 1 is completed, and the transfer block 41 returns to the transfer position where the packages 1 can be delivered from the transfer pickers 21 and 22, the clamps 43 may again open.

For reference, an example of the transfer block 41 is disclosed in Korean Patent No. 0548692, entitled “package loading block of tube-type package loading apparatus” and filed by the applicant of the present invention.

In the present invention unlike the reference patent, the return spaces 45 and 46 that are withdrawal movement paths of the pusher moving forward along the side of the package seating part 42 may be further provided in the upper surface of the transfer block (loading block) 41.

In this case, the return spaces 45 and 46 may be disposed parallel to the longitudinal direction of the package seating part 42 at one side or both sides of the package seating part 42 of the transfer block 41. The return spaces 45 and 46 may be a recessed part formed in the upper surface of the transfer block 41, or may be a stepped part which is stepped such that the pusher can move on the upper surface of the transfer block 41.

In FIGS. 2 and 3, the return spaces 45 and 46 are shown as recessed parts. In FIG. 4, the return spaces 45 and 46 are shown as stepped parts which are stepped such that the pusher can move on the upper surface of the transfer block 41.

The return spaces 45 and 46 may be formed in plurality in the upper surface of the transfer block 41. Like in FIGS. 2 and 3, two return spaces 45 and 46 may be formed, and like in FIGS. 7A through 7E, one return space 45 may be formed. The number of the return spaces 45 and 46 may increase according to the number of transfer pickers.

When the pusher 51 moves backward in a state where the return spaces 45 and 46 are formed, the pusher 51 may move backward while the front end of the pusher 51 is being inserted into the return spaces 45 and 46.

The pusher 51 may move forward along the package seating part 42 to allow the packages 1 to be loaded into the tube 31. Then, when the pusher 51 is completely separated from the transfer block 41 to the guide suit 47, i.e., from the package seating part 42 to the guide groove 48, and the transfer block 41 moves to the transfer position where the transfer block 41 can receive the packages 1 from the transfer pickers 21 and 22, the pusher 51 may move backward to the waiting position along the return spaces 45 and 46.

Generally, since the pusher 51 may linearly reciprocate along a path of one axis by driving of an actuator during forward and backward movement, the return

spaces 45 and 46 may be longitudinally formed parallel to the longitudinal direction of the package seating part 42.

Also, since the transfer block 41 is moved to the transfer position under the transfer pickers 21 and 22, and then the pusher 51 moves backward along the return spaces 45 and 46, the location of the return spaces 45 and 46 may be set to a location on the upper surface of the transfer block 41 where the transfer block 41 can be aligned along the withdrawal path of the push 51 when moved to the transfer position.

In this case, when the transfer block 41 moves to the transfer pickers 21 and 22, the return spaces 45 and 46 may be matched with the withdrawal path of the pusher 51. Accordingly, the return spaces 45 and 46 may be located at the opposite side of the corresponding transfer pickers 21 and 22, a distance between the package seating part 42 and the transfer pickers 21 and 22 may be configured to correspond to a distance between the loading position of the package seating part 42 and the return space (withdrawal path) of the pusher 51.

Since the pusher 51 is located at the loading position, and the transfer pickers 21 and 22 are located at the transfer position, an interval between the package seating part 42 and the return spaces 45 and 46 may be configured to correspond to an interval between the pusher 51 and the transfer pickers 21 and 22.

Particularly, when the return spaces 45 and 46 are recessed parts like FIGS. 2 and 3, the pusher 51 has to return while being inserted into the recessed part. Accordingly, an interval d1 between the package seating part 42 and the recessed parts (return spaces) 45 and 46 may be configured to be equal to an interval d2 between the pusher 51 and the transfer pickers 21 and 22 (in FIGS. 3 and 6A, d1 = d2)

Also, when the return spaces 45 and 46 are stepped parts like FIG. 4, the pusher 51 has only to return over the stepped part. Accordingly, the interval d1 between the package seating part 42 and the stepped parts (return spaces) 45 and 46 may be configured to be smaller than or equal to the interval d2 between the pusher 51 and the transfer pickers 21 and 22 (in FIG. 4, d1 $\leq$ d2). Here, the interval d1 between the package seating part 42 and the stepped parts 45 and 46 may be based on the inner end (at the side of the transfer picker) of the stepped parts 45 and 46 as shown in FIG. 4.

If two transfer pickers (sorting picker) 21 and 22 are disposed at both sides of the transfer block 41 as shown in FIG. 1, and the transfer block 41 is configured to move to two transfer positions, two return spaces 45 and 46 may be formed side by side at both sides of the package seating part 42.

Hereinafter, the return space 45 that is aligned with the withdrawal path of the pusher 51 when the transfer block 41 reaches the first transfer position will be

referred to as a first return space, and the return space 46 that is aligned with the withdrawal path of the pusher when the transfer block 41 reaches the second transfer position will be referred to as a second return space.

The package loading device 50, which is a part that mechanically pushes the packages 1 aligned over the transfer block 41 into the tube 31 to load the semiconductor packages 1 into the tube 31, may have a configuration similar to a typical configuration. The packages 1 may be loaded into the tube 31, and the pusher 51 that can linearly reciprocate and the actuator (not shown) for the linear reciprocating motion of the pusher may be provided.

In the embodiment of FIG. 1, the pusher 51 may perform linear reciprocating motion along the X-axis direction, i.e., horizontal direction on the drawing. When the actuator operates and the pusher 51 moves forward, the packages 1 aligned over the transfer block 41 may be pushed to the tube 31 by the pusher 51, and thus the packages 1 may be loaded into the tube 31.

As described above, the pusher 51 may move forward along the package seating part 42, and may simultaneously push the packages 1 into the tube 31. Thereafter, the guide suit 47 may move to be completely separated from the transfer block 41. Then, when the transfer block 41 moves to the first or second transfer position, the pusher 51 may move backward along the first return space 45 and the second return space 46 to return to the waiting position.

Hereinafter, the loading processing will be described in more detail with reference to FIGS. 6A through 6E.

First, as shown in FIG. 6A, in order to load semiconductor packages transferred by the first transfer picker 21, 1) the transfer block 41 may move from the loading position to the first transfer position at the side of the first transfer picker 21 (moving downward on the drawing), and 2) the pusher 51 that has moved forward to load packages into the tube 31 in the previous loading step may move backward in the left direction on the drawing along the first return space 45 to return to the waiting position, and simultaneously, the packages picked up by the first transfer picker 21 may be seated into the package seating part 42 of the transfer block 41.

FIG. 6A illustrates the transfer block 41 moved from the loading position to the first transfer position, the pusher 51 moved to the waiting position that is an initial position of the cycle after finishing the loading of the packages in the previous step, and the packages picked up by the first picker 21 and seated in the transfer block to be transferred.

In this case, the packages delivered from the first transfer picker 21 may be inserted into the package seating part 42 of the transfer block 41 in a line, and may be longitudinally aligned in the horizontal direction on the drawing.

As shown in FIG. 6B, in order to load the packages delivered from the first transfer picker 21 into the tube 31, 3) the transfer block 41 may move from the first

transfer position to the loading position (moving upward on the drawing) while the packages are being seated therein.

As shown in FIG. 6C, 4) the pusher 51 may move forward in the right direction on the drawing by the driving of the actuator, and the front end of the pusher 51 may move along the inside of the package seating part 42 to forcibly push the packages that are being aligned.

Thus, the packages may be sequentially loaded into the tube 31, and the loading of the packages transferred by the first transfer picker 21 into the tube 31 may be completely finished through the above operation steps 1) through 4).

As shown in FIG. 6D, in order to load semiconductor packages transferred by the second transfer picker 22, 5) the transfer block 41 may move from the loading position to the second transfer position at the side of the second transfer picker 22 (moving upward on the drawing), and 6) the pusher 51 that has moved forward to load packages into the tube 31 in the previous loading step may move backward in the left direction on the drawing along the second return space 46 to return to the waiting position, and simultaneously, the packages picked up by the second transfer picker 22 may be seated into the package seating part 42 of the transfer block 41.

FIG. 6D illustrates the transfer block 41 moved from the loading position to the second transfer position, the pusher 51 again moved to the waiting position after

finishing the loading of the packages in the previous step, and the packages picked up by the second picker 22 and seated in the transfer block to be transferred.

In this case, the packages delivered from the second transfer picker 22 may be inserted into the package seating part 42 of the transfer block 41 in a line, and may be longitudinally aligned in the horizontal direction on the drawing.

As shown in FIG. 6E, in order to load the packages delivered from the second transfer picker 22 into the tube 31, 7) the transfer block 41 may move from the second transfer position to the loading position (moving downward on the drawing) while the packages are being seated therein.

As shown in FIG. 6C, 8) the pusher 51 may move forward in the right direction on the drawing by the driving of the actuator, and the front end of the pusher 51 may move along the inside of the package seating part 42 to forcibly push the packages that are being aligned.

Thus, the packages may be sequentially loaded into the tube 31, and the loading of the packages transferred by the second transfer picker 22 into the tube 31 may be completely finished through the above operation steps 5) through 8).

finally, in the loading apparatus and method according to the embodiment of the present invention, one cycle of processing step in which packages transferred by the first transfer picker 21 and the second transfer picker 22 are sequentially loaded into the tube 31 may include total eight steps of 1) through 8). The total number of

processing steps sequentially (time-separately) performed during the cycle may be reduced by moving backward the pusher 51 by the return spaces 45 and 46 without an interference while the packages are being seated, compared to a typical method in which the pusher 51 moves backward to return to the waiting position through the package seating part 42 after the loading, and then moves to the picker to receive packages. Accordingly, the working time can be shortened, and the work efficiency can be achieved.

In the loading apparatus and method according to the embodiment of the present invention, since the pusher 51 is configured to return from the first and second transfer positions of the transfer block 41 to the waiting position using the first and second return spaces 45 and 46, the seating of the packages on the first and second transfer positions and the returning of the pusher 51 can be simultaneously performed. Accordingly, the processing steps during one cycle can be reduced compared to a typical method.

Thus, time needed for the loading of the packages can be reduced, and the productivity can be improved.

Also, in addition to good package products, rework products may also be separately loaded into the tube 31 through the above loading process after temporary loading of the packages to the tray 3.

When packages having undergone vision inspection are determined as rework products requiring additional processing, the packages may be primarily loaded to the tray 3 by the transfer pickers (sorting pickers) 21 and 22, and then may be loaded into the tube 31 through the above loading process including, for example, supplying the packages from the tray 3 to the transfer block 41 by two transfer pickers 21 and 22 and loading the packages into the tube 31 by the pusher 51.

Since it is possible to sort rework products to load them into the tube 31 and then temporarily load good products to the tray 3, it is apparent that temporary loading to the tray 3 will not be significantly limited within the scope of the present invention.

Also, even bad products can be loaded into the tube 31 through the same loading process after being loaded into a separate tray instead of the storage box 2.

FIGS. 7A through 7E are views illustrating a package loading process using a semiconductor package loading apparatus according to another embodiment of the present invention.

In this embodiment, a return space 46 may be formed in the upper surface of a transfer block 41 only at one side of a package seating part 42. The return space 46 may be a recessed part.

Except that the return space 46 is formed only at one side of the package seating unit 42, the return space 46 may be similar to that of the previous

embodiment in shape, structure, and location. When the return space 46 is formed only at one side, it is more efficient in movement distance of the transfer block 41 that the first transfer picker 21 and the second transfer picker 22 are provided at one side of the transfer block 41 side by side.

Also, the return space 46 may be formed parallel to the longitudinal direction of the package seating part 42, and an interval with the package seating part 42 is configured to correspond to an interval with a pusher in one of two transfer pickers 21 and 22.

In this embodiment, the interval between the return space 46 that is implemented with a recessed part and the package seating part 32 may be configured to be identical to the interval between the second transfer picker 22 and the pusher 51.

However, since the return space 46 is formed only at one side, when one transfer picker 22 seats semiconductor packages in the package seating part 42 of the transfer block 41, the pusher 51 may return through the return space 46, and then when the other transfer picker 21 seats the semiconductor packages in the package seating part 42 of the transfer block 41, the pusher 51 may return through a lateral space of the transfer block, i.e., a location where an interference with the transfer block is avoided.

More specifically, as shown in FIG. 8A, since a distance d3 between the other transfer picker 21 and the pusher 51 is greater than a distance d4 between the package seating part 42 and the end of the transfer block 41 (d3 > d4), when the transfer block 41 transfers to the other transfer picker (more distant from the package seating part 42) 21 to seat packages, the pusher 51 may not interfere with the transfer block 41.

In this embodiment, a loading position may be configured to locate at a side of two transfer positions instead of locating between the first transfer position and the second transfer position. The location of the pusher 51 may be set to a location where the pusher 51 completely deviate from the transfer block 31 in the lateral direction when the transfer block 41 moves to the other transfer picker (first transfer picker described later) 21.

Also, the recessed part of the return space may be replaced with a stepped part. In this case, the stepped part may be formed only at one side of the package seating part 42. As shown in FIG. 4, the stepped part may be formed only at one side, not both sides of the package seating part.

In the embodiment shown in FIGS. 7A through 7E, although one return space 46 is formed only at the opposite side to the first transfer picker 21 based on the package seating part 42, i.e., at the side of the second transfer picker 22 from the

package seating part 42, the return space 46 may also be formed at the opposite side, i.e., at the side of the first transfer picker 21.

FIG. 8B illustrates the transfer block 41 in which return spaces are formed at both sides of the package seating part 42 similarly to that of FIGS. 2 through 6E. However, when the transfer block 41 also has a structure of d3 > d4, the transfer pickers 21 and 22 may be disposed side by side at one side of the transfer block 41. FIG. 8B illustrates return space 46 by which the pusher returns when the second transfer picker 22 seats semiconductor packages in the package seating part 42 of the transfer block 41.

Hereinafter, a semiconductor package loading process will be described in detail with reference to FIGS. 7A through 7E.

First, as shown in FIG. 7A, in order to load semiconductor packages transferred by the first transfer picker 21, 1) the transfer block 41 may move from the loading position to the first transfer position at the side of the first transfer picker 21 (moving downward on the drawing), and 2) the pusher 51 that has moved forward to load packages into the tube 31 in the previous loading step may move backward in the left direction on the drawing through a lateral space of the transfer block 41 to return to the waiting position, and simultaneously, the packages picked up by the first transfer picker 21 may be seated into the package seating part 42 of the transfer block 41.

FIG. 7A illustrates the transfer block 41 moved from the loading position to the first transfer position, the pusher 51 moved to the waiting position that is an initial position of the cycle after finishing the loading of the packages in the previous step, and the packages picked up by the first picker 21 and seated in the transfer block to be transferred.

In this case, the packages delivered from the first transfer picker 21 may be inserted into the package seating part 42 of the transfer block 41 in a line, and may be longitudinally aligned in the horizontal direction on the drawing.

As shown in FIG. 7B, in order to load the packages delivered from the first transfer picker 21 into the tube 31, 3) the transfer block 41 may move from the first transfer position to the loading position (moving upward on the drawing) while the packages are being seated therein.

As shown in FIG. 7C, 4) the pusher 51 may move forward in the right direction on the drawing by the driving of the actuator, and the front end of the pusher 51 may move along the inside of the package seating part 42 to forcibly push the packages that are being aligned.

Thus, the packages may be sequentially loaded into the tube 31, and the loading of the packages transferred by the first transfer picker 21 into the tube 31 may be completely finished through the above operation steps 1) through 4).

As shown in FIG. 7D, in order to load semiconductor packages transferred by the second transfer picker 22, 5) the transfer block 41 may move from the loading position to the second transfer position at the side of the second transfer picker 22 (moving upward on the drawing), and 6) the pusher 51 that has moved forward to load packages into the tube 31 in the previous loading step may move backward in the left direction on the drawing along the return space 46 to return to the waiting position, and simultaneously, the packages picked up by the second transfer picker 22 may be seated into the package seating part 42 of the transfer block 41.

FIG. 7D illustrates the transfer block 41 moved from the loading position to the second transfer position, the pusher 51 again moved to the waiting position after finishing the loading of the packages in the previous step, and the packages picked up by the second picker 22 and seated in the transfer block to be transferred.

In this case, the packages delivered from the second transfer picker 22 may be inserted into the package seating part 42 of the transfer block 41 in a line, and may be longitudinally aligned in the horizontal direction on the drawing.

As shown in FIG. 7E, in order to load the packages delivered from the second transfer picker 22 into the tube 31, 7) the transfer block 41 may move from the second transfer position to the loading position (moving downward on the drawing) while the packages are being seated therein.

As shown in FIG. 7C, 8) the pusher 51 may move forward in the right direction on the drawing by the driving of the actuator, and the front end of the pusher 51 may move along the inside of the package seating part 42 to forcibly push the packages that are being aligned.

Thus, the packages may be sequentially loaded into the tube 31, and the loading of the packages transferred by the second transfer picker 22 into the tube 31 may be completely finished through the above operation steps 5) through 8).

finally, in the loading apparatus and method according to the embodiment of the present invention, one cycle of processing step in which packages transferred by the first transfer picker 21 and the second transfer picker 22 are sequentially loaded into the tube 31 may include total eight steps of 1) through 8). The total number of processing steps sequentially (time-separately) performed during the cycle may be reduced to eight steps compared to typical ten steps.

In the semiconductor package loading apparatuses and methods according the embodiments of the present invention, since the pusher is configured to return from the transfer position of the transfer block to the waiting position using the return space, the seating of the packages on the transfer position and the returning of the pusher can be simultaneously performed. Accordingly, the processing steps can be reduced compared to a typical method.

Thus, time needed for the loading of the packages can be reduced, and the productivity can be improved.

The invention has been described in detail with reference to exemplary embodiments thereof. However, it will be appreciated by those skilled in the art that changes may be made in these embodiments without departing from the principles and spirit of the invention, the scope of which is defined in the appended claims and their equivalents.

WHAT IS CLAIMED IS:

1. A semiconductor package loading apparatus comprising:

at least one transfer picker for picking up a semiconductor package and transferring the semiconductor package in one direction;

a transfer block having a package seating part where the semiconductor package picked up by the transfer picker is seated and at least one return space formed on an upper portion thereof, and orthogonally movable with respect to a transfer direction of the transfer picker; and

a pusher loading the semiconductor package seated in the transfer block into a tube and linearly reciprocating,

wherein the pusher loads the semiconductor package into the tube through the package seating part and moves backward through the return space as the transfer block moves after the semiconductor package is loaded into the tube.

2. A semiconductor package loading apparatus comprising:

a vision device inspecting the quality of a semiconductor package according to certain quality criteria;

at least one transfer picker for picking up a semiconductor package and transferring the semiconductor package in one direction according to an inspection result;

a transfer block having a package seating part where the semiconductor package picked up by the transfer picker is seated and at least one return space formed on an upper portion thereof, and orthogonally movable with respect to a transfer direction of the transfer picker;

a pusher loading the semiconductor package seated in the transfer block into a tube and linearly reciprocating; and

a tray orthogonally movable with respect to the transfer direction of the transfer picker,

wherein the pusher loads the semiconductor package into the tube through the package seating part and moves backward through the return space as the transfer block moves after the semiconductor package is loaded into the tube.

3. The semiconductor package loading apparatus of claim 1 or 2, wherein while the pusher is moving backward through the return space, a semiconductor package picked up by another transfer picker is seated in the package seating part of the transfer block that is vacant.

4. The semiconductor package loading apparatus of claim 1 or 2, wherein the transfer picker comprises a first transfer picker and a second transfer picker, and wherein when the transfer block moves to a second transfer picker to seat the semiconductor package picked up by the second transfer picker in the package seating part of the transfer block after the semiconductor package seated in the package seating part by a first transfer picker is loaded into the tube, the pusher moves backward through the return space.

5. The semiconductor package loading apparatus of claim 4, wherein a distance(d1) between the package seating part and the return space is equal to or smaller than a distance(d2) between the respective transfer picker and the pusher.

6. The semiconductor package loading apparatus of claim 1 or 2, further comprising a clamp that selectively opens and closes all or a part of an upper portion of the semiconductor package seated in the package seating part of the transfer block to prevent the semiconductor package seated in the package seating part from being separated therefrom.

7. The semiconductor package loading apparatus of claim 2, wherein a semiconductor package loaded into the tube is a good product, and a semiconductor package to be reworked is temporarily loaded into the tray..

8. The semiconductor package loading apparatus of claim 1 or 2, wherein the return space is formed parallel to a longitudinal direction of the package seating part at one or both sides of the package seating part.

9. The semiconductor package loading apparatus of claim 1 or 2, wherein the return space is a recessed part or a stepped part formed in an upper surface of the transfer block such that the pusher moves therethrough.

10. A semiconductor package loading method comprising:

seating a semiconductor package picked up by one transfer picker in a package seating part of a transfer block having at least one return space;

moving the transfer block in which the semiconductor package is seated to a loading position;

loading the semiconductor package seated in the package seating part of the transfer block into a tube using a pusher that linearly reciprocates;

moving the transfer block to the other transfer picker after the semiconductor package is loaded into the tube;

moving backward the pusher through the return space; and

seating the semiconductor package picked up by the other transfer picker in the package seating part of the transfer block that is vacant.

11. A semiconductor package loading method, comprising:

seating a certain semiconductor package to a tray according to whether the semiconductor package is a good or bad product;

picking up a residual semiconductor package to seat the semiconductor package in a package seating part of a transfer block having one or more return spaces;

moving the transfer block in which the semiconductor package is seated to a loading position;

loading the semiconductor package seated in the package seating part of the transfer block into a tube using a pusher that linearly reciprocates;

moving the transfer block to the other transfer picker after the semiconductor package is loaded into the tube;

moving backward the pusher through the return spaces; and

seating the semiconductor package picked up by the other transfer picker in the package seating part of the transfer block that is vacant.

12. The semiconductor package loading method of claim 10 or 11, wherein while the pusher is moving backward through the return space, an incoming semiconductor package picked up by the other transfer picker is seated in the package seating part that is vacant.

13. The semiconductor package loading method of claim 10 or 11, wherein the return space is formed parallel to a longitudinal direction of the package seating part at one side or both sides of the package seating part.

14. The semiconductor package loading method of claim 10 or 11, wherein a distance(d1) between the package seating part and the return space is equal to or smaller than a distance(d2) between the respective transfer picker and the pusher.

15. The semiconductor package loading method of claim 11, wherein the semiconductor package loaded to the tray is a rework product, and the rest of the semiconductor packages loaded into the tube are good products.

16. The semiconductor package loading method of claim 10 or 11, wherein the return space is a recessed part or a stepped part formed in an upper surface of the transfer block such that the pusher moves therein.