

Description

Title of Invention: BACKUP PLATE FEED AND RECOVERY APPARATUS, DIE BONDER, AND BONDING METHOD

Technical Field

[0001] The present invention relates to a backup plate feed and recovery apparatus, a die bonder, and a bonding method.

Background Art

[0002] As described in, for example, Patent Literature 1, a bonding apparatus configured to bond a chip on a lead frame conveys an island portion of the lead frame to a paste applying position, applies a paste to the island portion, and then conveys the island portion to a bonding position. Under this state, the bonding apparatus bonds the chip on the island portion. At the paste applying position and the bonding position, the lead frame is supported by a backup plate from below in order that paste applying work and bonding work are stably performed.

[0003] That is, when a chip (semiconductor chip) is affixed to a substrate (or a lead frame or an organic substrate) through heating of an adhesive film (die attach film (DAF)) affixed in advance to a back surface of the chip, in order to mount the chip on the substrate conveyed to the bonding position with high accuracy and high quality (without a void and with uniform bonding strength), a backup plate is used. Thus, various kinds of backup plates are

manufactured in accordance with, for example, sizes of substrates and design patterns of substrates. It has been required to replace the backup plate in accordance with the substrate.

[0004] Hitherto, bonding has been performed on the same kind of substrates for many days, and hence replacement frequency of the backup plate has been low, specifically, from about several weeks to about one month. Thus, productivity has not been really seen as a problem. However, in recent years, high-mix low-volume production has become a mainstream, and some users deal in several tens of kinds of products. Consequently, the replacement frequency becomes higher, and in some cases, the backup plate is replaced every day or several times a day.

Citation List

[0005] Patent Literature 1: JP 6124969 B1

Summary of Invention

Technical Problem

[0006] As the replacement frequency of the backup plate becomes higher, productivity becomes poorer. In addition, the backup plate subjected to the work is heated, and replacement is performed manually. Therefore, it has been required to leave the backup plate until the backup plate is cooled, and a time period for single replacement has been long. Further, there are many kinds of backup plates, and there is a fear in that the backup plate is replaced with an incorrect

backup plate. Moreover, there is a fear in that the backup plate is not mounted in a normal state after replacement.

[0007] In view of the problems described above, the present invention provides a backup plate feed and recovery apparatus, a die bonder, and a bonding method, which are capable of achieving automation of replacement of a backup plate and achieving improvement of productivity.

Solution to Problem

[0008] According to one embodiment of the present invention, there is provided a backup plate feed and recovery apparatus configured to feed one backup plate freely selected among a plurality of kinds of backup plates to a plate main body, and recover the fed backup plate from the plate main body, the backup plate feed and recovery apparatus comprising: a magazine mechanism configured to deliver one backup plate freely selected among the plurality of kinds of backup plates; and a raising and lowering mechanism configured to relatively raise and lower the plate main body and the backup plate, wherein the backup plate delivered from the magazine mechanism is arranged at a position above or below the plate main body, wherein the plate main body and the backup plate are relatively raised or lowered by the raising and lowering mechanism so that the plate main body and the backup plate are integrated with each other, and wherein the plate main body and the backup plate are relatively lowered or raised by the raising and lowering mechanism

so that the plate main body and the backup plate are separated from each other.

[0009] The backup plate feed and recovery apparatus according to the present invention can deliver one backup plate freely selected among the plurality of kinds of backup plates from the magazine mechanism. The plate main body is raised by the raising and lowering mechanism so that the plate main body and the backup plate are integrated with each other. Further, under a state in which the plate main body and the backup plate are integrated with each other, the plate main body is lowered by the raising and lowering mechanism so that the plate main body and the backup plate are separated from each other. The backup plate is thus separated from the plate main body, thereby being capable of performing feed and recovery (replacement) of the backup plate automatically without manual operation.

[0010] The backup plate feed and recovery apparatus may further comprise a conveyance mechanism configured to convey any one of the backup plate in the magazine mechanism and a substrate to be retained on a shuttle formed by integrating the plate main body and the backup plate with each other. According to the backup plate feed and recovery apparatus comprising the conveyance mechanism, the substrate or the backup plate can be conveyed from the magazine mechanism to the plate main body side, and can be recovered from the plate main body side to the magazine mechanism.

[0011] One magazine mechanism may be provided, a backup plate

in the one magazine mechanism may be fed to the plate main body by one conveyance mechanism, and the backup plate separated from the plate main body may be recovered to the one magazine mechanism by the one conveyance mechanism or another conveyance mechanism. This configuration requires only one magazine mechanism configured to feed the backup plate to the plate main body and recover the backup plate from the plate main body. As a result, downsizing of the entire apparatus can be achieved.

[0012] At least one pair of magazine mechanisms may be provided, a backup plate in one magazine mechanism may be fed to the plate main body by one conveyance mechanism, and the backup plate separated from the plate main body may be recovered to the one magazine mechanism or another magazine mechanism by the one conveyance mechanism or another conveyance mechanism. With this configuration, the backup plate can be recovered to the one magazine mechanism from which the backup plate to be recovered is fed, or to the another magazine mechanism. Thus, workability can be improved.

[0013] At least three magazine mechanisms may be provided, a backup plate in any one of the at least three magazine mechanisms may be fed to the plate main body by one conveyance mechanism, and the backup plate separated from the plate main body may be recovered to the one of the at least three magazine mechanisms from which the backup plate is fed or to another magazine mechanism by the one conveyance mechanism or another conveyance mechanism. With this configuration, various kinds of backup plates can be fed to the

plate main body from the at least three magazine mechanisms, and the backup plate can be recovered to any one of the magazine mechanisms. Thus, the backup plate feed and recovery apparatus is excellently convenient.

[0014] It is preferred that the conveyance mechanism convey the backup plate from the magazine mechanism to the plate main body along a conveyance rail unit, or convey the backup plate separated from the plate main body to the magazine mechanism along the conveyance rail unit, that the conveyance rail unit comprise a pair of guide rails opposed to each other, and that each of the pair of guide rails comprise a plate support portion configured to receive the backup plate. With this configuration, the backup plate is conveyed under a state of being supported by the conveyance rail unit. When the backup plate is conveyed by the conveyance mechanism, the backup plate can be stably conveyed.

[0015] It is preferred that the pair of guide rails be configured such that a guide rail interval is increased and reduced, that under a state in which the guide rail interval is increased, the pair of guide rails allows the backup plate to pass through between the pair of guide rails, and that under a state in which the guide rail interval is reduced, the plate support portions of the pair of guide rails are capable of receiving the backup plate.

[0016] It is preferred that the backup plate have information allowing identification of a kind of the backup plate. Thus, the backup plate having the information allowing identification of a

kind of the backup plate can allow identification of the backup plate to be fed. Accordingly, incorrect use (incorrect mounting) of the backup plate can be prevented.

[0017] In this case, it is preferred that the backup plate feed and recovery apparatus further comprise an identification mechanism configured to identify the information of the backup plate. Thus, according to the backup plate feed and recovery apparatus comprising the identification mechanism, reliability of preventing incorrect use (incorrect mounting) is improved.

[0018] It is preferred that the backup plate feed and recovery apparatus comprise a posture detection mechanism configured to detect a posture of the backup plate mounted to the plate main body. According to the backup plate feed and recovery apparatus comprising the posture detection mechanism, the backup plate can be mounted to the plate main body so as to assume a stable posture (normal posture).

[0019] The backup plate and the plate main body may be integrated with each other by a protrusion and recess fitting structure. According to the backup plate feed and recovery apparatus in which integration is obtained by the protrusion and recess fitting structure, the backup plate and the plate main body can be integrated with each other with the simple structure. Here, in the protrusion and recess fitting structure, a protruding portion is formed on one member, and a recessed portion in which the protruding portion is to be fitted is formed in another member. When the one member

and the another member are superposed on each other, the protruding portion is fitted in the recessed portion so that the two members are integrated with each other. Therefore, the protruding portion may be formed on the backup plate side, and the recessed portion may be formed on the plate main body side. Conversely, the recessed portion may be formed on the backup plate side, and the protruding portion may be formed on the plate main body side. It is desired that vacuum suction or a lock mechanism also be provided as measures for keeping the plate main body and the backup plate integrated with each other.

[0020] According to one embodiment of the present invention, there is provided a die bonder configured to bond a chip on an island portion of a substrate, wherein under a state in which a backup plate is conveyed by the backup plate feed and recovery apparatus, and the backup plate and a plate main body are integrated with each other, the backup plate supports the substrate.

[0021] According to the die bonder of the present invention, the backup plate adapted for a size of the substrate and a design pattern of the substrate is usable, and the substrate can be supported by the backup plate. Thus, the chip can be stably bonded on the substrate.

[0022] According to one embodiment of the present invention, there is provided a bonding method of bonding a chip on an island portion of a substrate, the bonding method comprising bonding the chip on the island portion of the substrate under a state in which

a backup plate is conveyed to a plate main body by the backup plate feed and recovery apparatus, the plate main body and the backup plate are integrated with each other, and the backup plate supports the substrate.

[0023] According to the bonding method of the present invention, the substrate can be supported by the backup plate adapted for a size of the substrate and a design pattern of the substrate. Thus, the chip can be stably bonded on the substrate.

Advantageous Effects of Invention

[0024] According to the present invention, feed and recovery (replacement) of the backup plate can be performed automatically without manual operation. Even when the backup plate involving heating is used, the backup plate is replaceable without requiring a so-called wait for cooling. Thus, productivity is excellent.

Brief Description of Drawings

[0025] Fig. 1 is a schematic block diagram for illustrating a backup plate feed and recovery apparatus according to the present invention.

Fig. 2 is a perspective view for illustrating a conveyance rail unit of the backup plate feed and recovery apparatus illustrated in Fig. 1.

Fig. 3 is a schematic view for illustrating the backup plate feed and recovery apparatus according to the present invention.

Fig. 4A is a schematic sectional view of a main part of the backup plate feed and recovery apparatus, for illustrating a relationship among a backup plate, a plate main body, and guide rails under a state in which the backup plate is conveyed to a position above the plate main body along the guide rails.

Fig. 4B is a schematic sectional view of the main part of the backup plate feed and recovery apparatus, for illustrating the relationship among the backup plate, the plate main body, and the guide rails under a state in which the plate main body is raised so that the backup plate and the plate main body are integrated with each other.

Fig. 5A is a schematic sectional view of the main part of the backup plate feed and recovery apparatus, for illustrating the relationship among the backup plate, the plate main body, and the guide rails under a state in which a guide rail interval is increased.

Fig. 5B is a schematic sectional view of the main part of the backup plate feed and recovery apparatus, for illustrating the relationship among the backup plate, the plate main body, and the guide rails when the plate main body is lowered under a state in which the guide rail interval is increased.

Fig. 5C is a schematic view for illustrating the relationship among the backup plate, the plate main body, and the guide rails under a state in which a substrate is conveyed to a position above the backup plate along the guide rails.

Fig. 5D is a schematic view for illustrating the relationship

among the backup plate, the plate main body, and the guide rails under a state in which the plate main body is raised so that the substrate is sucked on the backup plate.

Fig. 6 is a schematic view for illustrating workpieces.

Fig. 7 is a schematic view for illustrating operation of a bonding apparatus.

Description of Embodiments

[0026] An embodiment of the present invention is now described referring to Fig. 1 to Fig. 6.

[0027] Fig. 1 is a schematic block diagram for illustrating a backup plate feed and recovery apparatus according to the present invention. Fig. 2 is a perspective view for illustrating a conveyance rail unit of the backup plate feed and recovery apparatus. Fig. 3 is a schematic view for illustrating the entire backup plate feed and recovery apparatus. The backup plate feed and recovery apparatus is configured to deliver, from a loader 15, one backup plate 2 freely selected among a plurality of kinds of backup plates (adapter plates) 2, and convey the one backup plate 2 to a downstream side via a conveyance path comprising a conveyance rail unit 5, to thereby feed the one backup plate 2 to a plate main body 1 arranged in the conveyance path. Further, the backup plate feed and recovery apparatus is configured to recover the fed backup plate 2 from the plate main body 1 so as to load the backup plate 2 into an unloader 16.

[0028] As illustrated in Fig. 1, the backup plate feed and recovery apparatus comprises: one magazine mechanism (upstream-side magazine mechanism 3) capable of delivering one backup plate 2 freely selected among the plurality of kinds of backup plates 2; another magazine mechanism (downstream-side magazine mechanism 4) capable of accommodating one backup plate freely selected among the plurality of kinds of backup plates 2; one conveyance mechanism (upstream-side conveyance mechanism 6) configured to convey the backup plate 2 delivered from the upstream-side magazine mechanism 3 to the plate main body 1 along the conveyance rail unit 5; another conveyance mechanism (downstream-side conveyance mechanism 7) configured to convey the backup plate 2 from the plate main body 1 to the downstream-side magazine mechanism 4; and a raising and lowering mechanism 8 configured to raise and lower the plate main body 1. Further, besides being raised and lowered by the raising and lowering mechanism 8, the plate main body 1 is reciprocated by a reciprocating mechanism 9 in a horizontal direction along the conveyance rail unit 5. The plate main body 1 and the backup plate 2 form a shuttle 10. The shuttle 10 is raised and lowered, or reciprocated along the horizontal direction by a driver 11 formed by the raising and lowering mechanism 8 and the reciprocating mechanism 9. That is, the backup plate feed and recovery apparatus illustrated in Fig. 1 comprises a pair of magazine mechanisms 3 and 4, and a pair of conveyance mechanisms 6 and 7.

[0029] As the raising and lowering mechanism 8 and the

reciprocating mechanism 9, a well-known and well-used reciprocating mechanism such as a cylinder mechanism, a ball screw mechanism, or a linear guide mechanism is usable. As illustrated in Fig. 4A, Fig. 4B, and Figs. 5, the plate main body 1 is formed of a rectangular plate body, and a protruding portion 1a is formed on an upper surface of the plate main body 1. Further, the backup plate 2 is formed of a flat rectangular body. Cutout portions 2a and 2a are formed at long sides of a lower surface of the backup plate 2, and a recessed portion 2b, in which the protruding portion 1a is to be fitted, is formed in the backup plate 2. That is, the protruding portion 1a and the recessed portion 2b to be fitted thereto can form a protrusion and recess fitting structure M configured to integrate the plate main body 1 and the backup plate 2 with each other.

[0030] Further, a heating mechanism 12 and a suction mechanism 13 are provided to the shuttle 10 comprising the plate main body 1 and the backup plate 2. For example, the heating mechanism 12 may comprise a heating wire built in the plate main body 1, and a power source configured to heat the heating wire, but the present invention is not limited thereto. The heating mechanism 12 may use vapor, or employ induction heating. That is, the heating mechanism 12 may employ any method as long as a substrate 22 requires heating and a heating method has no adverse effect on the substrate 22 and a chip. Further, for example, the suction mechanism 13 comprises a suction passage arranged in the shuttle 10 (the plate main body 1 and the backup plate 2), and a vacuum generator connected to the

suction passage. The suction passage has a suction port formed to be opened in an upper surface of the backup plate 2. The vacuum generator may use a vacuum pump, or may employ an ejector system in which, through on-off control, high-pressure air is ejected through a nozzle to a diffuser so that negative pressure is generated in a diffusion chamber.

[0031] The upstream-side magazine mechanism 3 comprises the loader 15 (see Fig. 3) in which the plurality of backup plates 2 are arranged along an up-and-down direction of the upstream-side magazine mechanism 3, a raising and lowering mechanism (not shown) configured to raise and lower the loader 15, and a pusher mechanism (not shown) arranged at a predetermined height position. Thus, through raising and lowering of the loader 15, one backup plate 2 among the plurality of backup plates 2 accommodated in the loader 15 is aligned with the pusher mechanism. Then, under this state, the backup plate 2 aligned in height is pushed out by the pusher mechanism to the conveyance rail unit 5 side.

[0032] Further, the downstream-side magazine mechanism 4 comprises the unloader 16 (see Fig. 3) in which the plurality of backup plates 2 are to be arranged along an up-and-down direction of the downstream-side magazine mechanism 4, a raising and lowering mechanism (not shown) configured to raise and lower the unloader 16, and a pusher mechanism (not shown) arranged at a predetermined height position. Through raising and lowering of the unloader 16, an accommodation portion at a predetermined height position for

the backup plate conveyed along the conveyance rail unit 5 is aligned with the pusher mechanism. Then, under this state, the backup plate 2 is pushed into the accommodation portion aligned in height.

[0033] As illustrated in Fig. 2, Fig. 4A, Fig. 4B, and Fig. 5A to Fig. 5D, the conveyance rail unit 5 comprises a pair of guide rails 5a and 5a arranged in parallel to each other, and a guide-rail-interval increasing and reducing mechanism 17 (see Fig. 1) configured to increase and reduce a guide rail interval between the guide rails 5a and 5a. The guide rails 5a and 5a are each formed of a band-plate-shaped body, and receiving pieces 5a1 and 5a1 are formed in a protruding manner on center portions in an up-and-down direction of opposed surfaces of the guide rails 5a and 5a. As the guide-rail-interval increasing and reducing mechanism 17, a well-known and well-used reciprocating mechanism such as a cylinder mechanism, a ball screw mechanism, or a linear guide mechanism is usable. The guide-rail-interval increasing and reducing mechanism 17 displaces the guide rails 5a and 5a between a state in which the pair of guide rails 5a and 5a are close to each other so as to be capable of holding the backup plate 2 as illustrated in Fig. 4A and Fig. 4B, and a state in which the pair of guide rails 5a and 5a are away from each other so as to allow lowering of the backup plate 2 between the guide rails 5a and 5a as illustrated in Fig. 5D.

[0034] Further, the upstream-side conveyance mechanism 6 and the downstream-side conveyance mechanism 7 each comprise a chuck

portion configured to chuck the backup plate 2, and a reciprocating mechanism configured to reciprocate the chuck portion along the conveyance rail unit 5. The chuck portion may be formed of, for example, an openable and closable claw chuck. As the reciprocating mechanism, a well-known and well-used reciprocating mechanism such as a cylinder mechanism, a ball screw mechanism, or a linear guide mechanism is usable.

[0035] Further, as illustrated in Fig. 1, the backup plate feed and recovery apparatus comprises a posture detection mechanism 18 configured to detect a posture of the backup plate 2 mounted to the plate main body 1, and an identification mechanism 19 configured to identify information of the backup plate 2. The information of the backup plate 2 refers to information used for matching with information of a substrate to be sucked on the backup plate. Here, the information of the substrate refers to, for example, a size of the substrate and a design pattern of the substrate.

[0036] The posture detection mechanism 18 comprises an image recognition camera (not shown), and is configured to detect a difference between a position coordinate of the plate main body 1 calculated in advance, and a position coordinate of the backup plate 2 calculated through use of the image recognition camera. Accordingly, through correction of the difference, the backup plate 2 can be mounted precisely. That is, through use of the image recognition camera, the position coordinate of the plate main body 1 can be detected (calculated), and the position coordinate of the

backup plate 2 can be detected (calculated). Thus, the difference between those positions is computed by an arithmetic unit of a controller 20 (see Fig. 1). In this manner, position correction (position adjustment) of the plate main body 1 and/or the backup plate 2 is performed, thereby being capable of aligning the plate main body 1 and the backup plate 2 with each other.

[0037] The identification mechanism 19 is configured to read a portion to be identified, which is formed in the backup plate 2. Here, the portion to be identified may comprise a printed character, a mark, a figure, a bar code, and a QR code (registered trademark). Further, a character, a mark, and a figure can be read by, for example, image processing as a reading method. A bar code can be read by a bar code reader, and a QR code can be read by a QR code reader.

[0038] Incidentally, the mechanisms 3, 4, 6, 7, 12, 13, 17, 18, and 19 are controlled by the controller 20. Similarly to the bonding apparatus described above, for example, the controller 20 is a microcomputer in which a central processing unit (CPU) is connected to, for example, a read only memory (ROM) and a random access memory (RAM) through buses. The ROM stores programs to be executed by the CPU, and data.

[0039] Further, to a position above the shuttle 10 integrally comprising the backup plate 2 and the plate main body 1, a member S to be fed (substrate 22), which is to be conveyed by the conveyance rail unit 5, is guided by the conveyance rail unit 5 as illustrated

in Fig. 5C, and then is sucked on the shuttle 10 as illustrated in Fig. 5D. Under a state in which the member S to be fed is sucked, the member S to be fed is conveyed to a feed position in the conveyance rail unit 5, and as illustrated in Fig. 7, a workpiece W is mounted on a portion Sa to be fed of the member S to be fed.

[0040] As illustrated in Fig. 6, the workpiece W is a chip 21 cut out from a wafer (bundle of workpieces) 26. Chips 21 of the wafer 26 have a plurality of kinds of grades. In this embodiment, there are three kinds of grades, and the three kinds of grades are referred to as a first grade, a second grade, and a third grade, respectively. Further, in the single wafer 26, the chips 21 of the first grade are many, and the chips 21 of the second grade and the third grade are few. In this case, the number of the chips 21 of the second grade may be larger than that of the third grade, or the number of the chips 21 of the third grade may be larger than that of the second grade. Alternatively, the number of the chips 21 of the second grade and the number of the chips 21 of the third grade may be equal.

[0041] The member S to be fed corresponds to the substrate 22 such as a lead frame, and the portion Sa to be fed corresponds to an island portion 22a on the substrate 22. The chip 21 is bonded on each island portion 22a. At this time, a bonding apparatus (die bonder) as illustrated in Fig. 7 is used. Such a bonding apparatus is configured to pick up the chip (semiconductor chip) 21, which is cut out from the wafer 26, at a pickup position P with a collet

(adsorption collet) 23, and then transfer (mount) the chip to a bonding position Q of the substrate 22 such as a lead frame. The wafer 26 is stuck on a wafer sheet (pressure-sensitive adhesive sheet 25) stretched across a metal ring (wafer ring), and is divided (split) into a large number of chips 21 in a dicing step.

[0042] As illustrated in Fig. 7, the collet 23 can be raised in a direction indicated by the arrow A and lowered in a direction indicated by the arrow B at the pickup position P, and can be raised in a direction indicated by the arrow C and lowered in a direction indicated by the arrow D at the bonding position Q. The collet 23 can be reciprocated between the pickup position P and the bonding position Q in directions indicated by the arrows E and F. The collet 23 is provided to a bonding head (not shown), and the bonding head is provided to a bonding arm (not shown). The bonding arm is controlled by a controller (not shown), thereby controlling movement of the collet 23 in the directions indicated by the arrows A, B, C, D, E, and F. The controller is a microcomputer in which a central processing unit (CPU) is connected to, for example, a read only memory (ROM) and a random access memory (RAM) through buses. The ROM stores programs to be executed by the CPU, and data.

[0043] As described above, in this embodiment, the chips 21 have the first grade, the second grade, and the third grade. Further, the chips 21 of the same grade are mounted on one substrate 22. Thus, the substrates 22 comprise the substrate 22 (22A) on which the chips 21 of the first grade are mounted, the substrate 22 (22B)

on which the chips 21 of the second grade are mounted, and the substrate 22 (22C) on which the chips 21 of the third grade are mounted.

[0044] Thus, the backup plates 2 comprise a first backup plate 2A adapted for the substrate 22A, a second backup plate 2B adapted for the substrate 22B, and a third backup plate 2C adapted for the substrate 22C. The loaders 15 comprise a first loader 15A configured to accommodate the backup plate 2A, a second loader 15B configured to accommodate the backup plate 2B, and a third loader 15C configured to accommodate the backup plate 2C. Further, the unloaders 16 comprise a first unloader 16A configured to accommodate the backup plate 2A, a second unloader 16B configured to accommodate the backup plate 2B, and a third unloader 16C configured to accommodate the backup plate 2C.

[0045] Next, description is made of operation of the backup plate feed and recovery apparatus having the above-mentioned configuration. For example, when the chips 21 of the first grade are mounted, there is used the substrate 22 (22A) on which the chips 21 of the first grade are to be mounted. Thus, as the backup plate 2 of the shuttle 10, the backup plate 2A adapted for the substrate 22A is used.

[0046] The backup plate 2A is delivered from the loader 15 and guided by the conveyance rail unit 5 (received by the receiving pieces 5a1 and 5a1), and thus is positioned above the plate main body 1 through use of the upstream-side conveyance mechanism 6 as illustrated in Fig. 4A. That is, the receiving pieces 5a1 and 5a1

of the conveyance rail unit 5 are fitted to the cutout portions 2a and 2a of the backup plate 2 (2A) so that the backup plate 2 (2A) is supported by the conveyance rail unit 5. Further, the plate main body 1 is lowered so as to be positioned below the receiving pieces 5a1 and 5a1 of the conveyance rail unit 5. In this case, as described above, through use of the image recognition camera, the difference between the position coordinate of the shuttle 10 and the position coordinate of the backup plate 2 is corrected.

[0047] Then, when the plate main body 1 is raised from this state, the protruding portion 1a of the plate main body 1 is fitted into the recessed portion 2b of the backup plate 2 so that the plate main body 1 and the backup plate 2 are integrated with each other as illustrated in Fig. 4B. In this case, the backup plate 2 is chucked by the chuck portion of the upstream-side conveyance mechanism 6 so that the backup plate 2 is restrained from being raised along with the raising of the plate main body 1. Accordingly, the protruding portion 1a of the plate main body 1 can be fitted into the recessed portion 2b of the backup plate 2.

[0048] Under a state in which the plate main body 1 and the backup plate 2 are integrated with each other, the substrate 22 (22A) is guided by the conveyance rail unit 5 (received by the receiving pieces 5a1 and 5a1), and as illustrated in Fig. 5C, the substrate 22A is positioned above the shuttle 10 comprising the plate main body 1 and the backup plate 2 through use of the upstream-side conveyance mechanism 6.

[0049] Thus, as illustrated in Fig. 5A, the guide rails 5a and 5a of the conveyance rail unit 5 are relatively moved away from each other. That is, a space between the guide rails 5a and 5a is increased so that an interval between the receiving pieces 5a1 and 5a1 is set larger than a width dimension of the backup plate 2. When W1 represents the interval between the receiving pieces 5a1 and 5a1 and W represents the width dimension of the backup plate 2, a relation of $W1 > W$ is satisfied. Then, as illustrated in Fig. 5B, the shuttle 10 is lowered. In this case, the shuttle 10 is positioned below the receiving pieces 5a1 and 5a1 of the guide rails 5a and 5a.

[0050] Further, the substrate 22 (22A) is delivered from the loader (which is the loader different from the loader 15 accommodating the backup plate 2, and accommodates the substrate 22). The substrate 22A is guided by the conveyance rail unit 5, and is conveyed to a position above the shuttle 10 through use of the upstream-side conveyance mechanism 6 as illustrated in Fig. 5C. In this case, the backup plate 2 of the shuttle 10 having a shape adapted for the substrate 22A, namely, the first backup plate 2A is mounted to the plate main body 1. Further, the interval between the receiving pieces 5a1 and 5a1 is set smaller than the width dimension of the substrate 22 (22A), and a dimension between opposed surfaces of the guide rails 5a and 5a closer to the receiving pieces 5a1 and 5a1 is set larger than the width dimension of the substrate 22 (22A). That is, when W1 represents the interval between the receiving pieces

5a1 and 5a1, W3 represents the width dimension of the substrate 22, and W2 represents the dimension between the opposed surfaces, a relation of $W1 < W3 < W2$ is satisfied. With this configuration, the substrate 22 can be received by the receiving pieces 5a1 and 5a1.

[0051] As illustrated in Fig. 5C, under a state in which the substrate 22 is arranged above the shuttle 10, the shuttle 10 is raised so that the substrate 22 is sucked on an upper surface of the shuttle 10 as illustrated in Fig. 5D. At this time, it is preferred that the substrate 22 be clamped by, for example, a clamper (not shown).

[0052] The substrate 22 thus sucked and retained on the shuttle 10 is heated, and the chip 21 is bonded as the workpiece W on the island portion 22a of the substrate 22. In a bonding step, after completion of bonding performed on a row of the island portions 22a (see Fig. 7) extending in a direction orthogonal to a conveying direction (longitudinal direction), the shuttle 10 receiving the substrate 22 that is undergoing bonding is moved to the downstream side by a predetermined amount by the reciprocating mechanism 9. Thus, bonding can be performed on a next row of the island portions 22a.

[0053] Further, after mounting of the chips 21 on the substrate 22 (22A) is finished, as illustrated in Fig. 5C, the substrate 22 is supported by the receiving pieces 5a1 and 5a1 of the guide rails 5a and 5a. The substrate 22 is conveyed by the downstream-side conveyance mechanism 7 to the unloader on the downstream side (which

is the unloader different from the unloader 16 intended to accommodate the backup plate 2, and is intended to accommodate the substrate 22) so as to be accommodated in this unloader.

[0054] When the substrate 22A is changed to the substrate 22B along with, for example, change of the chips 21 to be mounted, as illustrated in Fig. 4B, the plate main body 1 is lowered under a state in which the receiving pieces 5a1 and 5a1 of the guide rails 5a and 5a are fitted to the cutout portions 2a and 2a of the backup plate 2. Thus, under a state in which the backup plate 2 is received by the receiving pieces 5a1 and 5a1 of the guide rails 5a and 5a, only the plate main body 1 is lowered so that the plate main body 1 and the backup plate 2 are separated from each other. Under this state, the backup plate 2 is conveyed to the unloader 16 side by the downstream-side conveyance mechanism 7, and the backup plate 2 is accommodated in the unloader 16.

[0055] After that, another backup plate 2, for example, the backup plate 2B is delivered from the loader 15B, and as illustrated in Fig. 4A, the backup plate 2B is arranged above the plate main body 1 through use of the upstream-side conveyance mechanism 6. Then, the plate main body 1 is raised so that the plate main body 1 and the backup plate 2B are integrated with each other.

[0056] In this manner, the shuttle 10 for the substrate 22B can be formed. The substrate 22B can be delivered from the loader (which is the loader different from the loader 15 accommodating the backup plate 2, and accommodates the substrate 22), and the

substrate 22B is fed to the shuttle 10, thereby being capable of mounting the chips 21 on the substrate 22B. After completion of mounting of the chips 21 on the substrate 22B, the substrate 22B can be fed to the unloader on the downstream side (which is the unloader different from the unloader 16 intended to accommodate the backup plate 2, and is intended to accommodate the substrate 22).

[0057] Now, when the chips 21 are mounted (bonded) on a different substrate 22, by the above-mentioned steps, the backup plate 2 (2C) can be replaced, and the substrate 22C can be sucked and retained on the backup plate 2C. Thus, the chips 21 can be mounted on the substrate 22C.

[0058] According to the backup plate feed and recovery apparatus of the present invention, one backup plate 2 freely selected among the plurality of kinds of backup plates 2 can be delivered from the upstream-side magazine mechanism 4, and the one backup plate 2 can be conveyed to the plate main body 1 by the upstream-side conveyance mechanism 6. In this conveyance, the backup plate 2 is conveyed to the plate main body 1 under a state of being supported by the conveyance rail unit 5. Then, the plate main body 1 is raised by the raising and lowering mechanism 8 so that the plate main body 1 and the backup plate 2 are integrated with each other. Further, under a state in which the plate main body 1 and the backup plate 2 are integrated with each other, the plate main body 1 is lowered by the raising and lowering mechanism 8 so that the plate main body

1 and the backup plate 2 are separated from each other. The backup plate 2 thus separated from the plate main body 1 is conveyed to the downstream-side magazine mechanism 4 by the downstream-side conveyance mechanism 7. In this case, the backup plate 2 is conveyed under a state of being supported by the conveyance rail unit 5.

[0059] That is, feed and recovery (replacement) of the backup plate 2 can be performed automatically without manual operation. Even when the backup plate 2 involving heating is used, the backup plate 2 is replaceable without requiring a so-called wait for cooling. Thus, productivity is excellent.

[0060] The guide rails 5a and 5a respectively comprise plate support portions (receiving pieces 5a1 and 5a1) configured to receive the backup plate 2. With this configuration, the backup plate 2 can be stably conveyed when the backup plate 2 is conveyed by the upstream-side conveyance mechanism 6 or the downstream-side conveyance mechanism 7.

[0061] The guide rail interval can be increased and reduced. With this configuration, the pair of guide rails 5a and 5a can stably support (receive) the backup plate 2 in accordance with a size of the backup plate 2. Further, the backup plate 2 has information allowing identification of a kind of the backup plate 2. Thus, the backup plate 2 to be fed can be identified, and incorrect use (incorrect mounting) of the backup plate 2 can be prevented. According to the backup plate feed and recovery apparatus comprising the identification mechanism configured to identify information

of the backup plate 2, reliability of preventing incorrect use (incorrect mounting) is improved.

[0062] According to the backup plate feed and recovery apparatus comprising the posture detection mechanism 18 configured to detect the posture of the backup plate 2 mounted to the plate main body 1, the backup plate 2 can be mounted to the plate main body 1 so as to assume a stable posture (normal posture).

[0063] According to the backup plate feed and recovery apparatus in which the backup plate 2 and the plate main body 1 are integrated with each other by the protrusion and recess fitting structure M, the backup plate 2 and the plate main body 1 can be integrated with each other with the simple structure. Here, in the protrusion and recess fitting structure M, a protruding portion is formed on one member, and a recessed portion in which the protruding portion is to be fitted is formed in another member. When the one member and the another member are superposed on each other, the protruding portion is fitted in the recessed portion so that the two members are integrated with each other. Therefore, the protruding portion may be formed on the backup plate 2 side, and the recessed portion may be formed on the plate main body 1 side. Conversely, the recessed portion may be formed on the backup plate 2 side, and the protruding portion may be formed on the plate main body 1 side. It is desired that vacuum suction or a lock mechanism also be provided as measures for keeping the plate main body and the backup plate integrated with each other.

[0064] According to the die bonder of the present invention, the backup plate feed and recovery apparatus according to the present invention is used. Therefore, the backup plate 2 adapted for a size of the substrate and a design pattern of the substrate is usable, and the substrate 22 can be supported by the backup plate 2. Thus, the chips 21 can be stably bonded on the substrate 22.

[0065] According to the bonding method of the present invention, the backup plate feed and recovery apparatus according to the present invention is used. Therefore, the substrate can be supported by the backup plate adapted for a size of the substrate and a design pattern of the substrate. Thus, the chips can be stably bonded on the substrate.

[0066] Incidentally, the conveyance mechanism 6 or the conveyance mechanism 7 configured to convey the backup plate 2 may also function as the conveyance mechanism configured to convey the substrate 22. That is, the conveyance mechanism 6 or the conveyance mechanism 7 can be used in a shared manner for conveyance of the backup plate 2 and conveyance of the substrate 22. Through shared use of the conveyance mechanism, downsizing of the entire apparatus can be achieved.

[0067] In the embodiment described above, by the upstream-side conveyance mechanism 6 comprising the chuck portion configured to chuck the backup plate 2, and the reciprocating mechanism configured to reciprocate the chuck portion along the conveyance rail unit 5, the backup plate 2 is conveyed to a position above the plate

main body 1. However, by another conveyor such as a crane, the backup plate 2 may be conveyed to a position above the plate main body 1. With this configuration, the conveyance rail unit 5 may be omitted, thereby being capable of achieving downsizing of the backup plate feed and recovery apparatus.

[0068] Further, in the embodiment described above, the backup plate 2 is conveyed by the upstream-side conveyance mechanism 6. However, the plate main body 1 may be conveyed by the upstream-side conveyance mechanism 6, or both of the backup plate 2 and the plate main body 1 may be conveyed by the upstream-side conveyance mechanism 6. That is, at least any one of the backup plate 2 and the plate main body 1 may be conveyed so that the backup plate 2 is arranged above the plate main body 1 as a result of relative movement of the backup plate 2 and the plate main body 1.

[0069] In the embodiment described above, the backup plate feed and recovery apparatus comprises the pair of magazine mechanisms 3 and 4, and the pair of conveyance mechanisms 6 and 7. The backup plate feed and recovery apparatus is configured to convey the backup plate 2 in the magazine mechanism 3 by the conveyance mechanism 6 to the plate main body 1 side, and convey the backup plate 2, which is separated from the plate main body 1, by the conveyance mechanism 7 to the magazine mechanism 4.

[0069] Alternatively, the backup plate feed and recovery apparatus may be configured to convey the backup plate 2 in the magazine mechanism 4 by the conveyance mechanism 7 to the plate

main body 1 side, and convey the backup plate 2, which is separated from the plate main body 1, by the conveyance mechanism 6 to the magazine mechanism 3.

[0071] Further, the backup plate 2 separated from the plate main body 1 may be recovered to the magazine mechanism 3 or the magazine mechanism 4 by the conveyance mechanism 6 or the conveyance mechanism 7. That is, the backup plate in the one magazine mechanism may be fed to the plate main body by one conveyance mechanism, and the backup plate separated from the plate main body may be recovered to the one magazine mechanism or another magazine mechanism by the one conveyance mechanism or another conveyance mechanism. With this configuration, the backup plate can be recovered to the one magazine mechanism from which the backup plate to be recovered is fed, or to the another magazine mechanism. Thus, workability can be improved.

[0072] The number of the magazine mechanisms may be one. That is, the backup plate feed and recovery apparatus may comprise one magazine mechanism 3 (4), and the backup plate 2 in the magazine mechanism 3 (4) may be recovered by the conveyance mechanism 6 (7) to the magazine mechanism 3 (4). That is, the backup plate in the magazine mechanism may be fed to the plate main body by one conveyance mechanism, and the backup plate separated from the plate main body may be recovered to the one magazine mechanism by the one conveyance mechanism or another conveyance mechanism. This configuration requires only one magazine mechanism configured to feed the backup

plate to the plate main body and recover the backup plate from the plate main body. As a result, downsizing of the entire apparatus can be achieved.

[0073] Moreover, the number of the magazine mechanisms may be at least three. That is, at least three magazine mechanisms may be provided, a backup plate in any one of the at least three magazine mechanisms may be fed to the plate main body by one conveyance mechanism, and the backup plate separated from the plate main body may be recovered to the one of the at least three magazine mechanisms from which the backup plate is fed or to another magazine mechanism by the one conveyance mechanism or another conveyance mechanism. With this configuration, various kinds of backup plates can be fed to the plate main body from the at least three magazine mechanisms, and the backup plate can be recovered to any one of the magazine mechanisms. Thus, the backup plate feed and recovery apparatus is excellently convenient.

[0074] The present invention is not limited to the embodiment described above, and various modifications may be made thereto. For example, in the embodiment described above, the member S to be fed is the substrate 22 on which the chips 21 cut out from the wafer 26 are to be bonded, but the member S to be fed is not limited to the substrate 22 described above. The member S to be fed may be a card such as a credit card, a cash card, or an IC card, or may be a flat plate member such as sheet metal. Thus, the workpiece W provided on the member S to be fed is not limited to the chip

21, and the workpiece W may be a component adapted for the member S to be fed. Further, when the substrate 22 is not used as the member S to be fed, and the member S to be fed does not require heating, the heating mechanism 12 of the shuttle 10 may be omitted.

[0075] In the embodiment described above, one shuttle 10 is provided, but two or more shuttles 10 may be provided. Further, the number of the kinds of backup plates 2 is not limited to three. The number of the kinds of the backup plates 2 may be one, two, or three or more. In the backup plate feed and recovery apparatus comprising the identification mechanism 19, a display unit may be provided. The display unit is configured to, when the backup plate 2 and the plate main body 1 are not matched with each other, inform unmatching (occurrence of an error) (for example, the display unit emits a warning sound, or indicates the unmatching in, for example, a monitor).

[0076] In the embodiment, the recessed portion 2b of the protrusion and recess fitting structure M is formed of a through hole. The recessed portion 2b may be formed of a dead-end hole having a bottom surface instead of the through hole. Further, the number of each of the protruding portion 1a and the recessed portion 2b of the protrusion and recess fitting structure M is not limited to one. In the embodiment described above, the magazine mechanisms 3 and 4 each comprise the pusher mechanism, but the magazine mechanisms 3 and 4 comprising no pusher mechanism may be adopted. When the pusher mechanism is not provided, the backup plate in the magazine

mechanism 3 (4) may be pulled out by the conveyance mechanism 6, the conveyance mechanism 7, or another pull-out mechanism.

Industrial Applicability

[0077] The present invention is applicable to an apparatus configured to deliver one backup plate freely selected among a plurality of kinds of backup plates in a loader, feed the one backup plate to a plate main body, and recover the fed backup plate from the plate main body.

Reference Signs List

[0078] 1 plate main body
1a protruding portion
2, 2A, 2B, 2C backup plate
2b recessed portion
3, 4 magazine mechanism
5 conveyance rail unit
5a guide rail
5a1 receiving piece
6, 7 conveyance mechanism
8 raising and lowering mechanism
9 reciprocating mechanism
10 shuttle
17 guide-rail-interval increasing and reducing mechanism
18 posture detection mechanism

19 identification mechanism

21 chip

22, 22A, 22B, 22C substrate

Claims

[Claim 1] A backup plate feed and recovery apparatus configured to feed one backup plate freely selected among a plurality of kinds of backup plates to a plate main body, and recover the fed backup plate from the plate main body, the backup plate feed and recovery apparatus comprising:

a magazine mechanism configured to deliver one backup plate freely selected among the plurality of kinds of backup plates; and

a raising and lowering mechanism configured to relatively raise and lower the plate main body and the backup plate,

wherein the backup plate delivered from the magazine mechanism is arranged at a position above or below the plate main body,

wherein the plate main body and the backup plate are relatively raised or lowered by the raising and lowering mechanism so that the plate main body and the backup plate are integrated with each other, and

wherein the plate main body and the backup plate are relatively lowered or raised by the raising and lowering mechanism so that the plate main body and the backup plate are separated from each other.

[Claim 2] The backup plate feed and recovery apparatus according to claim 1, further comprising a conveyance mechanism configured to convey any one of the backup plate in the magazine mechanism and a substrate to be retained on a shuttle formed by integrating

the plate main body and the backup plate with each other.

[Claim 3] The backup plate feed and recovery apparatus according to claim 1 or 2,

wherein one magazine mechanism is provided,

wherein a backup plate in the one magazine mechanism is fed to the plate main body by one conveyance mechanism, and

wherein the backup plate separated from the plate main body is recovered to the one magazine mechanism by the one conveyance mechanism or another conveyance mechanism.

[Claim 4] The backup plate feed and recovery apparatus according to claim 1 or 2,

wherein at least one pair of magazine mechanisms is provided,

wherein a backup plate in one magazine mechanism is fed to the plate main body by one conveyance mechanism, and

wherein the backup plate separated from the plate main body is recovered to the one magazine mechanism or another magazine mechanism by the one conveyance mechanism or another conveyance mechanism.

[Claim 5] The backup plate feed and recovery apparatus according to claim 1 or 2,

wherein at least three magazine mechanisms are provided,

wherein a backup plate in any one of the at least three magazine

mechanisms is fed to the plate main body by one conveyance mechanism,
and

wherein the backup plate separated from the plate main body
is recovered to the one of the at least three magazine mechanisms
from which the backup plate is fed or to another magazine mechanism
by the one conveyance mechanism or another conveyance mechanism.

[Claim 6] The backup plate feed and recovery apparatus according
to claim 1 or 2,

wherein the conveyance mechanism conveys the backup plate from
the magazine mechanism to the plate main body along a conveyance
rail unit, or conveys the backup plate separated from the plate
main body to the magazine mechanism along the conveyance rail unit,

wherein the conveyance rail unit comprises a pair of guide
rails opposed to each other, and

wherein each of the pair of guide rails comprises a plate support
portion configured to receive the backup plate.

[Claim 7] The backup plate feed and recovery apparatus according
to claim 6,

wherein the pair of guide rails is configured such that a guide
rail interval is increased and reduced,

wherein under a state in which the guide rail interval is
increased, the pair of guide rails allows the backup plate to pass
through between the pair of guide rails, and

wherein under a state in which the guide rail interval is reduced, the plate support portions of the pair of guide rails are capable of receiving the backup plate.

[Claim 8] The backup plate feed and recovery apparatus according to any one of claims 1 to 7, wherein the backup plate has information allowing identification of a kind of the backup plate.

[Claim 9] The backup plate feed and recovery apparatus according to claim 8, further comprising an identification mechanism configured to identify the information of the backup plate.

[Claim 10] The backup plate feed and recovery apparatus according to any one of claims 1 to 9, further comprising a posture detection mechanism configured to detect a posture of the backup plate mounted to the plate main body.

[Claim 11] The backup plate feed and recovery apparatus according to any one of claims 1 to 10, wherein the backup plate and the plate main body are integrated with each other by a protrusion and recess fitting structure.

[Claim 12] A die bonder configured to bond a chip on an island portion of a substrate, wherein under a state in which a backup plate is conveyed by the backup plate feed and recovery apparatus of any

one of claims 1 to 11, and the backup plate and a plate main body are integrated with each other, the backup plate supports the substrate.

[Claim 13] A bonding method of bonding a chip on an island portion of a substrate, the bonding method comprising bonding the chip on the island portion of the substrate under a state in which a backup plate is conveyed to a plate main body by the backup plate feed and recovery apparatus of any one of claims 1 to 11, the plate main body and the backup plate are integrated with each other, and the backup plate supports the substrate.