# DESCRIPTION

# DEVICE HANDLER

## TECHNICAL FIELD

**[0001]** The present invention relates to a device handler, and more particularly, to a device handler for loading and unloading a device such as a semiconductor chip onto and from a burn-in board.

## BACKGROUND ART

**[0002]** Semiconductor devices (hereinafter, will be referred to as 'devices') having undergone a packaging process undergo various tests such as electricity test, and reliability test against heat or pressure.

**[0003]** One of these tests for the devices, a burn-in test serves to test whether devices have inferiority, by inserting the plurality of devices into a burn-in board, accommodating the burn-in board in a burn-in test apparatus, and then applying heat or pressure to the burn-in board for the test time.

**[0004]** A device handler for the burn-in test indicates an apparatus for loading (inserting) new devices to be burn-in tested to empty spaces (sockets) of a burn-in board where devices are located, while unloading (sorting) the devices to each tray from the burn-in board on which the burn-in tested devices are loaded, according to sorting criterion applied to each device including good and bad products based on the test result of each device.

**[0005]** A performance of the device handler is evaluated based on the number of

sorted units per hour (UPH: Units Per Hour). And, this UPH is determined by time taken to transfer the devices and the burn-in board between each component of the device handler.

**[0006]** In order to enhance the UPH, configurations and arrangements of the respective components of the device handler need to be improved.

**[0007]** Device handlers for improving UPH as described above are disclosed in Korean Patent No. 10-1133188, Korean Patent No. 10-1177319, and the like.

**[0008]** However, the types, i.e. specifications, of devices to be sorted may be changed, and in this case, conventional device handlers have a limitation in that when a tray corresponding to a specification is loaded onto loading and unloading units, components such as a DC test part, a socket press and a moving buffer on a burn-in board which are conformable to the specification of the devices should be individually exchanged by manual work of an operator, and thus, exchange work is cumbersome.

**[0009]** In particular, since the operator should approach the inside of an apparatus equipped with heavy weight objects and work there, there is a limitation in that the operator may be injured.

**[0010]** Meanwhile, among devices to be tested, so-called BGA device has a plurality of balls installed on the bottom surface thereof instead of leads protruding from side surfaces thereof as terminals for connection to external terminals.

**[0011]** In addition, in general, the test on the BGA device is performed such that the device is inserted into a socket in which a plurality of contact pins, so-called pogo pins, which respectively contact corresponding balls, are installed.

**[0012]** A test socket for such a BGA device is disclosed in Korean Registered Utility Model No. 20-0463425.

**[0013]** In particular, Korean Registered Utility Model No. 20-0463425 is additionally

provided with an adaptor installed to guide a BGA device when the BGA device is loaded onto a test socket, so that the aligned state of contact pins and ball terminals is always maintained. Thus, the connection state of the contact pins and the ball terminals may be maintained and therefore, accurate inspection on the device may be performed.

**[0014]** However, for a stable loading of devices, the adaptor structure disclosed in Korean Registered Utility Model No. 20-0463425 should have a side surface gap between the side surfaces of a device and an adapter, and thus, the alignment state of contact pins and ball terminals are unfavorably disturbed by such side surface gaps.

**[0015]** In addition, when a device is unloaded from the test socket, the device unfavorably interferes with the adaptor, the operation of the apparatus is thereby stopped and the efficiency of the test work is decreased.

## DISCLOSURE OF THE INVENTION

## TECHNICAL PROBLEM

**[0016]** The object of the present invention is to provide an device handler for stably loading and unloading an device, such as a semiconductor chip, in and from a burn-in board.

## TECHNICAL SOLUTION

**[0017]** In accordance with an embodiment of the present invention, a device handler includes: a loading unit 100 in which a tray 30 loaded with devices to undergo a burn-in test is loaded; an X-Y table 410 for moving a burn-in board 20 in X-Y directions in which the devices to undergo the burn-in test are loaded on to empty portions from which devices having undergone the burn-in test are withdrawn; and an unloading unit in which non-

rejected devices among loaded devices having undergone the burn-in test are loaded on a tray 30.

**[0018]** The device handler may further include a DC test unit 170 which receives a device to undergo a burn-in test from the loading unit 100 and tests DC characteristics of the device in advance before the device is loaded on the burn-in board 20.

**[0019]** The device handler may further include a sorting unit 300 for sorting and loading devices determined as rejected device as a result of a DC characteristic test of the DC test unit 170, and devices determined as rejected device as a result of the burn-in test.

**[0020]** The device handler may further include: a first moving buffer 600 on which the device having undergone the DC characteristic test in the DC test unit 170 is temporarily loaded before loaded on the burn-in board 20; and a second moving buffer 700 on which the device having undergone the burn-in test and unloaded from the X-Y table 410 is temporarily loaded.

**[0021]** The device handler may further include a kit exchange unit 900 which automatically exchanges, according to the specifications of the device to undergo the burn-in test, at least one among the DC test unit 170, a socket press 45 on the X-Y table 410, the first moving buffer 600 and the second moving buffer 700, as an exchange kit.

**[0022]** The kit exchange unit 900 may include: a main body unit 901 having a buffer space 910 which is provided therein and in which an exchange kit to be exchanged is temporality stored; and an exchanging unit 930 which unloads an exchange kit installed in a main body 40 of the device handler, temporality stores the exchange kit in a buffer space 920, and loads a new exchange kit to the main body 40 of the device handler.

**[0023]** When the exchange kit is the DC test unit 170, an electrical connection unit 171 in which the DC test unit 170 may be inserted in a moving direction thereof, and

which is for electrical connection with the DC test unit 170, may be installed on the main body 40 of the device handler.

**[0024]** The device handler may include: a third transfer tool 510 which transfers devices between the loading unit 100 and the DC test unit 170; a fourth transfer tool 520 which transfers devices between the DC test unit 170 and the first moving buffer 600; a fifth transfer tool 550 which transfers devices between the second moving buffer 700 and the unloading unit 200; and one or more sorting tools which transfer devices between the first moving buffer 600 and the second moving buffer, and the sorting unit 300.

**[0025]** The one or more sorting tools may include: a first sorting tool 560 which transfers devices between the first moving buffer 600 and the sorting unit 300; and a second sorting tool 570 which transfers devices between the second moving buffer 700 and the sorting unit 300.

**[0026]** The exchange kit may be an device accommodation unit 610 in the first moving buffer 600, an device accommodation unit 710 in the second moving buffer 700, and at least one fixed buffer installed on the main body 40 of the device handler; the device accommodation unit 610 in the first moving buffer 600, the device accommodation unit 710 in the second moving buffer 700, and the fixed buffer may have the same structure; exchange of the device accommodation unit 610 in the first moving buffer 600 and the device accommodation unit 710 in the second moving buffer 700 may be respectively performed in the linear moving directions of the device accommodation unit 610 in the first moving buffer 600 and the device accommodation unit 710 in the second moving buffer 700; and exchange of the fixed buffer may be performed in at least any one of ends of the first moving buffer 600 and the second moving buffer 600.

**[0027]** The exchange kit may be an device accommodation unit 610 in the first

moving buffer 600, an device accommodation unit 710 in the second moving buffer 700, and at least one fixed buffer installed on the main body 40 of the device handler; the device accommodation unit 610 in the first moving buffer 600, the device accommodation unit 710 in the second moving buffer 700, and the fixed buffer may have the same structure; exchange of the device accommodation unit 610 in the first moving buffer 600 and the device accommodation unit 710 in the second moving buffer 700 may be introduced in a linear moving direction of any one of the device accommodation unit 610 in the first moving buffer 600 and the device accommodation unit 710 in the second moving buffer 700, and may be discharged, via the fixed buffer, in a linear moving direction of the other of the device accommodation unit 610 in the first moving buffer 600 and the device accommodation unit 710 in the second moving buffer 700.

**[0028]** The device handler may include a socket press unit 90 which is installed above the X-Y table 410 and presses a test socket installed on the burn-in board 20 to withdraw or insert an device from and onto the burn-in board 20.

**[0029]** The socket press unit 90 may include: a loading socket press 92 having therein loading openings 92a for guiding an device to undergo the burn-in test so as to be loaded in the test socket; and an unloading socket press 92 having therein unloading openings 91a for guiding an device having undergone the burn-in test so as to be unloaded from the test socket.

**[0030]** A size of the unloading openings 91a may be formed greater than that of the loading openings 92a so as not interfere with unloading of a device from the test socket.

**[0031]** The loading socket press 92 and the unloading socket press 91 may be arranged in a direction in which the loading unit 100 and the unloading unit 200 are arranged.

**[0032]** The first transfer tool 530 and the second transfer tool 540 may be installed to

be spaced apart from each other in a direction, in which the loading unit 100 and the unloading unit 200 are arranged, corresponding to the loading socket press 92 and the unloading socket press 91.

**[0033]** The device handler may further include an empty tray supply unit 80 which is installed in parallel on one side of the loading unit 100 and is provided to load a plurality of empty trays 30 on the burn-in board 20.

## ADVANTAGEOUS EFFECTS

**[0034]** A device handler according to the present invention has an advantage of quickly loading or unloading devices in a stable manner.

**[0035]** In particular, when a device is loaded onto a test socket installed on a burn-in board or the like, for precise loading, a gap between an adaptor coupled to a socket press and the device is favorably minimized, but when the gap was minimized, there has been a limitation of interfering with device unloading such that device is locked up while being unloaded.

**[0036]** Accordingly, the device handler according to the present invention has an advantage in that an adaptor member used for loading devices is different from the adaptor used for unloading devices, and thus, devices may be stably and quickly loaded or unloaded.

**[0037]** The device handler according to the present invention has an advantage in that when the specifications of devices to be sorted are changed, that is, when a tray for receiving devices with changed specifications is loaded, a kit exchange unit which automatically exchanges a DC test unit, a socket press on an X-Y table, and buffer units is provided, and thus, processing speed may be remarkably enhanced by reducing the time to

exchange the DC test unit and the like.

## BRIEF DESCRIPTION OF THE DRAWINGS

**[0038]** FIG. 1 is a conceptual view illustrating an example of a device handler according to the present invention.

**[0039]** FIG. 2 is a plan view illustrating a configuration of the device handler of FIG. 1.

**[0040]** FIG. 3 is a cross-sectional view illustrating a configuration of first moving buffers and second moving buffers of the device handler of FIG. 1.

**[0041]** FIG. 4 is a disposition diagram illustrating moving processes of an X-Y table and a burn-in board in the device handler of FIG. 1.

**[0042]** FIG. 5 illustrates conceptual views illustrating an exchange process of a burn-in board between the X-Y table and a burn-in board exchange buffer unit in the device handler of FIG. 1,

**[0043]** FIG. 5a is a conceptual view illustrating a state before firstly exchanging a burn-in board between the X-Y table and the burn-in board exchange buffer unit,

**[0044]** FIG. 5b is a conceptual view illustrating a state after exchanging the burn-in board between the X-Y table and the burn-in board exchange buffer unit, and

**[0045]** FIGS. 5c to 5d are views illustrating an exchange process of burn-in board between the X-Y table and the burn-in board exchange buffer unit.

**[0046]** FIG. 6 illustrates conceptual views illustrating an exchange process of a burn-in board between the burn-in board exchange buffer unit and a board loader in the device handler of FIG. 1,

**[0047]** FIG. 6a is a conceptual view illustrating a state before exchanging a burn-in board between the burn-in board exchange buffer unit and the board loader,

**[0048]** FIG. 6b is a conceptual view illustrating an intermediate state in which the burn-in board is being introduced into a rack of the board loader between the burn-in board exchange buffer unit and the board loader,

**[0049]** FIG. 6c is a conceptual view illustrating a state in which the burn-in board is loaded into the rack of the board loader between the burn-in board exchange buffer unit and the board loader,

**[0050]** FIG. 6d is a conceptual view illustrating an intermediate state in which the burn-in board is being unloaded from the rack of the board loader between the burn-in board exchange buffer unit and the board loader, and

**[0051]** FIG. 6e is a conceptual view illustrating a state in which the burn-in board is unloaded from the rack of the board loader between the burn-in board exchange buffer unit and the board loader.

**[0052]** FIG. 7 is a side view illustrating a configuration of a board loader.

**[0053]** FIG. 8a is a side cross-sectional view illustrating a burn-in board exchange buffer unit and a board loader which have modified configuration from the device handler of FIG. 1.

**[0054]** FIG. 8b is a side view illustrating the board loader of FIG. 8a.

**[0055]** FIG. 9 is a conceptual view illustrating a modified example of the device inspection apparatus of FIG. 2.

**[0056]** FIG. 10 is a conceptual view illustrating an exchange process when an exchange kit is a test unit in the device inspection apparatus of FIG. 2.

**[0057]** FIG. 11 is a partial plan view illustrating an exchange process of the exchange kit of FIG. 10.

**[0058]** FIG. 12 is a plan view illustrating a device handler according to a first modified

embodiment of the present invention.

**[0059]** FIG. 13 is a plan view illustrating a modified example of the device handler of FIG. 12.

**[0060]** FIG. 14 is a plan view illustrating a device handler according to a second modified embodiment of the present invention.

**[0061]** FIGS. 15a to 15b are partial plan views illustrating transfer processes of a first transfer tool and a second transfer tool in the device handler of FIG. 14.

## MODE FOR CARRYING OUT THE INVENTION

**[0062]** Hereinafter, a device handler according to the present invention will be described in detail with reference to the accompanying drawings.

**[0063]** A device handler according to an embodiment of the present invention, as illustrated in FIGS. 1 and 2, includes a loading unit 100, an unloading unit 200, a sorting unit 300, and a plurality of transfer tools 510, 520, 530, 540, 550, 560, and 570 for transferring devices 10.

**[0064]** A burn-in board 20 refers to a board onto which a first devices 10 are loaded so as to undergo a burn-in test in a burn-in test apparatus (not shown), and is provided with sockets in which the devices 10 are respectively inserted so that a test on electrical characteristics and signal characteristics under a high temperature may be performed.

**[0065]** The burn-in board 20 is mounted on an X-Y table 410 installed on the device handler and a second devices 10 having undergone a burn-in test are unloaded therefrom and a first devices 10 are loaded thereon.

**[0066]** The X-Y table 410 is a configuration for loading a burn-in board 20 in which the second devices 10 are inserted and unloading a burn-in board 20 in which a first

devices 10 are inserted, and as illustrated in FIGS. 1, 2, and 4, includes a burn-in board exchange device (not shown) to receive a burn-in board 20, in which devices 10 are to be exchanged, and to unload a burn-in board 20 in which exchange of devices 10 is completed.

**[0067]** In addition, the X-Y table 410 is configured to be driven by an X-Y table driving unit (not shown) to thereby move the burn-in board 20 so that the first devices 10 may be inserted in empty portions of the burn-in board 20 by the first transfer tool 530, or the second devices 20 may be withdrawn from the burn-in board 20.

**[0068]** The X-Y table driving unit may have various configurations such that the X-Y table 410 loaded with the burn-in board 20 is moved in X-Y directions, X-Y-θ directions, or the like while being interlocked with the second transfer tool 540 and the first transfer tool 530 so that the second transfer tool 540 and the first transfer tool 530 may easily load or unload the devices 10 onto and from the burn-in board 20.

**[0069]** That is, the X-Y table driving unit may be configured to move the X-Y table 410 so that the second devices 10 are withdrawn from the burn-in board 20 while interlocked with the second transfer tool 540, and the first devices 10 are inserted into empty portions of the burn-in board 20 while interlocked with the first transfer tool 530, and when the first devices 10 are completely inserted in the burn-in board 20, move the X-Y table 410 to a burn-in board exchange position.

**[0070]** Meanwhile, the X-Y table 410 is installed on a main body 40 constituting the device handler according to the present invention, and the main body 40 may include an upper plate 42 in which openings 41 for unloading and loading the devices 10 from and onto the burn-in board 20 by using the second transfer tool 540 and the first transfer tool 530 are formed.

**[0071]** In addition, a socket press 45, which presses sockets installed on the burn-in

board 20 for convenience in device unloading and loading from and onto the burn-in board 20, is installed above the X-Y table 410.

**[0072]** The socket press 45 enables withdrawing of a device inserted in the socket of the burn-in board 20 and loading a device onto the burn-in board 20, and may be variously configured according to a socket structure of the burn-in board 20.

**[0073]** The loading unit 100 is a configuration for loading a tray 30 (hereinafter, referred to as "loading tray") loaded with a plurality of first devices 10 to be loaded on the burn-in board 20, and may be variously configured.

**[0074]** In addition, the unloading unit 200 is a configuration for loading non-reject devices (hereinafter, referred to as "good product") from among the second devices 10 onto a tray (hereinafter, referred to as "unloading tray") and unloading the tray 30, and may be variously configured.

**[0075]** In general, each of the loading unit 100 and the unloading unit 200 is configured, as illustrated in FIG. 2, to include a pair of guide rails 110 and 210 which guide the tray 30 such that the tray 30 may be moved, and a driving unit (not shown) for moving the tray 30.

**[0076]** Also, although the loading unit 100 and the unloading unit 200 may be variously disposed according to a design condition, as illustrated in FIGS. 1 and 2, the loading unit 100 and the unloading unit 200 are, in general, disposed in parallel with each other so that the test unit 170, unloading unit 200, the sorting unit 300, the first moving buffer 600, and the second moving buffer 700 and the like are installed therebetween, but embodiments of the present invention are not limited thereto.

**[0077]** Meanwhile, after the first devices 10 are withdrawn from the tray 30 in the loading unit 100, empty trays 30 may be transferred to the unloading unit 200 by a tray

tranfer unit (not shown) so that the second devices 10 may be loaded.

**[0078]** In this case, devices 10 may remain in the tray 30. In order to remove the devices 10 remaining in the tray 30 before the tray 30 are transferred from the loading unit 100 to the unloading unit 200, a tray rotation unit 150 which rotates the tray 30 to thereby remove the remaining devices 10 may be further installed.

**[0079]** As illustrated in FIGS. 1 and 2, the tray rotation unit 150 is installed between the loading unit 100 and the unloading unit 200 on a transfer path of the tray 30, and is configured to receive the tray 30 from the loading unit 100 by the tray transfer unit, rotate the tray 30, and then transfer the tray 30 to the unloading unit 200.

**[0080]** In this case, on one side of the tray rotation unit 150, an empty tray unit (not shown), which may supply empty trays 30 to the sorting unit 300, unloading unit 200 or the like, or temporarily load the empty trays 30 from the loading unit 100, may further be installed.

**[0081]** Meanwhile, the device handler according to the present invention may further be provided with a test unit 170 for testing electrical characteristics such as DC characteristics of a device 10 after receiving first devices 10 from the loading units 100 in advance before the first devices 10 are loaded on the burn-in board in order to load only first good devices 10 on the burn-in board 20.

**[0082]** The test unit 170 may be configured variously, for example, to be installed between the loading unit 100 and the first moving buffer 600 and to be composed of a plurality of sockets to which the first devices 10 may be electrically connected. Preferably, the same number of sockets as in the tray 30 in the transverse direction may be installed in the traverse direction.

**[0083]** Test results of individual first device 10 from the test unit 170 are used as data

for sorting in the sorting unit 300 described below.

**[0084]** Meanwhile, the device handler according to the present invention may include a sorting unit 300 for sorting and loading first rejected devices 10 determined as rejected products according to test results by the test unit 170 and second rejected devices 10 which need to be sorted from among second devices 10.

**[0085]** The sorting unit 300 may be configured variously according to arrangements and sorting criteria, and include an appropriate number of tray 30 - sorting trays - according to each sorting criterion (good, rejected 1 (Contact Reject), rejected 2(DC Failure), etc.). The sorting unit 300 may have a configuration similar to the configuration of the loading unit 100 described above, or as illustrated in FIGS. 1 and 2, may be disposed between the loading unit 100 and the unloading unit 200 while being fixed to the main body 40.

**[0086]** In addition, aside from the configuration of being fixedly installed as illustrated in FIGS. 1 and 2, the sorting unit 300 may be configured, similar to the configurations of the loading unit 100 and the unloading unit 200, to include a pair of guide rails which respectively guides trays 30 so as to be moved and a driving unit (not shown) for moving the tray 30.

**[0087]** The transfer tool is a configuration for transferring devices 10 among the burn-in board 20, the loading unit 100, the test unit 170, the unloading unit 200, the sorting unit 300, and a first moving buffer 600 and a second moving buffer 700 which will be described later, and may be configured variously according to the arrangements of each configuration.

**[0088]** For example, the transfer tool may include: a third transfer tool 510 which transfers devices 10 between the loading unit 100 and the test unit 170; a fourth transfer

tool 520 which transfers devices 10 between the test unit 170 and the first moving buffer 600; a fifth transfer tool 550 which transfers devices 10 between the second moving buffer 700 and the unloading unit 200; and one or more sorting tools 560 and 570 which transfer devices 10 between the first moving buffer 600 and the second moving buffer 700, and the sorting unit 300.

**[0089]** In addition, the transfer tools 510, 520, 530, 540, 550, 560 and 570 may be configured to include: a first transfer tool 530 which receives the devices 10 loaded on a tray 30 in the loading unit 100 between the first moving buffer 600 and the burn-in board 20 and inserts the devices 10 in empty portions of the burn-in board 20; and a second transfer tool 540 which transfers second devices 10 from the burn-in board 20 between the burn-in board 20 and the second moving buffer 700.

**[0090]** Meanwhile, an array of the devices 10 loaded on the burn-in board 20 is different from an array of devices 10 loaded on a tray 30 in the loading unit 100 and the like, and the number of devices in the array on the burn-in board 20 is relatively large.

**[0091]** Accordingly, the first transfer tool 530 and the second transfer tool 540 which transfer or withdraw the devices 10 onto and from the burn-in board 20 are preferably configured to transfer the relatively larger number of devices 10 than the rest of transfer tools. For example, the first transfer tool 530 and the second transfer tool 540 may be configured to transfer devices of 12 x 2, and the rest of tools may be configured to transfer devices of 8 x 1, 8 x 2, or the like.

**[0092]** When the transfer tools are configured as described above, the transfer tool which transfers relatively small number of devices 10 may be used at a position, at which relatively small number of devices 10 need to be transferred, except for a position at which relatively large number of devices 10 need to be transferred, so that manufacturing costs of

the device handler may be saved, and size reduction and the stability of the device handler may be improved.

**[0093]** Meanwhile, the first transfer tool 530 and the second transfer tool 540 may be configured to integrally move with each other, considering that loading and unloading of devices 10 are alternately performed on a burn-in board 20.

**[0094]** The third transfer tool 510 and the fourth transfer tool 520 also transfer the devices 10 with the test unit 170 disposed therebetween, and may therefore be configured to integrally move with each other.

**[0095]** In addition, the number of pickers of the first transfer tool 530 and the second transfer tool 540 in the transverse direction may be configured to be the same as the number of device accommodation grooves (not shown) in the transverse direction for loading devices 10 in the first moving buffer 600 and the second moving buffer 700 in consideration of efficiency of the devices 10.

**[0096]** The sorting tools 560 and 570 may be variously configured, for example, as one unit or a plurality of units.

**[0097]** In particular, in order to quickly sort the devices 10 to be sorted as reject or the like in the first moving buffer 600 and the second moving buffer 700, as illustrated in FIGS. 1, 2, and 9, the sorting tools 560 and 570 may include: a first sorting tool 560 which transfers the devices 10 between the first moving buffer 600 and the sorting unit 300; and a second sorting tool 570 which transfers the devices 10 between the second moving buffer 700 and the sorting unit 300.

**[0098]** While moving between the first moving buffer 600 and the sorting unit 300, the first sorting tool 560 may transfer devices 10. For example, while moving within a sorting tool moving area, the first sorting tool 560 loads the devices 10 which are determined as

reject in the DC test unit 170 from among the devices 10 loaded in the first moving buffer 600, on to the tray corresponding tray for DC defect from among the trays disposed in the sorting unit 300.

**[0099]** Meanwhile, the first sorting tool 560 is configured to move up to the DC test unit 170 aside from between the first moving buffer 600 and the sorting unit 300, and thus, may load the devices 10 determined as reject in the DC test unit 170 directly on to the tray corresponding a tray for DC defect from among the trays disposed in the sorting unit 300.

**[00100]** In this case, considering movement interference with the fourth transfer tool 520, the DC test unit 170 horizontally moves the devices 10 determined as reject downward on the drawing, and thus, the first sorting tool 560 may transfer the devices 10 without movement interference with the fourth transfer tool 520.

**[00101]** The second sorting tool 570 may transfer devices 10 while moving within a sorting tool moving area. For example, the second sorting tool 570 loads the devices 10 except for the good devices from among the devices 10 loaded in the second moving buffer 700 on to one or more trays installed on the sorting unit 300 according to a sorted grade.

**[00102]** As described above, when the sorting tools 560 and 570 are configured from the first sorting tool 560 and the second sorting tool 570, device sorting may be performed more quickly.

**[00103]** Meanwhile, when devices 10 are directly loaded on to the tray in the sorting unit 300 by the first sorting tool 560 and the second sorting tool 570, the case, in which the first sorting tool 560 and the second sorting tool 570 may not transfer devices when any one of the trays in the sorting unit 300 is fully loaded with devices of corresponding sorting grade, may occur.

**[00104]** Accordingly, when any one of the trays in the sorting unit 300 is fully loaded

with devices of corresponding sorting grade, the sorting unit 300 may be configured to be provided with a buffer tray for temporary loading from among the trays, or configured to temporarily load devices on to a tray for another sorting grade and then reload the temporarily loaded device after the tray fully loaded with devices of corresponding sorting grade is exchanged for a new tray.

**[00105]** Each of the transfer tools may include one or more pickers having, at an end thereof, a suction head for sucking the devices 10 by a vacuum pressure, and a picker transfer device for transferring the pickers in an X-Z direction, a Y-Z direction, or an X-Y-Z direction.

**[00106]** Especially, the pickers of the transfer tools may be arranged in one line, or in a plurality of lines such as 12×2.

**[00107]** Meanwhile, in order to improve the loading and unloading speed when the first devices 10 are loaded from the loading unit 100 to the burn-in board 20 or when the second devices 10 are unloaded from the burn-in board 20 to the unloading unit 200, the device handler according to the present invention may include first moving buffers 600 and second moving buffers 700 which are respectively installed between the loading unit 100 and the burn-in board 20, and between the burn-in board 20 and the unloading unit 200, and on which the first devices 10 and the second devices 10 are temporarily loaded and transferred.

**[00108]** The first moving buffer 600 and the second moving buffer 700 are movably installed on the main body 40. While moving between a device exchange position ③ for exchanging devices with the burn-in board 20, a device exchange position ① for exchanging devices with the loading unit 100 or the unloading unit 200, and a sorting position ② for exchanging devices with the sorting unit 300, the first moving buffer 600

and the second moving buffer 700 cause device exchange to be smoothly performed without a break, and thus, the speed of a sorting process may be remarkably improved.

**[00109]** The first moving buffer 600 is configured to move between a loading position (device exchange position ①) for receiving the first devices 10 from the test unit 170 by the second transfer tool 540 to load the devices 10, a sorting position ② for transferring the first rejected devices 10 onto the sorting tray 30 by using the sorting tools 560 and 570, and a load position (device exchange position ③) for loading the rest of devices 10, after removing the first rejected devices 10, onto the burn-in board 20 of the X-Y table 410 by using the third transfer tool 510 which will be later explained.

**[00110]** As illustrated in FIG. 3, each of the first moving buffers 600 is configured to include: a device accommodation unit 610 to be loaded with devices 10; a guide member 620 which movably supports the device accommodation unit 610 with respect to the main body 40; and a moving apparatus (not shown) which moves the device accommodation unit 610 along the guide member 620.

**[00111]** In order to load more number of devices 10 at the load position ③, the device accommodation unit 610 preferably has more number of device accommodation grooves for loading devices 10 in the transverse direction than the number of device accommodation grooves for loading devices 10 in a tray 30 in the transverse direction.

**[00112]** The device accommodation unit 610 is a configuration for loading devices 10 and may be configured such that the devices 10 are directly loaded or configured to include a separate accommodation member 610a in which device accommodation grooves are formed because the size of the device may vary according to the kinds of devices to be sorted.

**[00113]** As illustrated in FIGS. 1 and 2, the first moving buffers 600 are preferably

configured in three units so that processes may simultaneously be performed at each of the positions ①, ②, ③. In this case, the guide member 620 is configured so as not to interfere with other guide members 620 during movement thereof.

**[00114]** That is, as illustrated in FIG. 3, the first moving buffers 600 may be configured to include: a first device accommodation unit 611 which is supported by the first guide member 621 and horizontally moves; a second device accommodation unit 612 which is supported by the second guide member 622 and horizontally moves; and a third device accommodation unit 613 which is supported by the third guide member 623 and horizontally moves.

**[00115]** The first to third guide members 621, 622, and 623, which are configurations for respectively guiding device accommodation units 611, 612, and 613 to horizontally move, may be configured variously, and as illustrated in FIG. 4, the first guide member 621 is installed on an upper portion of the support member 640, that is, on the upper end, the second guide member 622 is installed on the middle portion of the support member 640, that is, on the intermediate end, and the third guide member 623 is installed on a lower portion of the support member 640, that is, on the lower end or on the upper plate 42 of the main body 40. At this point, the first to third guide members 621, 622, and 623 may be configured to form pairs so as to stably support the device accommodation unit 620.

**[00116]** Meanwhile, a moving apparatus 630 for horizontally moving the first to third guide members 621, 622, and 623 may be variously configured according to driving types, and may include first to third moving apparatuses 631, 632, and 633 which horizontally move the first to third guide members 621, 622, and 623, respectively. In this case, the first to third moving apparatuses 631, 632, and 633 may be configured from a motor which generates rotation power, and belts coupled to the first to third guide members 621, 622,

and 623, particularly, combinations of timing belts and pulleys.

**[00117]** The operation of the first moving buffer 600 configured as described above will be described in detail below.

**[00118]** In the first moving buffers 600, a loading process is performed at the loading position ①, that is, the first devices 10 are loaded from the test unit 170 to the device accommodation unit 610. In this case, since the first devices 10 loaded onto the device accommodation unit 610 includes the first rejected devices 10 determined as reject in the test unit 170, and the first rejected devices 10 need to be removed.

**[00119]** Accordingly, the first moving buffers 600 move to the sorting position ② to sort the first rejected devices 10 after the devices 10 are completely loaded at the loading position ①.

**[00120]** When the first moving buffer 600 is positioned at the sorting position ②, the first rejected devices 10 are transferred from the device accommodation unit 610 to the sorting unit 300 by a first sorting process, that is, by transfer tools. In this case, the first rejected devices 10 are loaded onto trays 30 in the sorting unit 300 according to the defect criteria thereof.

**[00121]** At the sorting position ②, the positions of the device accommodation unit 610 from which the first rejected devices 10 have been removed are inserted with good devices 10 determined as good product as a test result by the test unit 170 (hereinafter, will be referred to as ‘first good devices’ 10), the first good devices 10 having been loaded from a first fixed buffer (Not shown) - buffering process.

**[00122]** Meanwhile, the first fixed buffer is installed on the body 40 and is loaded in advance with the first good devices 10 in test results. If the first fixed buffer is made to be empty at an initial time or while being operated, the first good devices 10 may be loaded

on the device accommodation unit 610 of the first moving buffer 600 disposed at the sorting position ②.

**[00123]** When the first sorting process is completed in the first moving buffer 600, the first moving buffer 600 moves from the sorting position ② to the load position ③. In addition, a loading process, in which the first good devices 10 having been loaded onto the first moving buffer 600 are loaded onto the burn-in board 20 by transfer tools, is performed.

**[00124]** In addition, when the device accommodation unit 610 of the first moving buffer 600 is completely emptied, the first moving buffer 600 moves from the load position ③ to the loading position ① and the loading process is performed again.

**[00125]** The second moving buffer 700 has a configuration similar to the first moving buffer 600 and is configured to repeatedly move between a load position (device exchange position) ③ for receiving the second devices 10 from the burn-in board 20 and loading the devices by using the second transfer tool 540, a sorting position ② for transferring the second rejected devices 10 onto the sorting tray 30 - sorting tray - by using the transfer tool, and an unloading position (device exchange position) ① for unloading the rest of second devices 10, after removing the second rejected devices 10, onto a tray 30 – unloading tray - by using the fifth transfer tool 550.

**[00126]** As illustrated in FIG. 3, the second moving buffer 700 having the configuration described above has a configuration similar to the first moving buffer 600 and is configured to include: a device accommodation unit 710 to be loaded with devices 10; a guide member 720 which movably supports the device accommodation unit 710 with respect to the main body 40; and a moving apparatus 730 which moves the device accommodation unit 710 along the guide member 720.

**[00127]** In order to load more number of devices 10 at the load position the device

accommodation unit 710 preferably has more number of device accommodation grooves for loading devices 10 in the transverse direction than the number of device accommodation grooves in a tray 30 for loading devices 10 in the transverse direction.

**[00128]** The device accommodation unit 710 is a configuration for loading devices 10, and may be configured such that the devices 10 are directly loaded, or may include a separate accommodation member 610a in which device accommodation grooves are formed because the size of the device may vary according to the kinds of devices to be sorted.

**[00129]** As illustrated in FIGS. 1 and 2, the second moving buffer 700 are preferably configured as three units so that processes may simultaneously be performed at respective positions ①, ②, ③. At this point, the guide member 720 is configured so as not to interfere with other guide members 720 during movement thereof.

**[00130]** That is, as illustrated in FIG. 3, the second moving buffers 700 may be configured to include: a first device accommodation unit 711 which is supported by the first guide member 721 and horizontally moves; a second device accommodation unit 712 which is supported by the second guide member 722 and horizontally moves; and a third device accommodation unit 713 which is supported by the third guide member 723 and horizontally moves.

**[00131]** The first to third guide members 721, 722, and 723, which are configurations for respectively guiding device accommodation units 711, 712, and 713 to horizontally move, may be configured variously, and as illustrated in FIG. 4, the first guide member 721 is installed on an upper portion of the support member 740, that is, on the upper end, the second guide member 722 is installed on the middle portion of the support member 1, that is, on the intermediate end, and the third guide member 723 is installed on a lower portion

of the support member 740, that is, on the lower end or on the upper plate 42 of the main body 40. The first to third guide members 721, 722, and 723 may be configured to form pairs so as to stably support the device accommodation unit 720.

**[00132]** Meanwhile, the moving apparatus 730 for horizontally moving the first to third guide members 721, 722, and 723 may be variously configured according to driving types, and may include first to third moving apparatuses 721, 722 and 723 which horizontally move the first to third guide members 721, 722, and 723, respectively. In this case, each of the first to third moving apparatuses 731, 732, and 733 may be configured from a motor which generates rotation power, and belts coupled to the first to third guide members 721, 722, and 723, in particular, combinations of timing belts and pulleys.

**[00133]** The second moving buffer 700 having the above-described configuration operates in a similar method to the first moving buffer 600, and performs: a loading process in which the second devices 10 are loaded onto the device accommodation unit 710 from the burn-in board 20 at the load position ③; a second sorting process in which the second rejected devices 10 are transferred to the sorting unit 300 at the sorting position ②; and an unloading process in which the rest of second devices 10 are transferred to a tray 30 of the unloading unit 200 at the unloading position ①.

**[00134]** In the loading process, the same number of devices as the number of devices 10 loaded in the first moving buffer 600, for example, devices arrayed in 12 x 2, are transferred at once.

**[00135]** In the second sorting process, the second rejected devices 10 are transferred from the device accommodation unit 710 to the sorting unit 300 by the transfer tool. In this case, the second rejected devices 10 are loaded onto the tray 30 of the sorting unit 300 according to the defect criteria thereof.

**[00136]** At the sorting position ②, the portions of the device accommodation unit 710 from which the second rejected devices are removed, may be inserted with the second good devices 10 from the second fixed buffer (not shown) in which the second good devices 10 are loaded in advance – buffering process.

**[00137]** Meanwhile, the second fixed buffer is installed on the main body 40 and is loaded in advance with the second good devices 10. If the second fixed buffer is made to be empty at an initial time or while being operated, the second good devices 10 may be loaded on the device accommodation unit 710 of the second moving buffer 700 disposed at the sorting position ②.

**[00138]** FIG. 5 shows conceptual views illustrating an exchange process of a burn-in board between an X-Y table and a burn-in board exchange buffer unit in the device handler of FIG. 1, FIG. 5a is a conceptual view illustrating a state before firstly exchanging a burn-in board between the X-Y table and the burn-in board exchange buffer unit, and FIG. 5b is a conceptual view illustrating a state after exchanging the burn-in board between the X-Y table and the burn-in board exchange buffer unit. FIG. 6 shows conceptual views illustrating an exchange process of a burn-in board between a burn-in board exchange buffer unit and a board loader in the device handler of FIG. 1, FIG. 6a is a conceptual view illustrating a state before exchanging a burn-in board between a burn-in board exchange buffer unit and a board loader, FIG. 6b is a conceptual view illustrating an intermediate state in which the burn-in board is introduced into the rack of the board loader between the burn-in board exchange buffer unit and the board loader, FIG. 6c is a conceptual view illustrating a state in which the burn-in board is introduced into a rack in the board loader between the burn-in board exchange buffer unit and the board loader, FIG. 6d is a conceptual view illustrating an intermediate state in which the burn-in board is unloaded

from the rack in the board loader between the burn-in board exchange buffer unit and the board loader, and FIG. 6e is a conceptual view illustrating a state in which the burn-in board is unloaded from the rack in the board loader between the burn-in board exchange buffer unit and the board loader. FIG. 7 is a side view illustrating a configuration of a board loader.

**[00139]** Meanwhile, when the exchange of the first devices 10 and the second devices 10 are completed in the burn-in board 20 on the X-Y table 410, the X-Y table 410 exchanges a new burn-in board 20 having thereon the second devices 10 with a board loader 800.

**[00140]** However, when the burn-in board 20 on the X-Y table 410 is exchanged, loading of the first device 10 and unloading of the second device 10 are stopped, and therefore, the loading and unloading of the device 10 is delayed by an exchange time (duration) of the burn-in board 20 on the X-Y table 410.

**[00141]** Accordingly, if the exchange time of the burn-in board 20 on the X-Y table 410 is reduced, the processing speed of the device handler, so-called UPH, may be improved as much. Accordingly, the device handler according to the present invention further includes a burn-in board exchange buffer unit 420 which temporarily stores the burn-in board 20 in which the first devices 10 are loaded and the burn-in board 20 in which the second devices 10 are loaded in an alternate manner, and exchanges the burn-in board 20 having the first devices 10 inserted thereinto on the X-Y table 410 with the burn-in board 20 having the second devices 10 inserted thereinto and selected from the board loader 800 having thereon the plurality of burn-in boards 20.

**[00142]** The burn-in board exchange buffer unit 420 is a configuration which is installed between the board loader 800 and the X-Y table 410 and relays the burn-in board

20, and may be variously configured according to design and appearance.

**[00143]** According to the configuration of the equipment, the burn-in board exchange buffer unit 420 may be installed on one side in the outer most end of the moving area of the X-Y table 410 or inside the board loader 800.

**[00144]** Meanwhile, in order to reduce the exchange time of the burn-in board 20, the X-Y table 410 and the burn-in board exchange buffer unit 420 favorably exchange a burn-in board 20 in which the first devices 10 are loaded and a burn-in board 20 in which the second devices 10 are loaded, simultaneously.

**[00145]** In addition, for simultaneous exchange of the burn-in boards 20, the X-Y table 410 may include a pair of burn-in board mounting units 411 respectively for mounting a burn-in boards 20 in a upper position and a lower position, and a burn-in board up-down moving unit 412 for moving the burn-in board 20 mounted in one the pair of the burn-in board mounting units 411 in at least one direction of upper and lower directions between the two burn-in board mounting units 411.

**[00146]** In this case, the burn-in board exchange buffer unit 420 may be configured to include a pair of burn-in board buffer units 421 on which the burn-in boards 20 are mounted one above another corresponding to the burn-in board mounting units 411 of the X-Y table 410.

**[00147]** The burn-in board buffer unit 421 may be any configuration as long as a burn-in board 20 may be loaded, and is favorably configured so as not to interfere with the movements of the first finger unit 441, the second finger unit 442, and the like which will be described later.

**[00148]** Meanwhile, as illustrated in FIGS. 5a to 5d, the transfer of a burn-in board 20 between the X-Y table 410 and the burn-in board exchange buffer unit 420 is performed by

using the first finger unit 441 and the second finger unit 442, and the configurations and the installation positions of the first finger unit 441 and the second finger unit 442 may be variously configured according to design and appearance.

**[00149]** The exchange process of burn-in boards 20 between the X-Y table 410 and the burn-in board exchange buffer unit 420 which have the configuration described above may be performed in various forms according to respective configurations, and one example thereof will be described below in detail with reference to accompanying drawings.

**[00150]** As shown in FIGS. 5A and 5B, the X-Y table 410 initially receives the burn-in board 20 having thereon the second devices 10 from the burn-in board exchange buffer unit 420. Here, in a case that the burn-in boards 20 are arranged in a upper position and a lower position, the X-Y table 410 may receive the burn-in boards 20 from the burn-in board exchange buffer unit 420 from either the upper side or the lower side. Preferably, as shown in FIGS. 6D and 6E, the X-Y table 410 receives the burn-in boards 20 from the burn-in board exchange buffer unit 420 from the upper side.

**[00151]** The X-Y table 410 having received the burn-in board 20 having thereon the second devices 10 is driven in an X-Y direction so that unloading of the second devices 10 and loading of the first devices 10 can be performed through the opening 41.

**[00152]** The burn-in board exchange buffer unit 420 is supplied with the burn-in board 20 having thereon the second devices 10 from the board loader 800 when the X-Y table 410 moves for unloading of the second devices 10 and loading of the first devices 10.

**[00153]** Upon completion of the unloading of the second devices 10 and the loading of the first devices 10, as shown in FIG. 5C, the burn-in board 20 having thereon the first devices 10 are moved to the burn-in board exchange buffer unit 420 so that another burn-in board 20 having thereon the second devices 10 can be supplied.

**[00154]** As shown in FIG. 5C, while the X-Y table 410 moves towards the burn-in board exchange buffer unit 420, the burn-in board 20 on the X-Y table 410 is downwardly moved by the burn-in board up-down moving unit 412 so as to be exchanged with the burn-in board 20 by the burn-in board exchange buffer unit 420.

**[00155]** As shown in FIG. 5D, the X-Y table 410 having moved to the burn-in board exchange buffer unit 420 is supplied with the burn-in board 20 disposed above the burn-in board exchange buffer unit 420. Here, the burn-in board 20 disposed below the X-Y table 410 is moved to the burn-in board buffer unit 421 disposed below the burn-in board exchange buffer unit 420.

**[00156]** In addition, the exchange of the burn-in boards 20 between the X-Y table 410 and the burn-in board exchange buffer unit 420 is favorably performed simultaneously to reduce the exchange time.

**[00157]** Meanwhile, as illustrated in FIGS. 1 and 2, the device handler according to the present invention includes a board loader 800 installed on one side thereof so as to be continuously provided with the burn-in boards 20.

**[00158]** The board loader 800 is a configuration for stacking and loading burn-in boards 20 in which the second devices 10 are inserted, and sequentially stacking and transferring burn-in boards 20 to a burn-in test in which the first devices 10 are inserted, that is, a configuration for continuously exchanging burn-in boards 20 with the X-Y table 410. The board loader 800 may be variously configured.

**[00159]** Once the first devices 10 have been loaded on all the burn-in boards 20 of one rack 50, the rack 50 having the first devices 10 completely loaded thereon is exchanged with another rack 50 having the burn-in boards 20 loaded with the second devices 10.

**[00160]** Here, the X-Y table 410 has to wait at the board loader 800 until it is supplied

with new burn-in board 20 after the racks 50 have been exchanged with each other. This may lower a processing speed of the device handler.

**[00161]** Accordingly, as shown in FIG. 7, the board loader 800 of the device handler may include a pair of rack loading units 810 disposed in a Y-axis direction of the X-Y table 410, for loading thereon racks in a plurality of stacks, the racks having thereon a plurality of burn-in boards, and an elevator unit 820 installed between the two rack loading units 810, for withdrawing the racks 50 from the rack loading units 810 and moving the racks 50 in upper and lower directions without influencing on the loading and unloading of the devices on the burn-in board.

**[00162]** The rack loading units 810 may have any configurations to load thereon the racks 50.

**[00163]** Preferably, the rack loading units 810 are configured in one pair, and are installed at both sides of the elevator unit 820.

**[00164]** In a case that the X-Y table 410 and the burn-in board exchange buffer unit 420 are provided, the elevator unit 820 is configured to exchange the burn-in board exchange buffer unit 420 with the burn-in board 20 by withdrawing the racks 50 from the rack loading units 810 and by up-down moving the withdrawn racks 50.

**[00165]** The board loader 800 includes a pair of rack withdrawal units 830 in correspondence to the two rack loading units 810, and configured to withdraw the racks 50 loaded on each of the rack loading units 810.

**[00166]** The rack withdrawal units 830 are configured to withdraw the racks 50 from the rack loading units 810 to a supporting unit 821 of the elevator unit 820, or are configured to load the racks 50 on the rack loading units 810 from the elevator unit 820.

**[00167]** Exchanging the burn-in boards 20 between the burn-in board exchange buffer

unit 420 and the board loader 800 may be variously performed according to each configuration. One example of the exchanging process will be explained in more detail with reference to the attached drawings.

**[00168]** As shown in FIGS. 6C and 6D, the burn-in board exchange buffer unit 420 initially receives the burn-in board 20 having thereon the second devices 10 from the board loader 800. Here, in a case that the burn-in boards 20 are arranged in upper and lower directions, the X-Y table 410 may receive the burn-in board 20 from the board loader 800 from either the upper side or the lower side. Preferably, the X-Y table 410 receives the burn-in board 20 from the upper side with consideration of the exchanges of the burn-in boards between the X-Y table 410 and the burn-in board exchange buffer unit 420.

**[00169]** That is, the burn-in board 20 having thereon the second devices 10 is withdrawn from the board loader 800, and is transferred to a burn-in board mounting unit 411 disposed above the X-Y table 410 via the burn-in board buffer unit 421 disposed above the burn-in board exchange buffer unit 420. And, the burn-in board 20 having thereon the first devices 10 is transferred to the board loader 800 via the burn-in board mounting unit 411 disposed below the X-Y table 410.

**[00170]** After completely exchanging the burn-in boards 20 with the X-Y table 410, the burn-in board exchange buffer unit 420 exchanges the burn-in boards 20 with the board loader 800 through processes shown in FIGS. 6A and 6B.

**[00171]** The burn-in board exchange buffer unit 420 supplies the burn-in board 20 received from the X-Y table 410, especially, the burn-in boar 20 mounted at a lower side of the burn-in board buffer unit 421, to empty portions of the racks 50 of the board loader 800. Preferably, the racks 50 are up-down moved by the elevator unit 820 so as to supply or withdraw the burn-in boards 20 thereto/therefrom. For smooth exchanges of the burn-in

boards 20, at least one of the uppermost rack 50 and the lowermost rack 50 is not provided with the burn-in boards 20.

**[00172]** The burn-in board exchange buffer unit 420 withdraws a new burn-in board 20 having thereon the second devices 10 from the rack 50. Here, the burn-in board 20 is withdrawn from the rack 50 thus to be mounted to the burn-in board exchange buffer unit 420, especially, the burn-in board buffer unit 421 disposed at an upper side.

**[00173]** As shown in FIGS. 6A to 6D, the exchanges of the burn-in boards 20 between the burn-in board exchange buffer unit 420 and the board loader 800 are performed by transferring the burn-in boards 20 by one or more sub-fingers 443 and 444 therebetween.

**[00174]** Here, the sub-fingers 443 and 444 may be configured to transfer the burn-in boards 20 at a plurality of moving sub-sections corresponding thereto among moving sections between the burn-in board exchange buffer unit 420 and the board loader 800.

**[00175]** FIG. 8a is a side cross-sectional view illustrating a burn-in board exchange buffer unit and a board loader which have modified configuration from the device handler of FIG. 1, and FIG. 8b is a side view illustrating the board loader of FIG. 8a.

**[00176]** As shown in FIGS. 8A and 8B, the device sorting apparatus according to the present invention may be configured to comprise only the rack loading units 810 for loading thereon the racks 50 without comprising the elevator unit 820 for up-down moving the racks 50. And, the device handler according to the present invention may be configured to move the burn-in board exchange buffer unit 420 in upper, lower, right and left directions so that the burn-in board 20 can be withdrawn from the racks 50 loaded on each of the rack loading units 810.

**[00177]** As shown in FIG. 8B, the board loader 800 may include the rack loading

portions 810 respectively for being loaded with a rack 50, i.e., nine rack loading portions 810 in the preferred embodiment.

**[00178]** As shown in FIGS. 8A and 8B, the device handler according to the present invention may further comprise an exchange buffer driving unit 430 for horizontal and vertical movements of the burn-in board exchange buffer unit 420.

**[00179]** The exchange buffer driving unit 430 may be variously configured to drive the burn-in board exchange buffer unit 420 in upper, lower, right and left directions, i.e., in horizontal and vertical directions so that the burn-in board 20 can be withdrawn from the racks 50 loaded on each of the rack loading portions 810.

**[00180]** For example, the exchange buffer driving unit 430 may include a first driving unit 431 for driving up-down movements of the burn-in board exchange buffer unit 420 based on upper and lower portions of the racks 50 loaded on the board loader 800, and a second driving unit 432 for driving horizontal movements of the burn-in board exchange buffer unit 420 based on a horizontal direction of the racks 50 arranged on the board loader 800.

**[00181]** As shown in FIGs. 8A and 8B, the first and the second driving units 431, 432 may be provided with screw jack, a linear movement apparatus, etc. in order to move the burn-in board exchange buffer unit 420 by supporting the burn-in board exchange buffer unit 420.

**[00182]** In the device sorting apparatus according to the present invention, the burn-in boards 20 are withdrawn by moving the burn-in board exchange buffer unit 420 in upper, lower, right and left directions in a state that the racks 50 are fixed. This may reduce withdrawal time of the burn-in boards 20 to greatly enhance a processing speed of the device sorting apparatus.

**[00183]** Furthermore, the board loader 800 is not required to have the elevator unit under a configuration that the burn-in board exchange buffer unit 420 is moved in upper, lower, right and left directions. This may allow the board loader 800 to have a simplified configuration. Also, the number of the racks 50 loaded on the board loader 800 is increased to prolong an exchange period of the racks 50, thereby enhancing operational efficiency.

**[00184]** The burn-in board exchange buffer unit 420 and the exchange buffer driving unit 430 may be configured as one board loader module together with the board loader 800.

**[00185]** However, the types, i.e. specifications, of devices to be sorted may vary. In this case, the device handler configured as described above has a limitation in that when a tray 30 corresponding to the specification is loaded on the loading unit 100 and then unloading unit 200, constituent members, such as a DC test unit 170, a socket press 45 and buffer units 600 and 700, which are conformable to the specifications of the devices, should be individually exchanged by manual work of operators, and thus, exchange work is cumbersome.

**[00186]** Accordingly, as illustrated in FIGS. 1 and 9, the device handler according to the present invention may further include a kit exchange unit 900 which automatically exchanges at least one of the DC test unit 170, the socket press 45 on the X-Y table 410, the buffer units 600 and 700, and the like according to the specifications of the devices when the specifications of the devices to be sorted vary.

**[00187]** The kit exchange unit 900 is a configuration which automatically exchanges at least one of the DC test unit 170, the socket press 45 on the X-Y table 410, buffer units 600 and 700, and the like according to the specifications of the devices when the specifications of the devices to be sorted vary, and may be variously configured.

**[00188]** The exchange kit to be exchanged may be the DC test unit 170, the socket press 45 on the X-Y table 410, the buffer units 600 and 700, and the like.

**[00189]** In case of the buffer units 600 and 700, the exchange kit may be the device accommodation units 610 and 710, the first fixed buffer, the second fixed buffer, and the like, rather than the entire buffer units.

**[00190]** As illustrated in FIG. 10, in a specific example, the kit exchange unit 900 may include: a main body unit 901 having a buffer space 910 which is provided therein and in which the exchange kit to be exchanged is temporality stored; and an exchanging unit 930 which unloads the exchange kit installed in a main body 40 of the device handler, temporality stores the exchange kit in a buffer space 920, and loads a new exchange kit to the main body 40 of the device handler.

**[00191]** The main body unit 901 may be any configuration as long as one or more new exchange kits to be exchanged may be loaded therein and an empty space for loading an exchange kit, which has been installed in the main body 40 and unloaded, is provided.

**[00192]** In addition, the main body unit 901 is favorably installed to be vertically movable for convenience of exchanging the exchange kit.

**[00193]** The exchanging unit 930 is a configuration for withdrawing an exchange kit installed in the main body 40, temporarily storing the kit in the buffer space 920, and exchanging the kit for a new exchange kit, and the exchanging unit 930 may be variously configured according to the types, configurations, and exchange methods of the exchange kits.

**[00194]** In this case, for convenience of exchanging exchange kits, one or more guide rails 902, which guide a linear movement of the exchange kit, are favorably installed.

**[00195]** In addition, in case of a DC test unit 170 in an exchange kit, an electrical

connection is required. Accordingly, as illustrated in FIGS. 10 and 11, an electrical connection unit 171, which is for electrical connection with the DC test unit 170 and in which the DC test unit 170 is inserted in the moving direction thereof, may be installed on the main body 40.

**[00196]** The electrical connection unit 171 is a configuration which is electrically connected to the DC test unit 170 so that a DC test may be performed by using the DC test unit 170, and the electrical connection unit 171 may be configured from one or more terminal members.

**[00197]** In addition, in case of the buffer units 600 and 700 in an exchange kit, the exchange kit may be variously configured according to the configurations and positions of the buffer units 600 and 700.

**[00198]** The buffer units 600 and 700 are configurations for temporarily loading devices, and may be installed on the main body 40 in various positions, in various numbers of units, and in a movable or fixed state.

**[00199]** For example, as illustrated in FIGS. 1 and 9, the buffer units 600 and 700 may include a first moving buffer 600, a second moving buffer 700, one or more fixed buffers, and the like.

**[00200]** In this case, the exchange kit may be a device accommodation unit 610 in a first moving buffer 600, a device accommodation unit 710 in a second moving buffer 700, and one or more fixed buffers.

**[00201]** In this case, the device accommodation unit 610 in the first moving buffer 600, the device accommodation unit 710 in the second moving buffer 700, and the one or more fixed buffers may have the same structure, that is, specification.

**[00202]** In addition, as illustrated in FIG. 1, exchange of the device accommodation unit

610 in the first moving buffer 600, the device accommodation unit 710 in the second moving buffer 700 may respectively be performed in the linear moving directions of the device accommodation unit 610 in the first moving buffer 600 and the device accommodation unit 710 in the second moving buffer 700, and exchange (a case in which an exchange buffer is not installed may also occur) of the one or more fixed buffers may be performed on at least one end of the first moving buffer 600 and the second moving buffer 700.

**[00203]** In addition, as illustrated in FIG. 2, the exchange of the device accommodation unit 610 in the first moving buffer 600, the device accommodation unit 710 in the second moving buffer 700, and one or more fixed buffers (fixed buffers may not be installed) is introduced in the linear moving direction of any one of the device accommodation unit 610 in the first moving buffer 600 and the device accommodation unit 710 in the second moving buffer 700, and is discharged via the fixed buffer (when the fixed buffer is installed) in the linear moving direction of the other of the device accommodation unit 610 in the first moving buffer (600) and the device accommodation unit 710 in the second moving buffer 700.

**[00204]** Meanwhile, the kit exchange unit 900 is favorably installed to be adjacent to the main body 40 and movable at a position facing the sorting unit 300 with respect to the arrangement directions of the loading unit 100 and the unloading unit 200.

**[00205]** As described above, when the kit exchange unit 900 is installed to be adjacent to the main body 40 and movable at a position facing the sorting unit 300 with respect to the arrangement directions of the loading unit 100 and the unloading unit 200, an exchange of the exchange kit and an exchange by an operator may become more easy, and the equipment may be compactly configured.

**[00206]** Meanwhile, as the kind of devices is diversified, the exchange kit to be exchanged is favorably installed in plurality. To exchange the kits, an exchange kit loading unit 910 in which a plurality of exchange kits are loaded may further be installed in a state separated from the device handler aside from the main body unit 901.

**[00207]** In the exchange kit loading unit 910, the exchange kit is favorably installed in plurality, and therefore to install the kits, a plurality of exchange kits to be exchanged are loaded separate from the main body unit 901, and the exchange kit loading unit 910 is further installed in a movable manner and in a state of being separate from the device handler. Thus, space utilization efficiency may be maximized while simplifying the configuration of the kit exchange unit 900.

**[00208]** That is, the kit exchange unit 900 and the exchange kit loading unit 910 are moved to the device handler and exchange the exchange kits only when the exchange of the exchange kits is required, and thus, space utilization efficiency of the equipment may be maximized while simplifying the overall configuration.

**[00209]** Meanwhile, in the present invention, the device handler illustrated in FIG. 1 may be variously modified.

**[00210]** For example, from the configuration of the device handler illustrated in FIG. 1, the device handler according to a first modified embodiment of the present invention may include, as illustrated in FIG. 12, an empty tray supply unit 80 which is installed parallel to one side of a loading unit 100 to load a plurality of empty trays 30 to be loaded onto a burn-in board 20.

**[00211]** At this point, a DC test unit 170, as illustrated in FIG. 12, may not be provided, or may be provided as illustrated in FIG. 13.

**[00212]** The device handler according to a first modified embodiment of the present

invention may carry out only a function of loading devices 10 onto a burn-in board 20, or only a function of unloading devices 10 from a burn-in board 20 and load the devices 10 on to a tray 30.

**[00213]** To carry out such a function, the loading unit 100 and an unloading unit 200 are both configured so as to load a tray 30 in which devices 10 are already loaded or to load an empty tray 30 to load devices 10.

**[00214]** Meanwhile, when the device handler according to a first modified embodiment of the present invention performs only a function of loading devices 10 from the burn-in board 20 and load the devices 10 onto a tray 30, the devices 10 may be considered as a sorting unit 300 according to test results.

**[00215]** In addition, the device handler according to a first modified embodiment of the present invention may carry out only loading of devices on a test socket or only unloading of devices, and at this point, a socket press, to which an adaptor member having different specification are coupled, are favorably used for device loading or device unloading.

**[00216]** When the socket press to which the adaptor member having different specification is used for device loading or device unloading, during device loading, an adaptor member having minimized gap to a device is used to carry out an accurate mounting of the device onto a test socket, and during device unloading, a gap with respect to the device is sufficiently set so as not to interfere with unloading.

**[00217]** At this point, the socket press is a configuration which operates the test socket installed on the burn-in board or the like and enables device loading or device unloading, and the socket press may be variously configured according to the structures of test sockets.

**[00218]** In addition, the socket press is provided with an adaptor member which is installed therein and which guides a device so as to be positioned at an accurate position in

a test socket, that is, at a position contacting a terminal (pogo pin, etc.) for connection with the terminal of the device.

**[00219]** The adaptor member is a configuration for allowing a device to be mounted at an accurate position on a test socket, and may be variously configured, such as, to have an inclined surface when viewed from above.

**[00220]** As another example, the device handler according to a second modified embodiment of the present invention is characterized in that from the configuration illustrated in FIG. 1, a socket press unit 90 including a loading socket press 92 and an unloading socket press 91 is provided as illustrated in FIGS. 14, 15a, and 15b.

**[00221]** In this case, a DC test unit 170 is an optional configuration, and may be installed if necessary.

**[00222]** The socket press unit 90 is a configuration which includes the loading socket press 92 and the unloading socket press 91 and presses the test socket (not shown) during device loading or device unloading to thereby help load or unload devices, and may be variously configured according to the structures of sockets.

**[00223]** The loading socket press 92 is a configuration for allowing a device to be mounted at an accurate position on a test socket installed on a burn-in board 20 during device loading, and has an adaptor member installed therein so that the device is accurately mounted onto the test socket after being dropped.

**[00224]** In particular, the adaptor member has openings 92a formed in a size nearly the same as the planar size of the device so that the device are accurately mounted on the test socket after being dropped.

**[00225]** The unloading socket press 91 is a configuration for allowing a device to be mounted at an accurate position on a test socket installed on a burn-in board 20 during

device unloading.

**[00226]** The unloading socket press 91 is opened in up-down direction so that devices may be withdrawn, and the size of openings 91a is favorably formed larger than that of the loading socket press 92 described above so as not to interfere with device unloading.

**[00227]** For reference, when the socket press is configured as a single unit, and when openings of an adaptor member in the socket press are formed small to load devices at an accurate position, there is a limitation of interfering with device unloading when the devices are withdrawn.

**[00228]** However, as described above, the socket press unit 90 is provided with the loading socket press 92 and the unloading socket press 91, so that during device loading, devices are mounted at a more accurate position, and during device unloading, devices may be unloaded without interference. Thus, device loading and device unloading may be smoothly performed.

**[00229]** Meanwhile, the loading socket press 92 and the unloading socket press 91, as illustrated in FIG. 14, are favorably arranged in the Y-axis direction perpendicular to the X-axis direction which is the arrangement direction of the loading unit 100 and the unloading unit 200.

**[00230]** In this case, as illustrated in FIG.S. 14, 15a and 15b, a first transfer tool 530 and a second transfer tool 540 are favorably installed to be spaced apart from each other in the Y-axis direction corresponding to the loading socket press 92 and the unloading socket press 91.

**[00231]** Meanwhile, the device handler according to the second modified embodiment of the present invention may include an empty tray supply unit 80 which is installed parallel to one side of the loading unit 100 to load a plurality of empty trays 30 to be

loaded onto a burn-in board 20.

**[00232]** The above-mentioned features are merely a description about a portion of exemplary embodiments which may be implemented by the present invention. Therefore, as is well known, the scope of the present invention should not be construed to be limited to the above embodiments, and all technical concepts based on the same root as the technical concept of the present invention should be considered to be included in the scope of the present invention.

**CLAIMS**

1. A device handler comprising:

a loading unit (100) in which a tray (30) loaded with devices to undergo a burn-in test is loaded;

an X-Y table (410) for moving a burn-in board (20) in X-Y directions in which the devices to undergo the burn-in test are inserted to empty portions from which devices having undergone the burn-in test are withdrawn; and

an unloading unit in which good devices among loaded devices having undergone the burn-in test are loaded on a tray (30).

2. The device handler of claim 1, further including a DC test unit (170) which receives a device to undergo a burn-in test from the loading unit (100) and tests DC characteristics of the device in advance before the device is loaded on the burn-in board (20).

3. The device handler of claim 2, further including a sorting unit (300) for sorting and loading devices determined as rejected devices as a result of a DC characteristic test of the DC test unit (170) and devices determined as rejected devices as a result of the burn-in test.

4. The device handler of claim 3, further including a first moving buffer (600) on which the device having undergone the DC characteristic test in the DC test unit (170) is temporarily loaded before loaded on the burn-in board (20); and a second moving

buffer (700) on which the device having undergone the burn-in test and unloaded from the X-Y table (410) is temporarily loaded.

5. The device handler of claim 4, further including a kit exchange unit (900) which automatically exchanges at least one among the DC test unit (170), a socket press (45) on the X-Y table (410), the first moving buffer (600) and the second moving buffer (700) as an exchange kit according to the specifications of the device to undergo the burn-in test.

6. The device handler of claim 5, wherein the kit exchange unit (900) includes:

a main body unit (901) having a buffer space (910) which is provided therein and in which an exchange kit to be exchanged is temporality stored; and an exchanging unit (930) which unloads an exchange kit installed in a main body (40) of the device handler, temporality stores the exchange kit in a buffer space (920), and loads a new exchange kit to the main body (40) of the device handler.

7. The device handler of claim 5, wherein an electrical connection unit (171) in which the DC test unit (170) is inserted in a moving direction thereof and which is for electrical connection with the DC test unit (170) is installed on the main body (40) of the device handler when the exchange kit is the DC test unit (170).

8. The device handler of claim 4, further including:

a third transfer tool (510) which transfers devices between the loading unit (100)

and the DC test unit (170);

a fourth transfer tool (520) which transfers devices between the DC test unit (170) and the first moving buffer (600);

a fifth transfer tool (550) which transfers devices between the second moving buffer (700) and the unloading unit (200); and

one or more sorting tools which transfer devices between the first moving buffer (600) and the second moving buffer (700), and the sorting unit (300).

9. The device handler of claim 8, wherein the one or more sorting tools includes:

a first sorting tool (560) which transfers devices between the first moving buffer (600) and the sorting unit (300); and

a second sorting tool (570) which transfers devices between the second moving buffer (700) and the sorting unit (300).

10. The device handler of claim 5,

wherein the exchange kit is a device accommodation unit (610) in the first moving buffer (600), a device accommodation unit (710) in the second moving buffer (700), and at least one fixed buffer installed on the main body (40) of the device handler;

wherein the device accommodation unit (610) in the first moving buffer (600), the device accommodation unit (710) in the second moving buffer (700), and the fixed buffer have a same structure;

wherein an exchange of the device accommodation unit (610) in the first moving buffer (600) and the device accommodation unit (710) in the second moving buffer (700) is

respectively performed in the linear moving directions of the device accommodation unit (610) in the first moving buffer (600) and the device accommodation unit (710) in the second moving buffer (700);

wherein an exchange of the fixed buffer is performed in at least any one of ends of the first moving buffer (600) and the second moving buffer (600).

11. The device handler of claim 5,

wherein the exchange kit is a device accommodation unit (610) in the first moving buffer (600), a device accommodation unit (710) in the second moving buffer (700), at least one fixed buffer installed on and the main body (40) of the device handler;

wherein the device accommodation unit (610) in the first moving buffer (600), the device accommodation unit (710) in the second moving buffer (700), and the fixed buffer have a same structure;

wherein an exchange of the device accommodation unit (610) in the first moving buffer (600), the device accommodation unit (710) in the second moving buffer (700), and the fixed buffer is introduced in the linear moving directions of any one of the device accommodation unit (610) in the first moving buffer (600) and the device accommodation unit (710) in the second moving buffer (700); and is discharged via the fixed buffer in a linear moving direction of the other of the device accommodation unit (610) in the first moving buffer (600) and the device accommodation unit (710) in the second moving buffer (700).

12. The device handler of claim 5, further including a socket press unit (90) which is installed above the X-Y table (410) and presses a test socket installed on the burn-

in board (20) to withdraw or insert a device from and onto the burn-in board (20);

wherein the socket press unit (90) includes: a loading socket press (92) having therein loading openings (92a) for guiding a device to undergo the burn-in test so as to be inserted in the test socket; and an unloading socket press (92) having therein unloading openings (91a) for guiding a device having undergone the burn-in test so as to be withdrawn from the test socket.

13. The device handler of claim 12, wherein a size of the unloading openings (91a) is formed greater than that of the loading openings (92a) so as not interfere with withdrawing of a device from the test socket.

14. The device handler of claim 12, wherein the loading socket press (92) and the unloading socket press (91) are arranged in a direction in which the loading unit (100) and the unloading unit (200) are arranged.

15. The device handler of claim 14, wherein the first transfer tool (530) and the second transfer tool (540) are installed to be spaced apart from each other in a direction in which the loading unit (100) and the unloading unit (200) are arranged, corresponding to the loading socket press (92) and the unloading socket press (91).

16. The device handler of any one of claims 1 to 15, further including an empty tray supply unit (80) which is installed in parallel on one side of the loading unit (100) and is provided to load a plurality of empty trays (30) on the burn-in board (20).