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SAWING AND HANDLER SYSTEM FOR MANUFACTURING SEMICONDUCTOR PACKAGE



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Technical Field

The present invention relates to a sawing and handler system for manufacturing a semiconductor package. More particularly, the present invention relates to a sawing and handler system for manufacturing a semiconductor package, capable of sawing and processing semiconductor strips at a high speed by sequentially aligning components of the sawing and handler system according to the process order for the semiconductor strips.

Background Art

Recently, as communication and computer technologies have been developed, semiconductor devices have become highly integrated. In response to the above tendency, solder ball packages or MLF (micro leaded frame) packages are extensively used in the field of semiconductor packages in place of lead frame packages connecting internal lines to an external device.

The solder ball packages or the MLF packages are fabricated in the form of a rectangular matrix, so they are called "strips".

The strip is sawn into several packages by means of a sawing machine such that the packages can be individually utilized. Then, the packages are sorted and stored according to quality thereof by means of a handler apparatus.

Although the function of the sawing machine is different from that of the handler apparatus, they are often incorporated with each other in an assembling line in order to facilitate the manufacturing process for the semiconductor devices. Such a sawing and handler system is disclosed in Korean Patent Application No. 10-2000-0079282 (Unexamined Publication No. 2002-0049954) entitled "sawing and handler system for manufacturing semiconductor package", which has been filed by applicant of the present invention.

FIG. 1 is a plan view of a conventional sawing and handler system for manufacturing a semiconductor package disclosed in Korean Patent Application No. 10-2000-0079282. Hereinafter, the conventional sawing and handler system will be described in relation to parts thereof, which may depart from the scope of the present invention.

As shown in FIG. 1, the conventional sawing and handler system mainly includes a handler apparatus performing a semiconductor strip feeding process and cleaning, drying, inspecting and stacking processes for semiconductor packages, and a sawing machine coupled to one side of the handler apparatus in order to saw the semiconductor strip into several semiconductor packages.

The handler apparatus includes an on-loader unit 10 for loading semiconductor strips stacked in a magazine or a cassette, a draw unit 15 for drawing the semiconductor strips from the on-loader unit 10, a strip picker 14 for conveying the semiconductor strip to the sawing machine 20 along a picker guide rail 25

by picking the semiconductor strip rested on the draw unit 15 using a vacuum, a package picker 24 for unloading the semiconductor packages sawn by the sawing machine 20, a cleaning unit 30 for cleaning the packages transferred thereto from the package picker 24, a drying unit 40 for drying the packages after the cleaning process has been finished, a transfer picker 52 for transferring the packages to a turn table 51 along the picker guide rail 25 after the drying process has been finished, upper and lower vision inspection units 50 performing vision inspection for the packages and an off-loader unit 60 for sorting and stacking semiconductor packages according to the result of the vision inspection of the upper and lower vision inspection units 50.

The strip picker 14 and the package picker 24 can be simultaneously moved in the horizontal direction or vertical direction by means of a strip/package picker transfer member 13. In addition, the transfer picker 52 and a tray picker 62 can be simultaneously moved in the horizontal direction or vertical direction by means of a package/tray picker transfer member 53.

The cleaning unit 30 includes a spray nozzle (not shown) for spraying cleaning water onto the semiconductor packages after the sawing process has been finished. The drying unit 40 is fixedly installed on a base and has a heater (not shown) for drying the semiconductor packages after the cleaning process has been finished.

In addition, the sawing machine 20 includes a chuck table 21, which is rotatably and horizontally moved and on which the semiconductor strip is loaded by the strip picker 14, and a spindle 22 provided with a sawing blade 23 in order to saw the semiconductor strip, rested on the chuck table 21, into several semiconductor packages.

Hereinafter, an operation of the conventional sawing and handler system having the above construction for manufacturing the semiconductor package will be described.

FIG. 2 is a plan view schematically illustrating a proceeding path of the semiconductor strip in the sawing and handler system shown in FIG. 1. The following description will be made with reference to FIGS. 1 and 2.

First, the draw picker 15 draws the semiconductor strip from the on-loader unit 10 and transfers the semiconductor strip into a pickup position. Thus, the strip picker 14 arranged in the pickup position picks up the semiconductor strip and moves along the picker guide rail 25 in order to load the semiconductor strip on the chuck table 21. Upon receiving the semiconductor strip from the strip picker 14, the chuck table 21 moves to the spindle 22 while gripping the semiconductor strip by using a vacuum. At this time, a vision inspection unit (not shown) may inspect the alignment of the semiconductor strip in the X-axis and Y-axis direction of the semiconductor strip secured to the chuck table 21. According to the result of vision inspection, the spindle 22 and the chuck table 21 relatively moves with respect to each other, thereby the semiconductor strip is sawn into several semiconductor packages.

While the sawing process is being carried out, the strip picker 14 moves towards the on-loader unit 10 in order to pick up the new semiconductor strip. After picking up the new semiconductor strip, the strip

picker 14 again moves towards the chuck table 21. When the semiconductor strip has been completely sawn into individual packages, the chuck table 21 moves down below the package picker 24. At this time, the package picker 24 picks up the individual packages by using a vacuum. After that, the strip picker 14 moves up above the chuck table 21 and loads the new semiconductor strip onto the chuck table 21. Upon receiving the new semiconductor strip from the strip picker 14, the chuck table 21 again moves towards the spindle 22. At this time, the package picker 24 sequentially transfers the packages to the cleaning unit 30 and the drying unit 40 for cleaning and drying the packages.

After the drying process has been completed, the semiconductor package is loaded on the turn table 51 by means of the transfer picker 52. In this state, the upper vision inspection unit 50 inspects defects on an upper surface of the semiconductor package loaded on the turn table 51 while moving in the Y-axis direction of the semiconductor package. Then, the turn table 51 moves to a position corresponding to a sort picker 55 along a guide rail 56 while gripping the semiconductor package, so that the sort picker 55 picks up the semiconductor package loaded on the turn table 51 by using a vacuum and moves towards the lower vision inspection unit 50. Thus, the lower vision inspection unit 50 inspects defects on a lower surface of the semiconductor package.

If the vision inspection has been finished, the sort picker 55 sorts the semiconductor packages according to the quality thereof based on the result of the vision inspection and loads the semiconductor packages on a tray 61. When the semiconductor packages are completely stacked on the tray 61, a tray feeder 62 equipped with the tray 61 moves up above a tray stacking section 63. At this time, the tray picker 62 positioned in the vicinity of the tray stacking section 63 picks up the tray 61 and the tray feeder 62 moves backward in the Y-axis direction. Then, the tray picker 62 loads the tray 61 on the tray stacking section 63. After that, the tray picker 62 moves to a tray feeding section 63 and picks up a new tray 61. Then, the tray picker 62 moves towards the tray feeder 62. At the same time, the tray feeder 62 moves towards the tray stacking section 63 and picks up the new tray 61. After that, the tray feeder 62 moves to the sort picker 55.

As described above, according to the conventional sawing and handler system for manufacturing the semiconductor package, the semiconductor strip introduced into the conventional sawing and handler system by means of the on-loader unit 10 must be transferred to the chuck table 21, which is positioned far from the semiconductor strip, so as to be subject to the sawing process while sequentially passing through the drying unit 40 and the cleaning 30 contrary to the process order of the conventional sawing and handler system. Such a problem may occur because the handler apparatus and the sawing machine of the conventional sawing and handler system are incorporated with each other after they are fabricated separately from each other.

For this reason, it is difficult to align the components of the conventional sawing and handler system according to the process order for the semiconductor strip and/or the semiconductor package, so the process efficiency for the semiconductor strip and/or the semiconductor package may be degraded. In addition, it takes a long time to transfer the semiconductor strip from the on-loader unit 10 to the chuck table

21, so UPH (unit per hour) of the system is degraded.

Due to the above structural problem of the conventional sawing and handler system, there are limitations to efficiently align the components of the conventional sawing and handler system. In addition, since the on-loader unit 10 is positioned in front of the cleaning unit 30 and the drying unit 40, the conventional sawing and handler system may unnecessarily protrude in a forward direction thereof (Y-axis direction), making it difficult to efficiently utilize the working space.

In addition, according to the conventional sawing and handler system, the nozzle (not shown) of the cleaning unit 30 horizontally moves in a chamber (not shown) lengthwise along the strip divided into packages in order to spray air and water onto the packages loaded on the package picker 24, so the nozzle must be reciprocated several times within the chamber in order to sufficiently wash the packages. Therefore, the conventional sawing and handler system may require a relatively long time for the cleaning process.

Furthermore, after the cleaning process for the packages has been finished, the drying unit 40 dries the packages while being fixedly installed on the base (not shown), so a relatively long time is also required for the drying process.

Disclosure of the Invention

Therefore, the present invention has been made in view of the above-mentioned problems, and it is an object of the present invention to provide a sawing and handler system for manufacturing a semiconductor package, which can improve the processing speed for a semiconductor strip while efficiently utilizing the installation space thereof.

In order to accomplish the above objects, according to one aspect of the present invention, there is provided a semiconductor strip sawing system comprising: an on-loader unit for accommodating a plurality of semiconductor strips therein; a sawing machine for sawing the semiconductor strip into individual semiconductor packages as the semiconductor strip is transferred thereto from the on-loader unit; a cleaning unit for cleaning the semiconductor packages after the semiconductor strip is sawn into the semiconductor packages by the sawing machine; a strip picker movably installed between the on-loader unit and the sawing machine in order to transfer the semiconductor strip to the sawing machine by drawing the semiconductor strip from the on-loader unit; and a package picker movably installed between the sawing unit and the cleaning unit in order to transfer the semiconductor packages from the sawing unit to the cleaning unit, wherein the on-loader unit, the sawing machine and the cleaning unit are sequentially aligned in the system so that the semiconductor strip or the semiconductor package sequentially passes through the on-loader unit, the sawing machine and the cleaning unit according to a process order thereof.

According to another aspect of the present invention, there is provided a sawing and handler system for a semiconductor strip, the sawing and handler system comprising: an on-load section for accommodating a plurality of semiconductor strips therein; a sawing section for sawing the semiconductor strip into individual semiconductor packages as the semiconductor strip is transferred thereto from the on-load

section; a cleaning section for cleaning the semiconductor packages after the semiconductor strip is sawn into the semiconductor packages in the sawing section; a drying section for drying the semiconductor packages after the semiconductor packages are cleaned in the cleaning section; a vision inspection section for inspecting defects of the semiconductor packages after the semiconductor packages are dried in the drying section; and an off-load section for sorting and stacking the semiconductor packages according to an inspection result of the semiconductor packages in the vision inspection section, wherein the on-load section, the sawing section, the cleaning section, the drying section, the vision inspection section and the off-load section are sequentially aligned in the system, so that the semiconductor strip or the semiconductor package sequentially passes through the on-load section, the sawing section, the cleaning section, the drying section, and the vision inspection section according to a process order thereof and is stacked on the off-load section according to the inspection result of the semiconductor packages.

According to still another aspect of the present invention, there is provided a semiconductor strip sawing system comprising: an on-load unit for accommodating a plurality of semiconductor strips therein; a sawing machine, which is linearly moved in a predetermined direction and includes a chuck table provided at an upper surface thereof with a pair of mounting sections on which the semiconductor strip is alternately loaded, and a spindle provided at an end portion thereof with a sawing blade and moved relative to the chuck table in order to saw the semiconductor strip loaded on one of the mounting sections into individual semiconductor packages; a cleaning unit for cleaning the semiconductor packages after the semiconductor strip is sawn into the semiconductor packages by the spindle; a rotator picker including a body section movably installed between the on-loader unit and the sawing machine and a head section rotatably installed at a lower portion of the body section in order to transfer the semiconductor strip onto one of the mounting sections of the chuck table by picking up the semiconductor strip drawn from the on-loader unit using a vacuum; and a package picker movably installed between the sawing machine and the cleaning unit in order to transfer the semiconductor package loaded on one of the mounting sections of the chuck table into the cleaning section, wherein the on-loader unit, the sawing machine and the cleaning unit are sequentially aligned in the system so that the semiconductor strip or the semiconductor package sequentially passes through the on-loader unit, the sawing machine and the cleaning unit according to a process order thereof.

According to still yet another aspect of the present invention, there is provided a semiconductor strip sawing system comprising: an on-load unit for accommodating a plurality of semiconductor strips therein; a jig table installed at one side of an inlet rail guiding the semiconductor strip drawn from the on-loader unit in order to temporarily load the semiconductor strip thereon; a sawing machine, which is linearly moved in a predetermined direction and includes a chuck table provided at an upper surface thereof with a pair of mounting sections on which the semiconductor strip is alternately loaded, and a spindle provided at an end portion thereof with a sawing blade and moved relative to the chuck table in order to saw the semiconductor strip loaded on one of the mounting sections into individual semiconductor packages; a cleaning unit for cleaning the semiconductor packages after the semiconductor strip is sawn into the

semiconductor packages by the spindle; a rotator picker including a body section movably installed between the on-loader unit and the jig table and a head section rotatably installed at a lower portion of the body section in order to load the semiconductor strip onto the jig table by picking up the semiconductor strip drawn from the on-loader unit using a vacuum; and a strip/package picker movably installed between the jig table and the cleaning unit for loading the semiconductor strip onto one mounting section of the chuck table by picking up the semiconductor strip loaded on the jig table using a vacuum and simultaneously unloading the semiconductor package mounted on the other mounting section of the chuck table, wherein the on-loader unit, the jig table, the sawing machine and the cleaning unit are sequentially aligned in the system so that the semiconductor strip or the semiconductor package sequentially passes through the on-loader unit, the jig table, the sawing machine and the cleaning unit according to a process order thereof.

According to still yet another aspect of the present invention, there is provided a semiconductor strip sawing system comprising: an on-load unit for accommodating a plurality of semiconductor strips therein; an inlet rail installed at one side of the on-loader unit in order to guide the semiconductor strip drawn from the on-loader unit; a sawing machine, which is linearly moved in a predetermined direction and includes a chuck table provided at an upper surface thereof with a pair of mounting sections on which the semiconductor strip is alternately loaded, and a spindle provided at an end portion thereof with a sawing blade and moved relative to the chuck table in order to saw the semiconductor strip loaded on one of the mounting sections into individual semiconductor packages; a cleaning unit for cleaning the semiconductor packages after the semiconductor strip is sawn into the semiconductor packages by the spindle; a draw picker moved along the inlet rail in order to transfer the semiconductor strip towards the chuck table by drawing the semiconductor strip from the on-loader unit; and a strip/package picker movably installed between the inlet rail and the cleaning unit and including a strip picker head and a package picker head, which are rotatably installed to load the semiconductor strip onto one mounting section of the chuck table by picking up the semiconductor strip loaded on the inlet rail using a vacuum and to simultaneously unload the semiconductor package mounted on the other mounting section of the chuck table, wherein the on-loader unit, the inlet rail, the sawing machine and the cleaning unit are sequentially aligned in the system so that the semiconductor strip or the semiconductor package sequentially passes through the on-loader unit, the inlet rail, the sawing machine and the cleaning unit according to a process order thereof.

Brief Description of the Drawings

The foregoing and other objects, features and advantages of the present invention will become more apparent from the following detailed description when taken in conjunction with the accompanying drawings in which:

FIG. 1 is a plan view schematically illustrating a conventional sawing and handler system for manufacturing a semiconductor package;

FIG. 2 is a plan view schematically illustrating a proceeding path of a semiconductor strip in a

conventional sawing and handler system shown in FIG. 1;

FIG. 3 is a plan view schematically illustrating a sawing and handler system for manufacturing a semiconductor package according to a first embodiment of the present invention;

FIGS. 4a and 4b are perspective and front views illustrating an on-loader unit, a sawing unit and a cleaning unit shown in FIG. 3;

FIG. 5 is a perspective view illustrating a structure of a chuck table installed in a sawing machine shown in FIG. 3;

FIG. 6 is an exploded perspective view illustrating a cleaning unit shown in FIG. 3;

FIG. 7 is an exploded perspective view illustrating a drying unit shown in FIG. 3;

FIGS. 8a and 8b are sectional views illustrating the structure and operation of a draw picker shown in FIG. 3;

FIG. 9 is a plan view schematically illustrating a proceeding path of a semiconductor strip in a sawing and handler system shown in FIG. 3;

FIGS. 10a to 10g are views illustrating the process of loading a semiconductor strip, which is stacked on an on-loader unit, into a sawing machine in a sawing and handler system shown in FIG. 3;

FIGS. 11a to 11e are views illustrating a process for transferring a semiconductor strip into a cleaning unit, a drying unit and a vision inspection unit by unloading the semiconductor strip after a sawing process has been finished in a sawing and handler system shown in FIG. 3;

FIG. 12 is a plan view schematically illustrating a sawing and handler system for manufacturing a semiconductor package according to a second embodiment of the present invention;

FIG. 13 is a perspective view illustrating the structure of a chuck table installed in a sawing region according to a second embodiment of the present invention;

FIG. 14 is a plan view schematically illustrating a sawing and handler system for manufacturing a semiconductor package according to a third embodiment of the present invention;

FIGS. 15a to 15c are views illustrating the operational state of a sawing and handler system according to a third embodiment of the present invention;

FIG. 16 is a plan view schematically illustrating a sawing and handler system for manufacturing a semiconductor package according to a fourth embodiment of the present invention;

FIGS. 17a to 17d are views illustrating the operational state of a sawing and handler system according to a fourth embodiment of the present invention;

FIG. 18 is a plan view schematically illustrating a sawing and handler system for manufacturing a semiconductor package according to a fifth embodiment of the present invention; and

FIGS. 19a to 19d are views illustrating the operational state of a sawing and handler system according to a fifth embodiment of the present invention.

Best Mode for Carrying Out the Invention

In the following description of the present invention, the same reference numerals will be used for the same elements and detailed description of known functions and configurations incorporated herein will be omitted in order to avoid redundancy.

Hereinafter, a first embodiment of the present invention will be described with reference to accompanying drawings.

FIG. 3 is a plan view schematically illustrating a sawing and handler system for manufacturing a semiconductor package according to the first embodiment of the present invention, and FIGS. 4a and 4b are perspective and front views illustrating an on-loader unit, a sawing unit and a cleaning unit shown in FIG. 3.

As shown in FIGS. 3, 4a and 4b, the sawing and handler system according to the first embodiment of the present invention mainly includes an on-loader unit 100, a sawing machine 200, a cleaning unit 300, a drying unit 400, a vision inspection unit 500 and an off-loader unit 600. In addition, a strip picker 140 is movably installed between the on-loader unit 100 and the sawing machine 200 and a draw picker 150 is provided at one side of the strip picker 140. A package picker 250 is movably installed between the sawing machine 200 and the cleaning unit 300.

The on-loader unit 100 has a plurality of semiconductor strips to be sawn by means of the sawing machine 200. The on-loader unit 100 includes a magazine 110, in which a plurality of semiconductor strips are accommodated, a magazine transfer section for moving the magazine 110, and a pusher 130 for feeding one of the semiconductor strips accommodated in the magazine 110 to an inlet rail 160. The magazine transfer section includes a conveyer belt 124 driven by a pulley 122 to horizontally move the magazine 110 and an elevator 126 for moving the magazine 110 up and down. The structure and operation of the on-loader unit 100 are disclosed in Korean Patent Application No. 10-2000-0079282 in detail, so detailed description thereof will be omitted.

Since the on-loader unit 100 is installed at one side of the sawing machine 200, the semiconductor strip drawn from the on-loader unit 100 can be transferred to the sawing machine 200 within a short period time and the configuration of the system can be simplified as compared with the conventional system in which the on-loader unit is installed in front of the cleaning unit.

The inlet rail 160 is installed between the on-loader unit 100 and the sawing machine 200 in order to guide and align the semiconductor strip when the semiconductor has been drawn from the on-loader unit 100 by means of the draw picker 150. The inlet rail 160 includes a pair of rails for supporting and guiding both sides of the semiconductor strip. A width of the inlet rail 140 can be adjusted according to the width of the semiconductor strip by means of a driving device (not shown), such as a servo motor, in order to guide semiconductor strips having various widths.

Hereinafter, the structure of the sawing machine 200 will be described in detail with reference to accompanying drawings.

As shown in FIG. 3, the sawing machine 200 saws the semiconductor strip into a plurality of semiconductor packages as the semiconductor strip is transferred thereto from the on-loader unit 100. The

sawing machine 200 mainly includes a chuck table 210 and a spindle 230.

FIG. 5 shows the structure of the chuck table 210 according to one embodiment of the present invention. As shown in FIG. 5, the chuck table 210 includes a chuck transfer frame 212, which is movable in a horizontal direction along a chuck guide rail 220 extending in a Y-axis direction, and a chuck plate 216 rotatably installed on the chuck transfer frame 212. The chuck plate 216 is provided at an upper surface thereof with a mounting section 210 on which the semiconductor strip is mounted. The chuck table 218 is moved in a Y-axis direction by means of interaction between a ball screw 222 coupled to a servo motor (not shown) and a nut (not shown) screw-coupled with the ball screw 222 on the chuck transfer frame 212. The chuck plate 216 is rotated clockwise or counterclockwise by means of a driving motor 214 installed below the chuck plate 216.

The spindle 230 is used for sawing the semiconductor strip into a plurality of individual semiconductor packages, and a sawing blade 232 is rotatably installed at an end portion of the spindle 230. The spindle 230 is installed on a spindle guide rail 240 aligned perpendicularly to the chuck guide rail 220 in such a manner that the spindle 230 can move in an axial direction of the spindle guide rail 240. According to the preferred embodiment of the present invention, a pair of spindles 230 are provided in opposition to each other in order to improve the sawing speed for the semiconductor strip. The spindles 230 can be moved up and down or can be moved to/from the chuck table 210 by means of a driving unit including a servo motor, a ball screw and a nut.

The sawing machine 200 performs the sawing process for the semiconductor strip as follows. First, when the semiconductor strip has been loaded on the mounting section 218 of the chuck plate 216, the chuck plate 216 rotates at an angle of 90° and moves back towards the spindle 230 along the chuck guide rail 220 extending in the Y-axis direction. Then, the semiconductor strip is aligned by means of a predetermined vision inspection unit (not shown) and is sawn into a plurality of individual packages by means of the spindle 230. That is, the sawing blade 232 of the spindle 230 rotates at a high speed while moving in the X-axis direction with a predetermined interval and the chuck table 210 moves in the Y-axis direction so that the semiconductor strip is sawn into individual packages by the spindle 230. When the semiconductor strip has been sawn into the individual packages, the chuck table 210 returns to the initial position thereof in order to unload the individual packages.

Hereinafter, description will be made in relation to the cleaning unit 300 with reference to accompanying drawings.

FIG. 6 is an exploded perspective view illustrating the cleaning unit 300 according to the present invention. As shown in FIG. 6, the cleaning unit 300 is provided to wash the semiconductor packages sawn by the spindle 230 and includes a chamber 310, a nozzle support section 320, water spray nozzles 322, air spray nozzles 324 and a nozzle driving section 330.

The chamber 310 is formed at an upper surface thereof with an opening 312 extending lengthwise along the chamber 310 and a hole 314 is formed at both sidewalls of the chamber 310. In addition, a mesh

net 316 is installed at a bottom of the chamber 310 in order to collect chip segments attached to the semiconductor packages during the sawing process. A drain hole (not shown) is formed below the mesh net 316.

The nozzle support section 320 is disposed below the opening 312 and extends lengthwise corresponding to the opening 312. A rotating shaft 326, which is inserted into the hole 314, is provided at both side ends of the nozzle support section 320. A plurality of water spray nozzles 322 and air spray nozzles 324 are installed on the upper surface of the nozzle support section 320. The water spray nozzles 322 may spray cleaning water onto the semiconductor packages and the air spray nozzles 324 may spray air onto the semiconductor packages. The water spray nozzles 322 and air spray nozzles 324 are rotated at a predetermined spray angle in the chamber 310 in order to selectively spray cleaning water or air onto the semiconductor packages.

The nozzle driving section 330 includes a first rotary cylinder 332 fixed to the chamber 310 in order to supply power, a driving gear 333 coupled to a rotating shaft of the first rotary cylinder 332, a driven gear 334 coupled to the rotating shaft 326 of the nozzle support section 320, a power transmission belt 336 coupled with the driving gear 333 and the driven gear 334 in order to transfer driving power of the driving gear 333 to the driven gear 334, and a casing 338 for covering the power transmission belt 336.

Although it is illustrated that the water spray nozzles 322 and the air spray nozzles 324 may rotate at a predetermined angle when the nozzle support section 320 is rotated by means of the nozzle driving section 330, the present invention is not limited thereto. For instance, a rotating mechanism capable of directly rotating the water spray nozzles 322 and the air spray nozzles 324 can be provided in the system. In addition, besides the gear/power transmission belt assembly, various rotating mechanisms, such as a sprocket wheel/chain assembly or a pulley/belt assembly, can be used for the nozzle driving section 330.

In the meantime, in order to improve the cleaning efficiency, a brush (not shown) for brushing the semiconductor packages secured to the package picker 250 can be further provided in the system. Preferably, the brush is installed between the chuck table 210 and the cleaning unit 300. In this case, a brush drive unit (not shown) can be provided to horizontally move the brush. Such a brush drive unit includes a pneumatic cylinder or a ball screw (not shown) and a movable nut (not shown) connected to a servo motor. In addition, the brush can be equipped with a water spray nozzle in order to improve the efficiency of the brush.

The water spray nozzles 322 and the air spray nozzles 324 can simultaneously spray cleaning water and air onto the semiconductor packages or can spray cleaning water and air in turns at a predetermined interval.

As mentioned above, the cleaning unit 300 performs the cleaning process while rotating the water spray nozzles 322 at a predetermined angle, thereby rapidly cleaning the semiconductor packages. In addition, the cleaning unit 300 includes the air spray nozzles 324 in addition to the water spray nozzle 322, so the cleaning unit 300 can spray strong air onto the semiconductor packages together with or alternately

with cleaning water so that the cleaning and drying efficiency of the cleaning unit 300 can be improved.

Hereinafter, description will be made in relation to the drying unit 400 with reference to accompanying drawings.

FIG. 7 is an exploded perspective view illustrating the drying unit 400 according to the first embodiment of the present invention. As shown in FIG. 7, the drying unit 400 is provided to dry the semiconductor packages after the cleaning process has been finished. To this end, the drying unit 400 mainly includes a transfer frame 410, a heater 420 and a horizontal transfer device.

The transfer frame 410 is provided at an upper surface thereof with a package mounting section 412, on which the semiconductor package is loaded, and a vacuum hole (not shown) is formed in the package mounting section 412 in order to securely load the semiconductor package on the package mounting section 412 by applying suction force to the semiconductor package through the vacuum hole. A guide member 414 is provided at a lower end portion of the transfer frame 410. The guide member 414 is coupled with a guide rail 442 installed on a support frame 440 so that the guide member 414 moves along the guide rail 442. In addition, a vacuum path (not shown) can be formed in the transfer frame 410 in order to remove humidity by using high-pressure vacuum.

The heater 420 generates heat in order to dry the semiconductor packages. According to the preferred embodiment of the present invention, the heater 420 includes two heating wires. However, the number, structure and heating value of the heating wires can be variously selected according to working environment thereof.

The horizontal transfer device includes a second rotary cylinder 432, a pinion 433 and a rack 434. The second rotary cylinder 432 is installed at a lower portion of the transfer frame 410 in order to apply rotational force to the pinion 433. The pinion 433 is coupled with a rotating shaft of the second rotary cylinder 432 and the rack 434 is installed on the support frame 440 in such a manner that the rack 434 can engage with the pinion 433. In this state, if the second rotary cylinder 432 is driven, the transfer frame 410 is horizontally moved along the guide rail 442.

Various horizontal transfer mechanisms can be used for the horizontal transfer device. For instance, the horizontal transfer device may include a ball screw connected to a driving motor and a nut screw-coupled with the ball screw. In this case, the ball screw is installed at one side of the support frame 440 in parallel to the guide rail and the nut is installed at one side of the transfer frame 410 so that the transfer frame 410 can be horizontally moved by means of interaction between the ball screw and the nut.

The drying unit 400 dries the semiconductor package loaded on the drying unit 400 while moving towards the vision inspection unit 500, so the semiconductor package can be transferred to the vision inspection unit 500 within the short period of time. Accordingly, the processing speed of the system can be significantly improved.

Hereinafter, the structure and operation of the strip picker 140 and the package picker 250 will be described with reference to accompanying drawings.

As shown in FIGS. 3 and 4, the strip picker 140 picks up the semiconductor strip by using a vacuum and loads the semiconductor strip onto the chuck table 210. To this end, the strip picker 140 includes a body section 142 and a head section 144 for picking up the semiconductor strip by using a vacuum. A draw picker 150 is installed at one side of the strip picker 140 in order to draw the semiconductor strip from the on-loader unit 100. In addition, a draw picker driving section 146 is provided in order to move the draw picker 140 up and down.

In addition, the package picker 250 picks up individual semiconductor packages after the semiconductor strip has been sawn into a plurality of individual semiconductor packages by means of the spindle 230 and transfers the individual semiconductor packages to the cleaning unit 300 and the drying unit 400. To this end, the package picker 250 includes a body section 252 and a head section 254 for picking up the semiconductor packages by using a vacuum.

The strip picker 140 is movable between the on-loader unit 100 and the sawing machine 200 and the package picker 250 is movable among the sawing machine 200, the cleaning unit 300 and the driving unit 400. In addition, the strip picker 140 and the package picker 250 can be moved up and down.

Since the strip picker 140 is driven separately from the package picker 250 by means of a separate picker driving section, the semiconductor strip can be easily loaded in the system or unloaded from the system. In other words, because the strip picker 140 and the package picker 250 can be moved separately from each other, the strip picker 140 plays the role of loading the semiconductor strip onto the chuck table 210 such that the semiconductor strip is sawn into a plurality of semiconductor packages and the package picker 250 plays the role of picking up the semiconductor packages from the chuck table 210 and transferring the semiconductor packages to the cleaning unit 300 and the drying unit 400. Upon picking up the semiconductor packages, the package picker 250 instantly transfers the semiconductor packages to the cleaning unit 300, so it is not necessary for the package picker 250 to wait for a predetermined period of time until the strip picker 140 loads a new semiconductor strip onto the chuck table 210. Thus, the process efficiency of the system can be improved. Various horizontal transfer mechanisms, such as a ball screw/nut assembly or a belt/pulley assembly, can be selectively used as the picker driving section according to working environment thereof.

Preferably, the head section 254 of the package picker 250 protrudes from the body section 252 towards the drying unit 400. That is, since the picker guide rail 260 for guiding the package picker 250 is installed separately from the guide rail 530 for guiding a transfer picker 520 aligned in the vision inspection region, the head section 254 of the package picker 250 protrudes from the body section 252 towards the drying unit 400 in order to allow the package picker 250 to easily transfer the semiconductor packages to the drying unit 400 after the cleaning process has been finished. However, the above configuration is not necessary if the picker guide rail 260 installed in a sawing region slightly extends towards the vision inspection region.

In addition, an air spray nozzle (not shown) can be installed in the head section 254 of the package

picker 250. The air spray nozzle is an auxiliary drying device, which cooperates with the drying unit 400 for rapidly drying the semiconductor package when the cleaning process has been finished.

Hereinafter, the structure and operation of the draw picker 150 will be described in detail with reference to accompanying drawings.

FIGS. 8a and 8b are sectional views illustrating the structure and operation of the draw picker 150. The draw picker 150 draws the semiconductor strip from the on-loader unit 100. To this end, the draw picker 150 includes a body section 152, a gripper driving section, an upper gripper 156 and a lower gripper 157. According to the preferred embodiment of the present invention, the gripper driving section includes a pneumatic cylinder 154.

The upper gripper 156 is fixed to a tip of a rod of the pneumatic cylinder 154 and the lower gripper 157 is fixed to a lower end portion of the body section 152 in opposition to the upper gripper 156. Accordingly, as the pneumatic cylinder 154 operates, the upper gripper 156 grips the semiconductor strip while moving relative to the lower gripper 157. A grip member 158 having a high coefficient of friction is attached to a lower surface of the upper gripper 156 in order to prevent the semiconductor strip from slipping out of the upper gripper 156 when the upper gripper 156 grips the semiconductor strip.

It is also possible to design the draw picker 150 such that the lower gripper 157 grips the semiconductor strip while moving relative to the upper gripper 156. In this case, the grip member is attached not only to the lower surface of the upper gripper 156, but also to an upper surface of the lower gripper 157.

Since the draw picker 150 is directly installed in a strip feeding route of the strip picker 140, the draw picker 150 can draw the semiconductor strip into the inlet rail 160 according to the movement of the strip picker 140 without using a separate driving source therefor. In addition, the draw picker 150 can be moved up and down relative to the strip picker 140 according to an operation of the draw picker driving section 146 installed on the strip picker 140. The reason why the draw picker 150 moves up and down relative to the strip picker 140 is to make the strip picker 140 not interfere with the inlet rail 160 and the chuck table 210.

Alternately, the draw picker 150 can be fixedly installed without being moved up and down relatively to the strip picker 140. In this case, since a space is formed at a center of the inlet rail 160, the draw picker 150 is installed at a position slightly lower than the lower end of the strip picker 140 corresponding to the space of the inlet rail 160 and the shape of the draw picker 150 or the chuck table 210 is modified in such a manner that the draw picker 150 may not interfere with the chuck table 210.

The draw picker 150 having the above structure may move together with the strip picker 140, so that it is possible to omit the horizontal transfer device used for moving the draw picker 150 to draw the semiconductor strip from the on-loader unit, thereby simplifying the structure of the system.

The vision inspection unit 500 inspects defects of the semiconductor packages after the drying process has been completed by means of the drying unit 400. The vision inspection unit 500 includes an upper vision inspection section 540 for inspecting an upper surface of the semiconductor package and a

lower vision inspection section 550 for inspecting a lower surface of the semiconductor package. The off-loader unit 600 sorts the semiconductor packages according to the quality thereof based on the inspection result of the upper and lower vision inspection sections 540 and 550 and unloads the semiconductor packages. The above components are similar to those of the prior art, so they will not be further described below.

According to the present invention, the transfer picker 520, which transfers the semiconductor packages from the drying unit 400 to the turn table 510 for vision inspection after the drying process has been finished, and a tray picker 620, which unloads the tray 610 having the semiconductor packages or loads a new tray 610 after the vision inspection process has been finished, are independently moved in the vertical or horizontal direction by means of separate pickier driving sections. Therefore, while the dried semiconductor packages are being transferred to the turn table 510 from the drying unit 400 by means of the transfer picker 520, the tray picker 620 performs its own functions separately from transfer work of the transfer picker 520, so the process speed can be significantly improved.

As described above, according to the first embodiment of the present invention, the on-loader unit 100, the inlet rail 160, the strip picker 140, the package picker 250, the cleaning unit 300 and the drying unit 400, which are installed adjacent to the handler apparatus in the conventional sawing and handler system, are installed adjacent to the sawing machine 200. That is, the on-loader unit 100, the inlet rail 160, the strip picker 140, and the draw picker 150, which may perform works for stacking the semiconductor strips and on-loading the semiconductor strip into the sawing machine 200, are provided in the inlet section of the sawing machine 200 and the package picker 250, the cleaning unit 300 and the drying unit 400 are provided in the outlet section of the sawing machine, so that the components of the sawing and handler system according to the present invention can be sequentially aligned in the proceeding direction of the semiconductor strip/semiconductor package according to the process order for the semiconductor strip/semiconductor package. Thus, the components of the handler apparatus can be efficiently aligned, so the UPH (unit per hour) of the sawing and handler system can be significantly improved.

Hereinafter, the operation of the sawing and handler system for manufacturing the semiconductor package according to the first embodiment of the present invention will be described with reference to accompanying drawings.

FIG. 9 is a plan view schematically illustrating a proceeding path of the semiconductor strip/package in the sawing and handler system according to the first embodiment of the present invention. The following description will be made in relation to the proceeding path of the semiconductor strip S/package P with reference to FIG. 9.

First, the semiconductor strip S stacked on the on-loader unit 100 is transferred to the sawing machine 200 through the inlet rail 160 so that the semiconductor strip S is sawn into a plurality of semiconductor packages P. The semiconductor packages P are washed by means of the cleaning unit 300 and dried by means of the drying unit 400. Then, the semiconductor packages P are transferred to the vision

inspection unit 500, and then the vision inspection unit 500 inspects defects of the semiconductor packages P. After the vision inspection process has been finished, the semiconductor packages P are sorted according to the quality thereof based on the inspection result of the vision inspection unit 500. After that, the semiconductor packages P are transferred to the off-loader unit 600.

Hereinafter, the process for loading the semiconductor strip S stacked on the on-loader unit 100 into the sawing machine 200 will be described.

FIGS. 10a to 10g are views illustrating the process of loading the semiconductor strip S, which is stacked on the on-loader unit 100, into the sawing machine 200 in the sawing and handler system according to the present invention.

First, the magazine 110 having a plurality of semiconductor strips S is horizontally transferred along a rail and is moved up, by the elevator, to the position corresponding to the inlet rail 160. In this state, the pusher 130 pushes one of the semiconductor strips S stacked in the magazine 110 towards the inlet rail 160. At this time, the draw picker 150 installed in the strip picker 140 is maintained in a lower portion of the strip picker 150 (see, FIGS. 10a and 10b).

When the semiconductor strip S has been fed into the inlet rail 160, the draw picker 150 moves towards the semiconductor strip S and grips one side of the semiconductor strip S. Since the draw picker 150 is directly installed on the side of the strip picker 140, the draw picker 150 can be horizontally moved together with the strip picker 140. Then, the strip picker 140 horizontally moves to the strip pickup position together with the draw picker 150 gripping the semiconductor strip S. In the strip pickup position, the draw picker 150 loads the semiconductor strip S on the inlet rail 160 (see, FIGS. 10c and 10d).

Then, when the draw picker 150 has been moved upwards by a predetermined distance, the strip picker 140 moves above the semiconductor strip S and the head section 144 of the strip picker 140 is moved down in order to pick up the semiconductor strip S by using a vacuum. After picking up the semiconductor strip S, the head section 144 of the strip picker 140 is moved upwards and the strip picker 140 is horizontally moved along the picker guide rail 260 so that the strip picker 140 is positioned above the chuck table 210. Then, the head section 144 of the strip picker 140 is moved down onto the upper surface of the chuck table. At this time, vacuum applied to the semiconductor strip S is released so that the semiconductor strip S is loaded on the mounting section of the chuck table 210 (see, FIGS. 10e, 10f and 10g).

As the semiconductor strip S has been rested on the chuck table 210, the chuck table 210 rotates at an angle of 90° and horizontally moves towards the spindle 230. Then, the vision inspection unit (not shown) inspects the alignment state of the semiconductor strip S. After the alignment error of the semiconductor strip S has been corrected according to the inspection result of the vision inspection unit, the semiconductor strip S is sawn widthwise and lengthwise thereof due to the relative movement between the spindle 230 and the chuck table 210, so that the semiconductor strip S is divided into a plurality of semiconductor packages.

While the semiconductor strip S is being sawn into the individual semiconductor packages P by

means of the spindle 230, a new semiconductor strip S is drawn from the on-loader unit 100 and waits for the next process as shown in FIG. 10f.

Hereinafter, unloading, cleaning, drying and vision inspection processes for the semiconductor package P after the sawing process will be described.

FIGS. 11a to 11e are views illustrating the process for transferring the semiconductor strip into the cleaning unit, the drying unit and the vision inspection unit by unloading the semiconductor strip after the sawing process in the sawing and handler system shown in FIG. 3.

When the semiconductor strip S has been sawn into the semiconductor packages P, the chuck table 210 horizontally moves into an unloading position of the semiconductor package P (that is, the loading position of the semiconductor strip S). As the chuck table 210 moves into the unloading position, the package picker 250 moves towards the upper surface of the chuck table 210 and picks up the semiconductor package P by using a vacuum. Then, the package picker 250 transfers the semiconductor package P to a position above the cleaning unit 300. At this time, it is preferred to unload the semiconductor package P by means of the package picker 250 while allowing the chuck table 210 to maintain the state rotated at an angle of 90° from the initial state thereof, which is different from the state of the chuck table 210 waiting for the semiconductor strip S transferred from the strip picker 140. This can make the cleaning unit 300 and the drying unit 400 for cleaning and drying the individual semiconductor packages P be aligned in the Y-axis direction of the system, so the structure of the system can be simplified in the X-axis direction thereof.

After that, the semiconductor package P transferred to the position above the cleaning unit 300 by means of the package picker 250 is moved down, so that the semiconductor package P closely makes contact with the opening 312 formed in the upper portion of the chamber 310 of the cleaning unit 300. Then, the water spray nozzle 322 installed in the cleaning unit 300 sprays water onto the semiconductor package P while rotating at a predetermined spray angle. In addition, air is sprayed onto the semiconductor package P by means of the air spray nozzle 324, thereby preliminarily removing water attached to the semiconductor package P (see, FIG. 6). According to the present invention, the water spray nozzle 322 and the air spray nozzle 324 can spray water and air onto the semiconductor package P at various spray angles, so chips or impurities attached to the semiconductor package P can be easily removed within the short period of time (see, FIGS. 11a and 11b).

After the cleaning process has been finished, the package picker 250 moves towards the drying unit 400 and loads the semiconductor package P onto the mounting section of the drying unit 400. At this time, since the head section 254 of the package picker 250 protrudes towards the drying unit 400 from the body section 252 of the package picker 250, the semiconductor package P can be easily loaded on the mounting section of the drying unit 400 (see, FIG. 11c).

As the semiconductor package P has been loaded on the mounting section of the drying unit 400, the drying unit 400 dries the semiconductor package P while moving towards the turn table 510 by means of the horizontal transfer device. If the semiconductor package P has been dried while the drying unit 400 is

being moved, the transfer picker 520 picks up the semiconductor package P from the drying unit 400 and transfers the semiconductor package P to the turn table 510 (see, FIGS. 11d and 11e).

After that, the vision inspection unit 500 inspects the vision of the semiconductor package P and the semiconductor packages P are sorted according to the quality thereof based on the inspection result of the vision inspection unit 500 and are stacked on the off-loader unit 600.

Hereinafter, a sawing and handler system for manufacturing a semiconductor package according to a second embodiment of the present invention will be described in detail with reference to accompanying drawings.

FIG. 12 is a plan view schematically illustrating the sawing and handler system for manufacturing the semiconductor package according to the second embodiment of the present invention, and FIG. 13 is a perspective view illustrating the structure of a chuck table provided in the sawing and handler system shown in FIG. 12.

Similarly to the first embodiment of the present invention, the sawing and handler system according to the second embodiment of the present invention mainly includes an on-loader unit 100, a sawing machine 200, a cleaning unit 300, a drying unit 400, a vision inspection unit 500 and an off-loader unit 600.

However, according to the second embodiment of the present invention, a pair of mounting sections 218 are provided on the chuck plate 216 of the chuck table 210 installed in the sawing machine 200. In addition, the head section of the strip picker 140 and the head section of the package picker 250 are moved along extension lines of the mounting sections 218 in parallel to each other without moving in the same line. Accordingly, the installation structure of the strip picker 140 and the package picker 250 according to the second embodiment of the present invention is different from that of the strip picker and the package picker according to the first embodiment of the present invention. In addition, processes for loading the semiconductor strip S onto the chuck table 210 of the sawing unit 200, sawing the semiconductor strip S in the sawing machine 200 and unloading individual semiconductor packages P according to the second embodiment of the present invention are different from those of the first embodiment of the present invention. Thus, the following description will be focused on parts different from those of the first embodiment of the present invention.

As shown in FIGS. 12 and 13, the chuck table 210 includes the chuck transfer frame 212, which is movable in a horizontal direction along the chuck guide rail 220, and the chuck plate 216 rotatably installed on the chuck transfer frame 212. The chuck plate 216 is provided at an upper surface thereof with a pair of mounting sections 218 on which the semiconductor strip is mounted.

In addition, the ceiling member of the system forwardly extends when viewed from a plan view and the picker guide rail 260 is installed below the ceiling member so that the strip picker 140 and the package picker 250 can move along the extension lines of the mounting sections 218, respectively. In the meantime, guide rails for guiding the package picker 250 and the strip picker 140 can be installed, respectively.

According to the present invention, the moving route of the head section of the strip picker 140 is

different from that of the head section of the package picker 250, so the rotating angle and the rotating direction of the chuck plate 216 of the chuck table 210 must be properly adjusted. That is, when unloading the semiconductor packages P after the sawing process has been finished, the chuck plate 216 must maintain the state rotated at an angle of 180° from the initial state waiting for the semiconductor strip S. In this case, the strip picker 140 can simultaneously load the semiconductor strip S when the package picker 250 unloads the semiconductor packages P. Such a method of controlling the chuck plate 216 is disclosed in PCT/KR2004/002189 filed by applicant of the present invention, so it will not be further described below.

According to the second embodiment of the present invention, loading work for the semiconductor strip S by means of the strip picker 140 is carried out simultaneously with unloading work for the semiconductor packages P by means of the package picker 250, so the sawing and handler system according to the second embodiment of the present invention can improve the process speed for the semiconductor strip as compared with that of the first embodiment of the present invention.

Hereinafter, a sawing and handler system for manufacturing a semiconductor package according to a third embodiment of the present invention will be described in detail with reference to accompanying drawings.

FIG. 14 is a plan view schematically illustrating the sawing and handler system for manufacturing the semiconductor package according to the third embodiment of the present invention.

Similarly to the second embodiment of the present invention, the sawing and handler system according to the third embodiment of the present invention mainly includes an on-loader unit 100, a sawing machine 200 and a cleaning unit 300. The sawing machine 200 includes a chuck table 210, which is linearly movable in a predetermined direction and on which a pair of mounting sections 218 are provided in order to mount the semiconductor strip thereon, and a spindle 230, which moves relative to the chuck table 210 in order to saw the semiconductor strip loaded on the mounting sections 218 into a plurality of individual semiconductor packages.

However, the sawing and handler system according to the third embodiment of the present invention includes a rotator picker 180 instead of the strip picker of the second embodiment of the present invention. The rotator picker 180 draws the semiconductor strip from the on-loader unit 100 in order to transfer the semiconductor strip onto one of the mounting sections 218 of the chuck table 210. The rotator picker 180 includes a body section 182 movable along the picker guide rail 260 and a head section 184 rotatably installed at a lower portion of the body section 182 in order to pick up the semiconductor strip and to transfer the semiconductor strip onto one of the mounting sections 218 of the chuck table 210. In addition, the draw picker 150 is installed at one side of the head section 184 of the rotator picker 180 in order to draw the semiconductor strip stacked on the on-loader unit 100.

In addition, the sawing and handler system according to the third embodiment of the present invention includes a package picker 250, which picks up individual semiconductor packages by using a vacuum and transfers the semiconductor packages to the cleaning unit 300. Differently from the package

picker according to the first and second embodiments of the present invention, the package picker 250 according to the third embodiment of the present invention extends in the Y-axis direction of the system and is biased in the left direction in the figure.

The rotator picker 180 is movable between the on-loader unit 100 and the chuck table 210 and the package picker 250 is movable among the chuck table 210, the cleaning unit 300 and the drying unit (not shown in FIG. 14). In addition, the rotator picker 180 and the package picker 250 can be moved up and down in order to pick up the semiconductor strip and the semiconductor packages by using a vacuum.

Hereinafter, the operation of the sawing and handler system according to the third embodiment of the present invention will be described.

It should be noted that insertion holes and vacuum holes formed in the mounting sections 218 of the chuck table 210 are omitted for the purpose of convenience and reference numerals S and P represent the semiconductor strip and individual semiconductor packages, respectively.

FIGS. 15a to 15c are views illustrating the operational state of the sawing and handler system according to the third embodiment of the present invention.

FIG. 15a shows the chuck table 210 when it returns to the initial position thereof after the sawing process for the semiconductor strip has been finished. At this time, the left mounting section 218 of the chuck table 210 is empty and the right mounting section 218 of the chuck table 210 has the semiconductor package loaded thereon. In this state, the rotator picker 180 picks up the semiconductor strip S from the inlet rail 160 and rotates counterclockwise at an angle of 90°, thereby loading the semiconductor strip S onto the left mounting section 218 of the chuck table 210. At the same time, the package picker 250 unloads the semiconductor package P mounted on the right mounting section 218 of the chuck table 210 by picking up the semiconductor package P using a vacuum (see, FIG. 15b).

Then, the rotator picker 180 moves towards the on-loader unit 100 in order to pick up a new semiconductor strip and the package picker 250 moves towards the cleaning unit 300 while gripping the semiconductor packages P. In addition, the chuck table 210 equipped with the new semiconductor strip S moves towards the spindle 230 (see, FIG. 15c).

When the sawing process for the semiconductor strip S has been finished, as shown in FIG. 15a, the chuck table 210 rotates at an angle of 180° to return to its initial position. Since the chuck table 210 rotates at an angle of 180°, loading work for the semiconductor strip S onto the chuck table 210 by means of the rotator picker 180 can be carried out simultaneously with unloading work for the semiconductor packages P from the chuck table 210 by means of the package picker 250.

As mentioned above, according to the third embodiment of the present invention, the rotator picker 180 rotates the semiconductor strip S at an angle of 90° such that the semiconductor strip S being transferred along a length direction thereof can be transferred along a width direction thereof, so loading work for the semiconductor strip S onto the chuck table and unloading work for the semiconductor package P from the chuck table can be achieved at a high speed without changing the structure of the sawing and handler

system. In addition, since the semiconductor strip can be transferred along the width direction thereof, the width of the sawing and handler system can be significantly reduced.

Hereinafter, a sawing and handler system for manufacturing a semiconductor package according to a fourth embodiment of the present invention will be described in detail with reference to accompanying drawings.

FIG. 16 is a plan view schematically illustrating the sawing and handler system for manufacturing the semiconductor package according to the fourth embodiment of the present invention.

Similarly to the second embodiment of the present invention, the sawing and handler system according to the fourth embodiment of the present invention mainly includes an on-loader unit 100, a sawing machine 200 and a cleaning unit 300. The sawing machine 200 includes a chuck table 210 having a pair of mounting sections 218 and a spindle 230 having a sawing blade 232.

In addition, the sawing and handler system according to the fourth embodiment of the present invention includes a rotator picker 180 identical to that of the third embodiment of the present invention and a jig table 170 for temporarily storing the semiconductor strip. Furthermore, the sawing and handler system according to the fourth embodiment of the present invention includes a strip/package picker 190 instead of the package picker according to the second embodiment of the present invention in order to simultaneously perform loading work for the semiconductor strip and unloading work for the semiconductor packages.

The basic structure of the rotator picker 180 according to the fourth embodiment of the present invention is substantially identical to that of the third embodiment of the present invention. However, although the rotator picker according to the third embodiment of the present invention is movably installed between the on-loader unit 100 and the chuck table 210 in such a manner that the rotator picker draws the semiconductor strip from the on-loader unit 100 and loads the semiconductor strip on one of the mounting sections 218 of the chuck table 210, the rotator picker 180 according to the fourth embodiment of the present invention is movably installed between the on-loader unit 100 and the jig table 170 in such a manner that the rotator picker 180 draws the semiconductor strip from the on-loader unit 100 and temporarily loads the semiconductor strip on the jig table 170.

The jig table 170 is installed at one side of the inlet rail 160 and plays the role of temporarily storing the semiconductor strip drawn from the on-loader unit 100 before the semiconductor strip is transferred to the chuck table 210. The jig table 170 is provided at an upper surface thereof with a mounting section 172 for loading the semiconductor strip thereon. In addition, the jig table 170 is formed at one side thereof with a recess 174 into which one end of the inlet rail 160 is inserted.

The strip/package picker 190 picks up the semiconductor strip from the jig table 170 by using a vacuum and loads the semiconductor strip on one mounting section 218 of the chuck table 210. At the same time, the strip/package picker 190 unloads the semiconductor package mounted on the other mounting section 218 of the chuck table 210 by picking up the semiconductor package using a vacuum. The strip/package picker 190 includes a body section 192 movable along the picker guide rail 260. In addition, a

strip picker head 144 for loading the semiconductor strip onto the chuck table 210 by picking up the semiconductor strip using a vacuum and a package picker head 254 for unloading the semiconductor package from the chuck table 210 by picking up the semiconductor package using a vacuum are installed at a lower portion of the body section 192 of the strip/package picker 190 in parallel to each other. The strip/package picker 190 is movable between the jig table 170 and the cleaning unit 300.

Hereinafter, the operation of the sawing and handler system according to the fourth embodiment of the present invention will be described.

FIGS. 17a to 17d are views illustrating the operational state of the sawing and handler system according to the fourth embodiment of the present invention.

FIG. 17a shows the chuck table 210 when it returns to the initial position thereof after the sawing process for the semiconductor strip has been finished. At this time, the left mounting section 218 of the chuck table 210 is empty and the right mounting section 218 of the chuck table 210 has the semiconductor package P loaded thereon. In addition, the rotator picker 180 temporarily loads the new semiconductor strip S drawn from the on-loader unit 100 on the jig table 170.

In this state, the strip/package picker 190 moves in the left direction in FIG. 17a and picks up the semiconductor strip S from the jig table 170 by using the strip picker head 144. Then, the strip/package picker 190 moves to the chuck table 210. When the strip/package picker 190 is positioned above the chuck table 210, the strip picker head 144 loads the semiconductor strip S on one mounting section 218 of the chuck table 210. At the same time, the package picker head 254 unloads the semiconductor package P mounted on the other mounting section 218 of the chuck table 210 by picking up the semiconductor package P using a vacuum (see, FIGS. 17b and 17c).

Then, the rotator picker 180 picks up the new semiconductor strip S by using a vacuum and temporarily loads the new semiconductor strip S on the jig table 170. And the strip/package picker 190 moves towards the cleaning unit 300 while gripping the semiconductor package P. In addition, the chuck table 210 equipped with the new semiconductor strip S moves towards the spindle 230 (see, FIG. 17d).

Similarly to the third embodiment of the present invention, the chuck table 210 rotates at an angle of 180° to return to its initial position after the sawing process has been finished (see, FIG. 17a).

As described above, according to the fourth embodiment of the present invention, the rotator picker 180 plays the role of temporarily loading the semiconductor strip on the jig table 170 and the strip/package picker 190 plays the role of loading the semiconductor strip and unloading the semiconductor packages. Therefore, loading work for the semiconductor strip S onto the chuck table and unloading work for the semiconductor package P from the chuck table can be achieved at a high speed. In addition, since one end of the inlet rail 160 is inserted into the recess 174 formed at the side of the jig table 170, the width of the sawing and handler system can be significantly reduced.

Hereinafter, a sawing and handler system for manufacturing a semiconductor package according to a fifth embodiment of the present invention will be described with reference to accompanying drawings.

FIG. 18 is a plan view schematically illustrating the sawing and handler system for manufacturing the semiconductor package according to the fifth embodiment of the present invention.

Similarly to the fifth embodiment of the present invention, the sawing and handler system according to the fifth embodiment of the present invention mainly includes an on-loader unit 100, a sawing machine 200 and a cleaning unit 300. The sawing machine 200 includes a chuck table 210 having a pair of mounting sections 218 and a spindle 230 having a sawing blade 232.

However, the sawing and handler system according to the fifth embodiment of the present invention only has the draw picker 150 for drawing the semiconductor strip from the on-loader unit 100 without the strip picker according to the second embodiment of the present invention. In addition, similarly to the fourth embodiment of the present invention, the sawing and handler system according to the fifth embodiment of the present invention includes the strip/package picker 190 capable of simultaneously loading the semiconductor strip and unloading the semiconductor package.

The basic structure of the draw picker 150 is substantially identical to that of the first embodiment (see, FIGS. 8a and 8b), except that the draw picker 150 according to the fifth embodiment of the present invention can transfer the semiconductor strip towards the chuck table 210 by drawing the semiconductor strip from the on-loader unit 100. In addition, the draw picker 150 is movable along a draw guide rail 151 extending along the inlet rail 160.

The basic structure of the strip/package picker 190 is substantially identical to that of the fourth embodiment, except that the strip picker head 144 and the package picker head 254 are rotatably installed at the lower portion of the body section 192 of the strip/package picker 190.

Hereinafter, the operation of the sawing and handler system according to the fifth embodiment of the present invention will be described.

FIGS. 19a to 19d are views illustrating the operational state of the sawing and handler system according to the fifth embodiment of the present invention.

FIG. 19a shows the chuck table 210 when it returns to the initial position thereof after the sawing process for the semiconductor strip has been finished. At this time, the left mounting section 218 of the chuck table 210 is empty and the right mounting section 218 of the chuck table 210 has the semiconductor package P loaded thereon. In addition, the draw picker 150 transfers the new semiconductor strip S towards the chuck table 210 along the inlet rail 160 by drawing the new semiconductor strip S from the on-loader unit 100.

In this state, the strip/package picker 190 moves in the left direction in FIG. 19a while rotating counterclockwise at an angle of 90°, thereby picking up the semiconductor strip S from the inlet rail 160 by using the strip picker head 144. Then, the strip/package picker 190 moves to the chuck table 210. When the strip/package picker 190 is positioned above the chuck table 210, the strip picker head 144 loads the semiconductor strip S on one mounting section 218 (empty mounting section 218) of the chuck table 210. At the same time, the package picker head 254 unloads the semiconductor package P mounted on the other

mounting section 218 of the chuck table 210 by picking up the semiconductor package P using a vacuum (see, FIGS. 19b and 19c).

Then, the draw picker 150 draws the new semiconductor strip S and transfers the new semiconductor strip S towards the chuck table 210 and the strip/package picker 190 moves towards the cleaning unit 300 while gripping the semiconductor package P. In addition, the chuck table 210 equipped with the new semiconductor strip S moves towards the spindle 230 (see, FIG. 19d).

Similarly to the third embodiment of the present invention, the chuck table 210 rotates at an angle of 180° to return to its initial position after the sawing process has been finished (see, FIG. 19a).

As described above, the sawing and handler system according to the fifth embodiment of the present invention includes the strip/package picker, in which the strip picker head and the package picker head are rotatably installed at the lower portion of the strip/package picker. Thus, the strip/package picker can directly load the semiconductor strip on the chuck table by picking up the semiconductor strip placed on the inlet rail. Accordingly, it is possible to omit the strip picker and the jig table from the sawing and handler system. Therefore, the sawing and handler system according to the fifth embodiment of the present invention can be fabricated with a simple structure while presenting advantages of the above embodiments.

While this invention has been described in connection with what is presently considered to be the most practical and preferred embodiment, it is to be understood that the invention is not limited to the disclosed embodiment and the drawings, but, on the contrary, it is intended to cover various modifications and variations within the spirit and scope of the appended claims.

Industrial Applicability

As can be seen from the foregoing, according to the present invention, components of the sawing and handler system can be sequentially aligned according to the process order for the semiconductor strip/package, so the working procedure for the semiconductor strip/package is simplified, thereby improving the UPH.

In addition, since the on-loader unit and the inlet rail are aligned at one side of the sawing machine and the cleaning unit is installed at the other side of the sawing machine, the width of the system can be significantly reduced, so that it is possible to efficiently use the installation space of the system.

Furthermore, the semiconductor strips stacked in the on-loader unit can be easily drawn by means of the draw picker having the improved structure. The draw picker is coupled to one side of the strip picker so that the draw picker can be horizontally moved without using a separate driving source. Thus, the structure of the system can be simplified.

In addition, the cleaning unit of the present invention is provided with rotating nozzles so that the cleaning process can be performed at a high speed. Also, after the cleaning process has been finished, the semiconductor package is rested on the drying unit such that the semiconductor package can be dried while being moved. Thus, the cleaning and drying processes for the semiconductor packages can be performed

within the short period of time, thereby improving workability of the system.

According to the present invention, the chuck table can be provided with a pair of mounting sections so that loading work for the semiconductor strip and unloading work for the semiconductor package can be simultaneously performed. Thus, the process speed of the system for the semiconductor strip can be significantly improved.

In addition, the present invention employs the rotator picker and/or the jig table, so the width of the sawing and handler system can be significantly reduced while improving the loading speed of the semiconductor strip onto the chuck table and the unloading speed of the semiconductor package from the chuck table.

Therefore, the present invention can improve the productivity of the sawing and handler system and can reduce the installation and maintenance cost for the sawing and handler system.

Claims

1. A semiconductor strip sawing system comprising:

an on-loader unit for accommodating a plurality of semiconductor strips therein;

a sawing machine for sawing the semiconductor strip into individual semiconductor packages as the semiconductor strip is transferred thereto from the on-loader unit;

a cleaning unit for cleaning the semiconductor packages after the semiconductor strip is sawn into the semiconductor packages by the sawing machine;

a strip picker movably installed between the on-loader unit and the sawing machine in order to transfer the semiconductor strip to the sawing machine by drawing the semiconductor strip from the on-loader unit; and

a package picker movably installed between the sawing unit and the cleaning unit in order to transfer the semiconductor packages from the sawing unit to the cleaning unit, wherein the on-loader unit, the sawing machine and the cleaning unit are sequentially aligned in the system so that the semiconductor strip or the semiconductor package sequentially passes through the on-loader unit, the sawing machine and the cleaning unit according to a process order thereof.

2. The semiconductor strip sawing system as claimed in claim 1, wherein the strip picker includes a draw picker for drawing the semiconductor strip from the on-loader unit and an inlet rail is installed between the on-loader unit and the sawing machine in order to guide and align the semiconductor strip drawn by the draw picker.

3. The semiconductor strip sawing system as claimed in claim 2, wherein the draw picker includes a body section, a gripper driving section installed on the body section, an upper gripper coupled to the gripper driving section so as to be moved up and down according to an operation of the gripper driving unit and a lower gripper fixed to a lower end of the body section in opposition to the upper gripper, and the draw picker grips the semiconductor strip according to a relative movement between the upper gripper and the lower gripper.

4. The semiconductor strip sawing system as claimed in claim 3, wherein the draw picker is moved up and down relative to the strip picker.

5. The semiconductor strip sawing system as claimed in claim 1, wherein the cleaning unit includes a chamber, a nozzle support section rotatably installed in the chamber, a plurality of water spray nozzles installed in the nozzle support section for spraying cleaning water onto the semiconductor packages transferred thereto from the sawing machine while rotating at a predetermined spraying angle, and a nozzle driving section installed at one side of the chamber to provide rotational force to the nozzle support section.

6. The semiconductor strip sawing system as claimed in claim 5, further comprising a plurality of air spray nozzle installed in the nozzle support section for spraying drying air onto the semiconductor packages transferred thereto from the sawing machine.

7. The semiconductor strip sawing system as claimed in any one of claims 1 to 6, wherein the sawing machine includes a chuck table, which is movable in a horizontal direction and on which a pair of mounting sections are provided in order to alternately load the semiconductor strip thereon, and a spindle provided at an end portion thereof with a sawing blade and moved relative to the chuck table in order to saw the semiconductor strip loaded on one of the mounting sections into individual semiconductor packages.

8. A sawing and handler system for a semiconductor strip, the sawing and handler system comprising:

an on-load section for accommodating a plurality of semiconductor strips therein;

a sawing section for sawing the semiconductor strip into individual semiconductor packages as the semiconductor strip is transferred thereto from the on-load section;

a cleaning section for cleaning the semiconductor packages after the semiconductor strip is sawn into the semiconductor packages in the sawing section;

a drying section for drying the semiconductor packages after the semiconductor packages are cleaned in the cleaning section;

a vision inspection section for inspecting defects of the semiconductor packages after the semiconductor packages are dried in the drying section; and

an off-load section for sorting and stacking the semiconductor packages according to an inspection result of the semiconductor packages in the vision inspection section, wherein the on-load section, the sawing section, the cleaning section, the drying section, the vision inspection section and the off-load section are sequentially aligned in the system, so that the semiconductor strip or the semiconductor package sequentially passes through the on-load section, the sawing section, the cleaning section, the drying section, and the vision inspection section according to a process order thereof and is stacked on the off-load section according to the inspection result of the semiconductor packages.

9. The sawing and handler system as claimed in claim 8, wherein a strip picker movably installed between the on-load section and the sawing section in order to transfer the semiconductor strip to the sawing section by drawing the semiconductor strip from the on-load section, and a package picker is movably installed among the sawing section, the cleaning section and the drying section in order to transfer the semiconductor packages from the sawing section to the cleaning section and the drying cleaning section, the package picker being movable separately from the strip picker.

10. The sawing and handler system as claimed in claim 8, wherein a drying unit is provided in the driving section in order to dry the semiconductor packages, the dry unit being horizontally moved by means of a horizontal transfer unit.

11. The sawing and handler system as claimed in claim 10, wherein the drying unit includes a transfer frame, which is moved in a predetermined direction in order to transfer the semiconductor package loaded on a mounting section provided at an upper portion of the transfer frame, a heater installed below the mounting section in order to dry the semiconductor package loaded on the mounting section, and the horizontal transfer unit coupled to the transfer frame in order to horizontally move the transfer frame.

12. The sawing and handler system as claimed in claim 11, wherein the horizontal transfer unit includes a rotary cylinder installed on the transfer frame, a pinion rotatably coupled to the transfer frame, and a rack extending in a moving direction of the transfer frame while being engaged with the pinion.

13. A semiconductor strip sawing system comprising:

an on-load unit for accommodating a plurality of semiconductor strips therein;

a sawing machine, which is linearly moved in a predetermined direction and includes a chuck table provided at an upper surface thereof with a pair of mounting sections on which the semiconductor strip is alternately loaded, and a spindle provided at an end portion thereof with a sawing blade and moved relative to the chuck table in order to saw the semiconductor strip loaded on one of the mounting sections into individual semiconductor packages;

a cleaning unit for cleaning the semiconductor packages after the semiconductor strip is sawn into the semiconductor packages by the spindle;

a rotator picker including a body section movably installed between the on-loader unit and the sawing machine and a head section rotatably installed at a lower portion of the body section in order to transfer the semiconductor strip onto one of the mounting sections of the chuck table by picking up the semiconductor strip drawn from the on-loader unit using a vacuum; and

a package picker movably installed between the sawing machine and the cleaning unit in order to transfer the semiconductor package loaded on one of the mounting sections of the chuck table into the cleaning section, wherein the on-loader unit, the sawing machine and the cleaning unit are sequentially aligned in the system so that the semiconductor strip or the semiconductor package sequentially passes through the on-loader unit, the sawing machine and the cleaning unit according to a process order thereof.

14. A semiconductor strip sawing system comprising:

an on-load unit for accommodating a plurality of semiconductor strips therein;

a jig table installed at one side of an inlet rail guiding the semiconductor strip drawn from the on-loader unit in order to temporarily load the semiconductor strip thereon;

a sawing machine, which is linearly moved in a predetermined direction and includes a chuck table provided at an upper surface thereof with a pair of mounting sections on which the semiconductor strip is alternately loaded, and a spindle provided at an end portion thereof with a sawing blade and moved relative to the chuck table in order to saw the semiconductor strip loaded on one of the mounting sections into individual semiconductor packages;

a cleaning unit for cleaning the semiconductor packages after the semiconductor strip is sawn into the semiconductor packages by the spindle;

a rotator picker including a body section movably installed between the on-loader unit and the jig table and a head section rotatably installed at a lower portion of the body section in order to load the semiconductor strip onto the jig table by picking up the semiconductor strip drawn from the on-loader unit using a vacuum; and

a strip/package picker movably installed between the jig table and the cleaning unit for loading the semiconductor strip onto one mounting section of the chuck table by picking up the semiconductor strip loaded on the jig table using a vacuum and simultaneously unloading the semiconductor package mounted on the other mounting section of the chuck table, wherein the on-loader unit, the jig table, the sawing machine and the cleaning unit are sequentially aligned in the system so that the semiconductor strip or the semiconductor package sequentially passes through the on-loader unit, the jig table, the sawing machine and the cleaning unit according to a process order thereof.

15. A semiconductor strip sawing system comprising:

an on-load unit for accommodating a plurality of semiconductor strips therein;

an inlet rail installed at one side of the on-loader unit in order to guide the semiconductor strip drawn from the on-loader unit;

a sawing machine, which is linearly moved in a predetermined direction and includes a chuck table provided at an upper surface thereof with a pair of mounting sections on which the semiconductor strip is alternately loaded, and a spindle provided at an end portion thereof with a sawing blade and moved relative to the chuck table in order to saw the semiconductor strip loaded on one of the mounting sections into individual semiconductor packages;

a cleaning unit for cleaning the semiconductor packages after the semiconductor strip is sawn into the semiconductor packages by the spindle;

a draw picker moved along the inlet rail in order to transfer the semiconductor strip towards the chuck table by drawing the semiconductor strip from the on-loader unit; and

a strip/package picker movably installed between the inlet rail and the cleaning unit and including a strip picker head and a package picker head, which are rotatably installed to load the semiconductor strip

onto one mounting section of the chuck table by picking up the semiconductor strip loaded on the inlet rail using a vacuum and to simultaneously unload the semiconductor package mounted on the other mounting section of the chuck table, wherein the on-loader unit, the inlet rail, the sawing machine and the cleaning unit are sequentially aligned in the system so that the semiconductor strip or the semiconductor package sequentially passes through the on-loader unit, the inlet rail, the sawing machine and the cleaning unit according to a process order thereof.

16. The semiconductor strip sawing system as claimed in any one of claims 13 to 15, wherein, when the chuck table returns to an initial position thereof after the semiconductor strip has been sawn into the individual semiconductor packages by means of the spindle, the chuck table maintains a predetermined state rotated at an angle of 180° from the initial position in order to simultaneously perform loading work for a new semiconductor strip and unloading work for the semiconductor package.