SPECIFICATION

BATCH LOADING AND UNLOADING APPARATUS AND METHOD FOR AGING DEVICE

TECHNICAL FIELD

0001. The present disclosure relates to the technical field of automation devices, and in particular to a batch loading and unloading apparatus and method for an aging device.

BACKGROUND

0002. During chip manufacturing, aging test accelerates the exposure of potential chip defects by simulating extreme conditions such as high temperature and high pressure, thereby effectively screening out early failure products and predicting the service life, and thus improving the reliability of chip applications in key fields such as automotive and healthcare. However, the loading and unloading process of the existing aging device still relies on conventional manual or semi-automated operations, resulting in problems such as low chip positioning accuracy and long fixture changeover duration. This leads to insufficient device utilization during large-scale testing, making it difficult to meet the high-throughput requirements of advanced process chips.

SUMMARY

0003. In a first aspect, the present disclosure provides a batch loading and unloading apparatus for an aging device. The batch loading and unloading apparatus for an aging device includes a tray loading and unloading assembly, a board loading and unloading assembly, a cover opening assembly, a cover closing assembly, a pre-test assembly, and a transfer assembly.

0004. The tray loading and unloading assembly is configured to receive and store trays. The trays include a loading tray, an unloading tray, and an abnormal tray. The loading tray, the unloading tray, and the abnormal tray carry a chip to be tested, a chip that has completed an aging test, and a chip that has failed a pre-test, respectively.

0005. The board loading and unloading assembly is configured to receive and store a board, a plurality of fixtures are disposed on the board, each of the fixtures includes an openable and closable box cover, and in the board loading and unloading assembly, the box cover is in a closed state.

0006. The cover opening assembly is configured to extract the board from the board loading and unloading assembly and perform a cover opening operation on the box cover, and the cover closing assembly is configured to perform a cover closing operation on the box cover.

0007. The pre-test assembly includes a pre-test mechanism and a swapping mechanism. The pre-test mechanism is configured to pre-test the chips on the board, and the swapping mechanism is configured to perform cover opening, chip swapping, and cover closing operations on the fixtures that have failed pre-tests and adjacent fixtures that have passed pre-tests on the board in an aging state.

0008. The transfer assembly is configured to transfer the trays, the board, and the chips among the tray loading and unloading assembly, the board loading and unloading assembly, the cover opening assembly, the cover closing assembly, and the pre-test assembly.

0009. In an optional embodiment, the tray loading and unloading assembly includes:

0010. a storage bin assembly, including a loading bin, an unloading bin, and an abnormal sorting bin configured to store the loading tray, the unloading tray, and the abnormal tray, respectively; and

0011. a de-stacking and stacking mechanism, the de-stacking and stacking mechanism being configured to perform a de-stacking operation and a stacking operation on the tray in the storage bin assembly, where the de-stacking operation removes the loading tray from the loading bin, and the stacking operation stores the unloading tray and the abnormal tray into the unloading bin and the abnormal sorting bin, respectively.

0012. The transfer assembly includes a tray transfer mechanism. The tray transfer mechanism is configured to receive the loading tray from the de-stacking and stacking mechanism and transfer the loading tray to a loading station, and to transfer the unloading tray and the abnormal tray from an unloading station to the de-stacking and stacking mechanism located at the unloading bin and the abnormal sorting bin, respectively.

0013. In an optional embodiment, the board loading and unloading assembly includes:

0014. a plurality of layers of board storage bins, each layer of board storage bin being configured to store at least one board;

0015. a lifting mechanism configured to adjust a vertical position of the plurality of layers of board storage bins; and

0016. a detection sensor configured to monitor an empty/full status of each layer of board storage bin in real time.

0017. In an optional embodiment, the cover opening assembly includes an X-axis moving module, a Z-axis lifting module, and a board-pulling gripper, the board-pulling gripper is configured to connect to the board, and the X-axis moving module and the Z-axis lifting module are configured to drive the board-pulling gripper.

0018. In an optional embodiment, the box cover of the fixture includes a pull rod, and the cover opening assembly includes:

0019. an X-axis moving module configured to drive a Z-axis lifting module to move horizontally;

0020. a Z-axis lifting module configured to drive a cover-opening gripper to move vertically; and

0021. a cover-opening gripper having a closed state and an open state, where the cover-opening gripper in the closed state is capable of clamping the pull rod, the Z-axis lifting module drives the cover-opening gripper to move upward, the cover-opening gripper drives the pull rod to open the box cover, and the cover-opening gripper in the open state is separated from the pull rod.

0022. In an optional embodiment, the box cover of the fixture includes a pull rod, and the cover closing assembly includes:

0023. an X-axis displacement module configured to drive a Z-axis pressing module to move horizontally; and

0024. a Z-axis pressing module configured to drive a cover-pushing gripper to vertically press down to close the box cover.

0025. In an optional embodiment, the pre-test mechanism includes:

0026. a pre-test machine including a port configured to connect to the board; and

0027. a press-fitting module configured to press-fit the port of the board with a port of the pre-test machine.

0028. In an optional embodiment, the box cover of the fixture includes a pull rod, and the swapping mechanism includes:

0029. a cover-opening gripper having a closed state and an open state, where the cover-opening gripper in the closed state is capable of clamping the pull rod, and the cover-opening gripper in the open state is disengaged from the pull rod;

0030. a mouthpiece configured to pick up and release the chip in the fixture; and

0031. a three-axis moving module configured to drive the cover-opening gripper and the mouthpiece to move.

0032. In an optional embodiment, the transfer assembly includes:

0033. a board transfer mechanism configured to transfer the board among the tray loading and unloading assembly, the cover opening assembly, the cover closing assembly, the pre-test assembly, and the board loading and unloading assembly; and

0034. a chip transfer mechanism configured to transfer the chip between the tray and the fixture.

0035. In a second aspect, the present disclosure provides a batch loading and unloading method for an aging device, which employs the batch loading and unloading apparatus for an aging device according to any one of the aforementioned embodiments and includes the following steps:

0036. using the transfer assembly, the tray loading and unloading assembly, the board loading and unloading assembly, the cover opening assembly, and the cover closing assembly to transfer the chip to be tested from the loading tray into the fixture of the board, performing a cover closing operation on the box cover, and transferring the board to the pre-test assembly;

0037. performing, by the pre-test mechanism, a first round of pre-test on the board, where if an abnormal result occurs in a pre-test, the swapping mechanism performs cover opening, chip swapping, and cover closing operations on the fixtures with abnormal results in the pre-test and adjacent fixtures with normal pre-test results on the board in the aging state, and then performs a second round of pre-test; if a same fixture is abnormal in both the first round of pre-test and the second round of pre-test, a corresponding fixture is evaluated as abnormal

and the corresponding fixture is shielded; if a same chip is abnormal in both the first round of pre-test and the second round of pre-test, a corresponding chip is evaluated as abnormal, and the transfer assembly transfers the chip evaluated as abnormal to the abnormal tray;

0038. transferring, by the transfer mechanism, the board that has completed the pre-test from the pre-test assembly to the board loading and unloading assembly;

0039. taking the board out from the board loading and unloading assembly for the aging test, and returning the board that has completed the aging test to the board loading and unloading assembly; and

0040. using the transfer assembly, the tray loading and unloading assembly, the board loading and unloading assembly, the cover opening assembly, and the cover closing assembly to transfer the chips inside the board that has completed the aging test onto the unloading tray in the tray loading and unloading assembly.

0041. The batch loading and unloading apparatus for an aging device according to the present disclosure has the following beneficial effects:

0042. 1. According to the present disclosure, by means of the tray loading and unloading assembly, the board loading and unloading assembly, the cover opening assembly, the cover closing assembly, the pre-test assembly, and the transfer assembly, closed-loop full-process operations covering automatic loading and unloading, cover opening and closing, pre-test, and exception handling of the chip and the board are achieved, and the full-automatic operation of batch loading and unloading of the aging device is achieved, thereby improving the efficiency of batch loading and unloading of the aging device.

0043. 2. The pre-test assembly can promptly detect faults of the chip or the fixture on the board, confirm whether the abnormality originates from the chip or the fixture by means of a swapping structure, so as to promptly handle the abnormal chip or fixture, thereby preventing the abnormal chip or fixture from being subjected to the aging test, and improving the efficiency of the aging test.

0044. The batch loading and unloading method for an aging device according to the present disclosure has the following beneficial effects:

0045. 1. According to the present disclosure, the chip can be automatically transferred from the tray to the board to perform a pre-test. The abnormal chip or fixture is promptly handled

and then automatically fed into the board loading and unloading assembly for an aging test in the next step. After the aging test is completed, the chip can be automatically moved from the board to the tray to facilitate the subsequent production process.

0046. 2. When the pre-test assembly is used for a pre-test, not only can the specific abnormality of the fixture on the board be found, but also the swapping mechanism is used to swap chips in the abnormal fixture and an adjacent fixture, so as to confirm whether the chip or the fixture is abnormal, thereby promptly sorting out the chip or shielding the fixture, and thus improving the efficiency of the aging test.

BRIEF DESCRIPTION OF THE DRAWINGS

0047. To more clearly illustrate the technical solutions in embodiments of the present disclosure or in the prior art, the drawings required to be used in the description of the embodiments or the prior art are briefly introduced below. It is obvious that the drawings in the description below are some embodiments of the present disclosure, and those of ordinary skill in the art can obtain other drawings according to these drawings without creative efforts.

0048. FIG. 1 is a schematic diagram of an overall structure of a batch loading and unloading apparatus for an aging device according to an embodiment of the present disclosure;

0049. FIG. 2 is a schematic top view of part of the structure of a batch loading and unloading apparatus for an aging device according to an embodiment of the present disclosure;

0050. FIG. 3 is a three-dimensional schematic diagram of part of the structure of a batch loading and unloading apparatus for an aging device according to an embodiment of the present disclosure;

0051. FIG. 4 is a three-dimensional schematic diagram of a tray loading and unloading assembly of a batch loading and unloading apparatus for an aging device according to an embodiment of the present disclosure;

0052. FIG. 5 is a schematic side view of a tray loading and unloading assembly of a batch loading and unloading apparatus for an aging device according to an embodiment of the present disclosure;

0053. FIG. 6 is a three-dimensional schematic diagram of a board loading and unloading assembly of a batch loading and unloading apparatus for an aging device according to an embodiment of the present disclosure;

0054. FIG. 7 is a schematic side view of a board loading and unloading assembly of a batch loading and unloading apparatus for an aging device according to an embodiment of the present disclosure;

0055. FIG. 8 is a three-dimensional schematic diagram of a cover opening assembly of a batch loading and unloading apparatus for an aging device according to an embodiment of the present disclosure;

0056. FIG. 9 is a schematic diagram of a partial structure of a cover opening assembly of a batch loading and unloading apparatus for an aging device according to an embodiment of the present disclosure;

0057. FIG. 10 is a schematic three-dimensional structural diagram of a cover closing assembly of a batch loading and unloading apparatus for an aging device according to an embodiment of the present disclosure;

0058. FIG. 11 is a schematic side view of a pre-test assembly of a batch loading and unloading apparatus for an aging device according to an embodiment of the present disclosure;

0059. FIG. 12 is a structural schematic diagram of a swapping mechanism of a batch loading and unloading apparatus for an aging device according to an embodiment of the present disclosure;

0060. FIG. 13 is a structural schematic diagram of a chip transfer mechanism of a batch loading and unloading apparatus for an aging device according to an embodiment of the present disclosure; and

0061. FIG. 14 is a structural schematic diagram of a board transfer mechanism of a batch loading and unloading apparatus for an aging device according to an embodiment of the present disclosure.

0062. Reference numerals: 100-chip; 200-tray loading and unloading assembly; 211-loading bin; 212-unloading bin; 213-abnormal sorting bin; 221-loading tray; 222-unloading tray; 223-abnormal tray; 230-de-stacking and stacking mechanism; 300-board loading and

unloading assembly; 310-board storage bin; 320-lifting mechanism; 330-board; 331-fixture; 332-pull rod; 400-cover opening assembly; 410-X-axis moving module; 420-Z-axis lifting module; 430-board-pulling gripper; 440-cover-opening gripper; 500-cover closing assembly; 510-cover-pushing gripper; 600-pre-test assembly; 610-pre-test mechanism; 611-pre-test machine; 612-press-fitting module; 613-three-axis moving module; 620-swapping mechanism; 621-mouthpiece; 710-tray transfer mechanism; 720-board transfer mechanism; 730-chip transfer mechanism.

DETAILED DESCRIPTION

0063. To make the objectives, technical solutions, and advantages of embodiments of the present disclosure clearer, the following clearly and completely describes the technical solutions in the embodiments of the present disclosure with reference to the drawings in the embodiments of the present disclosure. Apparently, the described embodiments are some but not all of the embodiments of the present disclosure. Generally, the assemblies in the embodiments of the present disclosure described and illustrated in the drawings herein may be arranged and designed in a wide variety of different configurations.

0064. Therefore, the following detailed description of the embodiments of the present disclosure provided in the drawings is not intended to limit the scope of the present disclosure as claimed, but merely represents selected embodiments of the present disclosure. Based on the embodiments of the present disclosure, all other embodiments obtained by those of ordinary skill in the art without creative effort shall fall within the protection scope of the present disclosure.

0065. It should be noted that similar reference numerals and letters refer to similar items in the following drawings, and thus, once an item is defined in one figure, it does not need to be further defined or explained in subsequent figures.

0066. In the description of the present disclosure, it should be noted that the terms such as “center”, “upper”, “lower”, “left”, “right”, “vertical”, “horizontal”, “inner”, “outer”, and the like indicate orientations or positional relationships based on those shown in the drawings, or orientations or positional relationships commonly assumed when using the product of the present disclosure, which is merely for the convenience of describing the present disclosure

and simplifying the description, rather than indicating or implying that the apparatus or element referred to must have a specific orientation, be constructed and operated in the specific orientation, and thus should not be construed as limiting the present disclosure. Furthermore, the terms “first”, “second”, “third”, and the like are used for distinguishing descriptions only and shall not be construed as indicating or implying relative importance.

0067. Furthermore, the terms “horizontal”, “vertical”, “hanging”, and the like do not imply that the components are absolutely horizontal or hanging, but may be slightly inclined. For example, "horizontal" merely means that the direction is more horizontal than "vertical", and does not mean that the structure must be completely horizontal, but may be slightly inclined.

0068. In the description of the present disclosure, it should also be noted that unless otherwise explicitly specified or defined, the terms “dispose”, “mount”, “interconnect”, and “connect” should be understood in their broad sense. For example, “connect” may refer to a fixed connection, a detachable connection, or an integrated connection; a mechanical connection or an electrical connection; or a direct connection, an indirect connection via an intermediate, or internal communication between two elements. For those of ordinary skill in the art, the specific meaning of the above terms in the present disclosure can be understood according to specific conditions.

0069. Some embodiments of the present disclosure will be described in detail below with reference to the drawings. In the absence of conflict, the following embodiments and features in the embodiments may be combined with each other.

0070. Batch loading and unloading apparatus for aging device

0071. The embodiments provide a batch loading and unloading apparatus for an aging device, as shown in FIGs. 1 to 14. The batch loading and unloading apparatus for an aging device includes a tray loading and unloading assembly 200, a board loading and unloading assembly 300, a cover opening assembly 400, a cover closing assembly 500, a pre-test assembly 600, and a transfer assembly 700.

0072. The tray loading and unloading assembly 200 is configured to receive and store trays. The trays include a loading tray 221, an unloading tray 222, and an abnormal tray 223. The loading tray 221, the unloading tray 222, and the abnormal tray 223 carry a chip 100 to be

tested, a chip 100 that has completed an aging test, and a chip 100 that has failed a pre-test, respectively;

0073. The board loading and unloading assembly 300 is configured to receive and store a board 330, and a plurality of fixtures 331 are disposed on the board 330. Each of the fixtures 331 includes an openable and closable box cover, and in the board loading and unloading assembly 300, the box cover is in a closed state.

0074. The cover opening assembly 400 is configured to extract the board 330 from the board loading and unloading assembly 300 and perform a cover opening operation on the box cover, and the cover closing assembly 500 is configured to perform a cover closing operation on the box cover.

0075. The pre-test assembly 600 includes a pre-test mechanism 610 and a swapping mechanism 620. The pre-test mechanism 610 is configured to pre-test the chips 100 on the board 330, and the swapping mechanism 620 is configured to perform cover opening, chip 100 swapping, and cover closing operations on the fixtures 331 that have failed pre-tests and adjacent fixtures 331 that have passed pre-tests on the board 330 in an aging state.

0076. The transfer assembly 700 is configured to transfer the trays, the board 330, and the chips 100 among the tray loading and unloading assembly 200, the board loading and unloading assembly 300, the cover opening assembly 400, the cover closing assembly 500, and the pre-test assembly 600.

0077. FIG. 1 is a schematic diagram of an overall structure of the batch loading and unloading apparatus for an aging device according to the embodiments, including an outer frame of the device, and particularly shows the tray loading and unloading assembly 200, the board loading and unloading assembly 300, the cover opening assembly 400, and the cover closing assembly 500. As shown in FIG. 1, the tray loading and unloading assembly 200 and the board loading and unloading assembly 300 may be respectively disposed at two opposite ends of the device, and the cover opening assembly 400 and the cover closing assembly 500 may be disposed between the tray loading and unloading assembly 200 and the board loading and unloading assembly 300.

0078. FIG. 2 is a schematic top view of part of the structure of the batch loading and unloading apparatus for an aging device according to the embodiments, with the outer frame

of the device and the board loading and unloading assembly 300 omitted, and particularly shows the tray loading and unloading assembly 200, the cover opening assembly 400, the cover closing assembly 500, and the pre-test assembly 600.

0079. FIG. 3 is a three-dimensional schematic diagram of part of the structure of the batch loading and unloading apparatus for an aging device according to the embodiments. Similar to FIG. 2, the outer frame of the device and the board loading and unloading assembly 300 are omitted, and in particular, the tray loading and unloading assembly 200, the cover opening assembly 400, the cover closing assembly 500, and the pre-test assembly 600 are shown.

0080. FIG. 4 is a three-dimensional schematic diagram of a tray loading and unloading assembly 200 of a batch loading and unloading apparatus for an aging device according to the embodiments, and FIG. 5 is a schematic side view of the tray loading and unloading assembly 200 of the batch loading and unloading apparatus for an aging device according to the embodiments. As shown in FIGs. 4 and 5, the trays include a loading tray 221, an unloading tray 222, and an abnormal tray 223. The trays are stored in a stacked manner, and each type of tray may have a plurality of stacks. Specifically, the tray in the stacked state may be taken out by the transfer assembly 700, thereby emptying the stack of the tray.

0081. FIG. 6 is a three-dimensional schematic diagram of a board loading and unloading assembly 300 of the batch loading and unloading apparatus for an aging device according to the embodiments, and FIG. 7 is a schematic side view of the board loading and unloading assembly 300 of the batch loading and unloading apparatus for an aging device according to the embodiments. In FIGs. 6 and 7, the outer frame and some trays are omitted to more clearly show the internal structure.

0082. FIG. 11 is a schematic side view of a pre-test assembly 600 of the batch loading and unloading apparatus for an aging device according to the embodiments, and FIG. 12 is a structural schematic diagram of a swapping mechanism 620 of the batch loading and unloading apparatus for an aging device according to the embodiments.

0083. The batch loading and unloading apparatus for an aging device according to the embodiments has the following beneficial effects:

0084. 1. By means of the tray loading and unloading assembly 200, the board loading and unloading assembly 300, the cover opening assembly 400, the cover closing assembly 500, the pre-test assembly 600, and the transfer assembly 700, closed-loop full-process operations including automatic loading and unloading, cover opening and closing, pre-test, and exception handling for the chip 100 and the board 330 are achieved, thereby enabling fully automated batch loading and unloading of the aging device, and improving the efficiency of batch loading and unloading of the aging device.

0085. 2. The pre-test assembly 600 can promptly detect faults of the chip 100 or the fixture 331 on the board 330, confirm whether the abnormality originates from the chip 100 or the fixture 331 by means of a swapping structure, so as to promptly handle the abnormal chip 100 or fixture 331, thereby preventing the abnormal chip 100 or fixture 331 from being subjected to the aging test, and improving the efficiency of the aging test.

0086. In some embodiments, as shown in FIGs. 4 and 5, the tray loading and unloading assembly 200 includes:

0087. a storage bin assembly including a loading bin 211, an unloading bin 212, and an abnormal sorting bin 213 configured to store the loading tray 221, the unloading tray 222, and the abnormal tray 223, respectively; and

0088. a de-stacking and stacking mechanism 230, the de-stacking and stacking mechanism 230 being configured to perform a de-stacking operation and a stacking operation on the tray in the storage bin assembly. The de-stacking operation removes the loading tray 221 from the loading bin 211, and the stacking operation stores the unloading tray 222 and the abnormal tray 223 into the unloading bin 212 and the abnormal sorting bin 213, respectively.

0089. The transfer assembly 700 includes a tray transfer mechanism 710. The tray transfer mechanism 710 is configured to receive the loading tray 221 from the de-stacking and stacking mechanism 230 and transfer the loading tray to a loading station, and to transfer the unloading tray 222 and the abnormal tray 223 from an unloading station to the de-stacking and stacking mechanism 230 located at the unloading bin 212 and the abnormal sorting bin 213, respectively.

0090. A plurality of loading bins 211, unloading bins 212, and abnormal sorting bins 213 may be provided to facilitate the temporary storage of trays and reduce the need for tray transfer.

0091. The loading bin 211, the unloading bin 212, and the abnormal sorting bin 213 may be arranged in a linear layout, and the tray transfer mechanism 710 may adopt a linear movement module. As shown in FIGs. 4 and 5, the tray transfer effect can be achieved by simply performing linear movement. The loading station and the unloading station may be further arranged at a position among the loading bin 211, the unloading bin 212, and the abnormal sorting bin 213. As shown in FIGs. 4 and 5, a plurality of loading bins 211 and unloading bins 212 are arranged adjacent to each other and are discontinuously arranged with respect to the abnormal sorting bin 213, and a gap is formed therebetween to serve as the loading station and the unloading station. This structural arrangement also facilitates the storage of the incoming tray into the device and the removal of the unloading tray 222 from the device, and enables the device to be provided with more centralized loading and unloading windows.

0092. Each of the loading bin 211, the unloading bin 212, and the abnormal sorting bin 213 may be provided with one de-stacking and stacking mechanism 230, or the de-stacking and stacking mechanism 230 may be configured as a movable mechanism. The tray de-stacking and stacking mechanism 230 belongs to a conventional technology, and the specific structure of the de-stacking and stacking mechanism 230 is not limited in the present application.

0093. In some embodiments, as shown in FIGs. 6 and 7, the board loading and unloading assembly 300 includes:

0094. a plurality of layers of board storage bins 310, each layer of board storage bin 310 being configured to store at least one board 330;

0095. a lifting mechanism 320 configured to adjust the vertical position of the plurality of layers of board storage bins 310; and

0096. a detection sensor configured to monitor the empty/full status of each layer of board storage bin 310 in real time.

0097. The plurality of layers of board storage bins 310 can improve the space utilization of the device. After the detection sensor detects the empty/full state of the board storage bin 310,

the lifting mechanism 320 can perform lifting operations based on the empty/full state of the board storage bin 310. When the board loading and unloading assembly 300 needs to receive the board 330, for example, when the board 330 that has completed the pre-test needs to be stored, or when the board 330 that has completed the aging test needs to be stored, the board storage bin 310 in the empty state reaches the receiving position. When the board loading and unloading assembly 300 needs to provide the board 330, for example, when the board 330 is taken out from the board loading and unloading assembly 300 for the aging test, or when the cover opening assembly 400 needs to take out the board 330 for cover opening, the board storage bin 310 in the full state reaches the receiving position. The receiving position may be specifically configured according to different mechanisms, and the lifting mechanism 320 may be adjusted based on the state of the board storage bin 310.

0098. In some embodiments, as shown in FIGs. 1, 2, 8, and 9, the cover opening assembly 400 includes an X-axis moving module 410, a Z-axis lifting module 420, and a board-pulling gripper 430. The board-pulling gripper 430 is configured to connect to the board 330, and the X-axis moving module 410 and the Z-axis lifting module 420 are configured to drive the board-pulling gripper 430.

0099. FIG. 8 is a three-dimensional schematic diagram of a cover opening assembly 400 of the batch loading and unloading apparatus for an aging device according to the embodiments, and FIG. 9 is a schematic diagram of a partial structure of a cover opening assembly 400 of the batch loading and unloading apparatus for an aging device according to the embodiments.

0100. As shown in FIG. 1, the cover opening assembly 400 and the board loading and unloading assembly 300 are disposed adjacent to each other, and the direction in which they are adjacently arranged is defined as an X-axis. The X-axis moving module 410 is configured to drive the board-pulling gripper 430 to move into the board loading and unloading assembly 300, and the Z-axis lifting module 420 can drive the board-pulling gripper 430 to move up and down. For example, before the board-pulling gripper 430 moves to the board loading and unloading assembly 300, the board-pulling gripper 430 is in a relatively high position. After the board-pulling gripper 430 moves to the board loading and unloading assembly 300, the Z-axis lifting module 420 drives the board-pulling gripper 430 to descend, such that the board-pulling gripper 430 is engaged with the board 330. Then, the X-axis moving module

410 drives the board-pulling gripper 430 to return, thereby achieving the operation of taking out the board 330 from the board loading and unloading assembly 300. The action logic of the cover opening assembly 400 for taking out the board 330 is not limited thereto. According to the specific structure of the board 330 and the specific structure of the board-pulling gripper 430, various cooperation modes and operation modes can be flexibly configured, which is not limited in the present disclosure.

0101. In some embodiments, as shown in FIGs. 6, 8, and 9, the box cover of the fixture 331 includes a pull rod 332, and the cover opening assembly 400 includes: an X-axis moving module 410 configured to drive a Z-axis lifting module 420 to move horizontally; a Z-axis lifting module 420 configured to drive a cover-opening gripper 440 to move vertically; and a cover-opening gripper 440 having a closed state and an open state. The cover-opening gripper 440 in the closed state is capable of clamping the pull rod 332, the Z-axis lifting module 420 drives the cover-opening gripper 440 to move upward, the cover-opening gripper 440 drives the pull rod 332 to open the box cover, and the cover-opening gripper 440 in the open state is separated from the pull rod 332.

0102. On the board 330, the chip 100 is placed in the fixture 331, and the box cover of the fixture 331 is configured to protect the chip 100. When the board 330 is located in the board loading and unloading assembly 300, the box cover is in the closed state. The cover-opening gripper 440 can open the box cover by cooperating with the pull rod 332 of the box cover. The specific operation logic is as follows: The X-axis moving module 410 drives the Z-axis lifting module 420 to move horizontally until the cover-opening gripper 440 is vertically aligned with the pull rod 332. During the movement, the Z-axis lifting module 420 keeps the cover-opening gripper 440 at a relatively high position. After alignment, the Z-axis lifting module 420 lowers the cover-opening gripper 440 until the cover-opening gripper 440 is horizontally aligned with the pull rod 332. Later, the cover-opening gripper 440 is closed to clamp the pull rod 332, and then the Z-axis lifting module 420 drives the cover-opening gripper 440 to move the cover-opening gripper 440 upward, thereby driving the pull rod 332 to open the box cover. During this process, the X-axis moving module 410 may move synchronously to achieve the combined movement. After the box cover is fully opened, the

cover-opening gripper 440 is opened, and the X-axis moving module 410 and the Z-axis lifting module 420 drive the cover-opening gripper 440 to move away.

0103. As shown in FIG. 9, the cover-opening grippers 440 may be arranged in pairs, the cover-opening grippers 440 arranged in pairs move toward each other to achieve the closed state and move away from each other to achieve the open state, and the movement of the cover-opening grippers 440 may be driven by a cylinder, a servo motor, or the like.

0104. In the cover opening assembly 400, a plurality of cover-opening grippers 440 may be provided, thereby enabling batch cover opening. As shown in FIG. 6, the fixtures 331 on the board 330 may be arranged in a plurality of rows and a plurality of columns. After a plurality of cover-opening grippers 440 are arranged, the covers of one row or one column of boxes can be opened in a single operation, thereby improving the operation efficiency.

0105. In some embodiments, as shown in FIGs. 6 and 10, the box cover of the fixture 331 includes a pull rod 332, and the cover closing assembly 500 includes: an X-axis displacement module configured to drive a Z-axis pressing module to move horizontally; and a Z-axis pressing module configured to drive a cover-pushing gripper 510 to vertically press down to close the box cover.

0106. FIG. 10 is a schematic three-dimensional structural diagram of a cover closing assembly 500 of the batch loading and unloading apparatus for an aging device according to the embodiments. As shown in FIG. 10, a lower end of the cover-pushing gripper 510 may be further provided with a structure such as a roller, such that rolling contact is achieved between the cover-pushing gripper 510 and the box cover, thereby reducing damage to the box cover. As shown in FIG. 10, the cover closing assembly 500 may be further provided with a cover-opening gripper 440, and the cover-opening gripper 440 can cooperate with the pull rod 332. After the box cover is closed, the pull rod 332 is further used to enhance the effect of the box cover while reducing damage to the box cover. The cover-opening gripper 440 moves through the X-axis displacement module and the Z-axis pressing module, and the opening or closing operation of the cover-opening gripper 440 may be similar to that in the above embodiments.

0107. In some embodiments, as shown in FIGs. 11 and 12, the pre-test mechanism 610 includes: a pre-test machine 611 including a port configured to connect to the board 330; and

a press-fitting module 612 configured to press-fit the port of the board 330 with a port of the pre-test machine 611. The press-fitting module 612 may fix the board 330, thereby ensuring that the port of the board 330 is press-fitted with the port of the pre-test machine 611. The press-fitting module 612 may include a linear movement mechanism, e.g., driven by a linear servo motor, so as to drive the board 330 to be connected to the pre-test machine 611.

0108. In some embodiments, as shown in FIGs. 11 and 12, the box cover of the fixture 331 includes a pull rod 332, and the swapping mechanism 620 includes: a cover-opening gripper 440 having a closed state and an open state, where the cover-opening gripper 440 in the closed state is capable of clamping the pull rod 332, and the cover-opening gripper 440 in the open state is disengaged from the pull rod 332; a mouthpiece 621 configured to pick up and release the chip 100 in the fixture 331; and a three-axis moving module 613 configured to drive the cover-opening gripper 440 and the mouthpiece 621 to move. The cover-opening grippers 440 may be arranged in pairs, and the opening or closing operation of the cover-opening grippers 440 may be similar to that in the above embodiments. The mouthpiece 621 may be provided with an additional Z-axis movement distance, as shown in FIG. 12, such that the mouthpiece 621 does not interfere with the box cover during the operation of the cover-opening gripper 440. After the cover opening is completed, the mouthpiece 621 moves downward further to pass beyond the lower end of the cover-opening gripper 440, thereby picking up the chip 100 in the fixture 331. Two sets of mouthpieces 621 and cover-opening grippers 440 may be provided to simultaneously perform cover opening and chip 100 pickup operations on two fixtures 331, thereby improving the operation efficiency. The swapping mechanism 620 may be further provided with a cover-pushing gripper 510, and the structure and control method of the cover-pushing gripper 510 may be similar to those in the above embodiments.

0109. In some embodiments, as shown in FIGs. 13 and 14, the transfer assembly 700 includes: a board transfer mechanism 720 configured to transfer the board 330 among the tray loading and unloading assembly 200, the cover opening assembly 400, the cover closing assembly 500, the pre-test assembly 600, and the board loading and unloading assembly 300; and a chip transfer mechanism 730 configured to transfer the chip 100 between the tray and the fixture 331.

0110. FIG. 13 is a structural schematic diagram of a chip transfer mechanism 730 of the batch loading and unloading apparatus for an aging device according to the embodiments, and FIG. 14 is a structural schematic diagram of a board transfer mechanism 720 of the batch loading and unloading apparatus for an aging device according to the embodiments.

0111. Specifically, after the cover opening assembly 400 performs the cover opening operation on the board 330, the board transfer mechanism 720 may take the board 330 away from the cover opening assembly 400 and transfer the board to the loading station, and at the loading station, the chip transfer mechanism 730 transfers the chip 100 from the tray to the board 330. As shown in FIG. 13, the chip transfer mechanism 730 may be provided with a plurality of mouthpieces 621 to simultaneously pick up a plurality of chips 100. The chip transfer mechanism 730 may be further provided with a pitch adjustment mechanism to change the spacing between the plurality of chips 100, so as to adapt to different arrangement configurations of the chips 100 on the tray and the board 330. The pitch adjustment mechanism may take the form of a multi-stage cylinder, a multi-stage motor, a pitch-adjusting guide groove, or the like, and the pitch adjustment effect is achieved by adjusting the positions of the plurality of mouthpieces 621.

0112. Batch loading and unloading method for aging device

0113. The embodiments provide a batch loading and unloading method for an aging device, which employs the batch loading and unloading apparatus for an aging device according to any one of the foregoing embodiments and includes the following steps:

0114. using the transfer assembly 700, the tray loading and unloading assembly 200, the board loading and unloading assembly 300, the cover opening assembly 400, and the cover closing assembly 500 to transfer the chip 100 to be tested from the loading tray 221 into the fixture 331 of the board 330, performing a cover closing operation on the box cover, and transferring the board 330 to the pre-test assembly 600;

0115. performing, by the pre-test mechanism 610, a first round of pre-test on the board 330, where if an abnormal result occurs in the pre-test, the swapping mechanism 620 performs cover opening, chip 100 swapping, and cover closing operations on the fixtures 331 with abnormal results in the pre-test and adjacent fixtures 331 with normal pre-test results on the board 330 in the aging state, and then performs a second round of pre-test; if the same fixture

331 is abnormal in both the first round of pre-test and the second round of pre-test, a corresponding fixture 331 is evaluated as abnormal and the corresponding fixture 331 is shielded; if the same chip 100 is abnormal in both the first round of pre-test and the second round of pre-test, a corresponding chip 100 is evaluated as abnormal, and the transfer assembly transfers the chip 100 evaluated as abnormal to the abnormal tray 223;

0116. transferring, by the transfer mechanism, the board (330) that has completed the pre-test from the pre-test assembly 600 to the board loading and unloading assembly 300;

0117. taking the board 330 out from the board loading and unloading assembly 300 for an aging test, and returning the board 330 that has completed the aging test to the board loading and unloading assembly 300; and

0118. using the transfer assembly 700, the tray loading and unloading assembly 200, the board loading and unloading assembly 300, the cover opening assembly 400, and the cover closing assembly 500 to transfer the chips 100 inside the board 330 that has completed the aging test onto the unloading tray 222 in the tray loading and unloading assembly 200.

0119. The batch loading and unloading method for an aging device according to the embodiments has the following beneficial effects:

0120. 1. According to the present disclosure, the chip 100 can be automatically transferred from the tray to the board 330 to perform a pre-test. The abnormal chip 100 or fixture 331 is promptly handled and then automatically fed into the board loading and unloading assembly 300 for an aging test in the next step. After the aging test is completed, the chip 100 can be automatically moved from the board 330 to the tray to facilitate the subsequent production process.

0121. 2. When the pre-test assembly 600 is used for a pre-test, not only can the specific abnormality of the fixture 331 on the board 330 be found, but also the swapping mechanism 620 is used to swap chips 100 in the abnormal fixture 331 and an adjacent fixture 331, so as to confirm whether the chip 100 or the fixture 331 is abnormal, thereby promptly sorting out the chip 100 or shielding the fixture 331, and thus improving the efficiency of the aging test.

0122. A plurality of assemblies are involved in this method, and the plurality of assemblies can operate synchronously without interference, thereby improving the operation efficiency.

0123. In the pre-test, if no abnormality is found in the result of the second round of interpretation, it is determined that misoperations such as placement deviation have occurred in the first round of the test, and there is no need to determine the chip 100 and the fixture 331 as abnormal. If two fixtures 331 are abnormal in the second round of the test, the two fixtures 331 and the chip 100 can be determined as abnormal, the two fixtures 331 are shielded, and the abnormal chip 100 is transferred to the abnormal tray 223.

0124. The specific operation of transferring the abnormal chip 100 to the abnormal tray 223 may be that the board transfer mechanism 720 transfers the board 330 from the pre-test mechanism 610 to the loading and unloading station, and the chip transfer mechanism 730 transfers the chip 100 to the abnormal tray 223 at the loading and unloading station.

0125. Finally, it should be noted that the above embodiments are merely intended to describe the technical solutions of the present disclosure, rather than to limit the present disclosure. Although the present disclosure has been described in detail with reference to the foregoing embodiments, those of ordinary skill in the art should understand that they may still make modifications to the technical solutions described in the foregoing embodiments, or make equivalent replacements to part or all of the technical features therein; and these modifications or replacements do not make the essence of the corresponding technical solutions depart from the scope of the technical solutions of the embodiments of the present disclosure.

CLAIMS

1. A batch loading and unloading apparatus for an aging device, comprising a tray loading and unloading assembly (200), a board loading and unloading assembly (300), a cover opening assembly (400), a cover closing assembly (500), a pre-test assembly (600), and a transfer assembly (700), wherein the tray loading and unloading assembly (200) is configured to receive and store trays, the trays comprise a loading tray (221), an unloading tray (222), and an abnormal tray (223), and the loading tray (221), the unloading tray (222), and the abnormal tray (223) carry a chip (100) to be tested, a chip (100) that has completed an aging test, and a chip (100) that has failed a pre-test, respectively; the board loading and unloading assembly (300) is configured to receive and store a board (330), a plurality of fixtures (331) are disposed on the board (330), each of the fixtures (331) comprises an openable and closable box cover, and in the board loading and unloading assembly (300), the box cover is in a closed state; the cover opening assembly (400) is configured to extract the board (330) from the board loading and unloading assembly (300) and perform a cover opening operation on the box cover, and the cover closing assembly (500) is configured to perform a cover closing operation on the box cover; the pre-test assembly (600) comprises a pre-test mechanism (610) and a swapping mechanism (620), the pre-test mechanism (610) is configured to pre-test the chips (100) on the board (330), and the swapping mechanism (620) is configured to perform cover opening, chip (100) swapping, and cover closing operations on the fixtures (331) that have failed pre-tests and adjacent fixtures (331) that have passed pre-tests on the board (330) in an aging state; the transfer assembly (700) is configured to transfer the trays, the board (330), and the chips (100) among the tray loading and unloading assembly (200), the board loading and unloading assembly (300), the cover opening assembly (400), the cover closing assembly (500), and the pre-test assembly (600).

2. The batch loading and unloading apparatus for an aging device according to claim 1, wherein the tray loading and unloading assembly (200) comprises: a storage bin assembly, including a loading bin (211), an unloading bin (212), and an abnormal sorting bin (213) configured to store the loading tray (221), the unloading tray (222), and the abnormal tray (223), respectively; and a de-stacking and stacking mechanism (230), the de-stacking and stacking mechanism (230) being configured to perform a de-stacking operation and a

stacking operation on the tray in the storage bin assembly, wherein the de-stacking operation removes the loading tray from the loading bin (211), and the stacking operation stores the unloading tray (222) and the abnormal tray (223) into the unloading bin (212) and the abnormal sorting bin (213), respectively; the transfer assembly (700) comprises a tray transfer mechanism (710), the tray transfer mechanism (710) being configured to receive the loading tray from the de-stacking and stacking mechanism (230) and transfer the loading tray to a loading station, and to transfer the unloading tray (222) and the abnormal tray (223) from an unloading station to the de-stacking and stacking mechanism (230) located at the unloading bin (212) and the abnormal sorting bin (213), respectively.

3. The batch loading and unloading apparatus for an aging device according to claim 1, wherein the board loading and unloading assembly (300) comprises: a plurality of layers of board storage bins (310), each layer of board storage bin (310) being configured to store at least one board (330); a lifting mechanism (320) configured to adjust a vertical position of the plurality of layers of board storage bins (310); and a detection sensor configured to monitor an empty/full status of each layer of board storage bin (310) in real time.

4. The batch loading and unloading apparatus for an aging device according to claim 1, wherein the cover opening assembly (400) comprises an X-axis moving module (410), a Z-axis lifting module (420), and a board-pulling gripper (430), the board-pulling gripper (430) is configured to connect to the board (330), and the X-axis moving module (410) and the Z-axis lifting module (420) are configured to drive the board-pulling gripper (430).

5. The batch loading and unloading apparatus for an aging device according to claim 1, wherein the box cover of the fixture (331) comprises a pull rod (332), and the cover opening assembly (400) comprises: an X-axis moving module (410) configured to drive a Z-axis lifting module (420) to move horizontally; the Z-axis lifting module (420) configured to drive a cover-opening gripper (440) to move vertically; and the cover-opening gripper (440) having a closed state and an open state, wherein the cover-opening gripper (440) in the closed state is capable of clamping the pull rod (332), the Z-axis lifting module (420) drives the cover-opening gripper (440) to move upward, the cover-opening gripper (440) drives the pull rod (332) to open the box cover, and the cover-opening gripper (440) in the open state is separated from the pull rod (332).

6. The batch loading and unloading apparatus for an aging device according to claim 1, wherein the box cover of the fixture (331) comprises a pull rod (332), and the cover closing assembly (500) comprises: an X-axis displacement module configured to drive a Z-axis pressing module to move horizontally; and a Z-axis pressing module configured to drive a cover-pushing gripper (510) to vertically press down to close the box cover.

7. The batch loading and unloading apparatus for an aging device according to claim 1, wherein the pre-test mechanism (610) comprises: a pre-test machine (611) including a port configured to connect to the board (330); and a press-fitting module (612) configured to press-fit the port of the board (330) with a port of the pre-test machine (611).

8. The batch loading and unloading apparatus for an aging device according to claim 7, wherein the box cover of the fixture (331) comprises a pull rod (332), and the swapping mechanism (620) comprises: a cover-opening gripper (440) having a closed state and an open state, wherein the cover-opening gripper (440) in the closed state is capable of clamping the pull rod (332), and the cover-opening gripper (440) in the open state is disengaged from the pull rod (332); a mouthpiece (621) configured to pick up and release the chip (100) in the fixture (331); and a three-axis moving module (613) configured to drive the cover-opening gripper (440) and the mouthpiece (621) to move.

9. The batch loading and unloading apparatus for an aging device according to claim 1, wherein the transfer assembly (700) comprises: a board transfer mechanism (720) configured to transfer the board (330) among the tray loading and unloading assembly (200), the cover opening assembly (400), the cover closing assembly (500), the pre-test assembly (600), and the board loading and unloading assembly (300); and a chip transfer mechanism (730) configured to transfer the chip (100) between the tray and the fixture (331).

10. A batch loading and unloading method for an aging device, using the batch loading and unloading apparatus for an aging device according to any one of claims 1 to 9, comprising the following steps: using the transfer assembly (700), the tray loading and unloading assembly (200), the board loading and unloading assembly (300), the cover opening assembly (400), and the cover closing assembly (500) to transfer the chip (100) to be tested from the loading tray (221) into the fixture (331) of the board (330), performing a cover closing operation on the box cover, and transferring the board (330) to the pre-test assembly (600); performing, by

the pre-test mechanism (610), a first round of pre-test on the board (330), wherein if an abnormal result occurs in a pre-test, the swapping mechanism (620) performs cover opening, chip (100) swapping, and cover closing operations on the fixtures (331) with abnormal results in the pre-test and adjacent fixtures (331) with normal pre-test results on the board (330) in the aging state, and then performs a second round of pre-test; if a same fixture (331) is abnormal in both the first round of pre-test and the second round of pre-test, a corresponding fixture (331) is evaluated as abnormal and the corresponding fixture (331) is shielded; if a same chip (100) is abnormal in both the first round of pre-test and the second round of pre-test, a corresponding chip (100) is evaluated as abnormal, and the transfer assembly (700) transfers the chip (100) evaluated as abnormal to the abnormal tray (223); transferring, by the transfer assembly (700), the board (330) that has completed the pre-test from the pre-test assembly (600) to the board loading and unloading assembly (300); taking the board (330) out from the board loading and unloading assembly (300) for the aging test, and returning the board (330) that has completed the aging test to the board loading and unloading assembly (300); and using the transfer assembly (700), the tray loading and unloading assembly (200), the board loading and unloading assembly (300), the cover opening assembly (400), and the cover closing assembly (500) to transfer the chips (100) inside the board (330) that has completed the aging test onto the unloading tray (222) in the tray loading and unloading assembly (200).