(the outer pair) encloses the inner pair of the plates 8B with L-shaped supporting edges.

[0015] The detachment and removal of a semiconductor chip 5 from the foil 4 occurs by means of the die ejector 1 in cooperation with a chip gripper 16 (Fig. 10). The chip gripper 16 advantageously contains a suction member which can be supplied with vacuum and which will suck up the semiconductor chip and tightly hold the same. The chip gripper 16 can also contain a suction member based on the Bernoulli effect, which suction member needs to be supplied with compressed air in order to achieve the suction effect. The method for detaching a semiconductor chip will be explained in detail by reference to Figs. 5 to 13, with said drawings respectively representing a snapshot. The foil 4 and the drive means for the movement of the plates 8 are not shown in Figs. 5 to 13. A movement of the plates 8 in the positive z-direction will be designated as lifting and a movement of the plates 8 in the negative z-direction will be designated as lowering.

[0016] In order to detach the next semiconductor chip from the foil 4, the foil 4 is displaced relative to the die ejector 1, so that the semiconductor chip 5 to be detached is located above the hole 6 of the cover plate 3. Furthermore, all plates 8 are lifted relative to the carrier 9, so that their supporting edges 19 are situated in a common plane, and the carrier 9 is brought to a predetermined position z_0 in which the supporting edges 19 are flush with the surface 12 of the cover plate 3. In this initial position the foil 4 rests on the supporting edges 19 of the plates 8. The method for detaching the semiconductor chip 5 from the foil 4 comprises the following steps:

A) supplying the chamber 2 with vacuum, so that the foil 4 is drawn towards the cover plate 3;

B) lifting of the carrier 9 by a predetermined distance Δz_1, so that the supporting edges 19 of the plates 8 will assume a height H_1 above the surface 12 of the cover plate 3;

C) lowering of the outermost pair of plates 8C with the L-shaped supporting edge;

D) optionally, lowering of the ~~second~~ inner pair of plates 8B with L-shaped supporting edge;

E) lifting of the carrier 9 by a predetermined distance Δz_2, so that the supporting edges of the plates that have not yet been lowered will assume a height $H_2 > H_1$ above the surface 12 of the cover plate 3;

F) staggered lowering of plates 8 that have not yet been lowered in a predetermined sequence, with at least one or several (preferably three) plates 8A not being lowered;

G) optionally, lowering of the carrier 9 by a predetermined distance Δz_3, so that the supporting edges of the plates that have not yet been lowered assume a height $H_3 < H_2$ above the surface 12 of the cover plate 3;

H) staggered lowering of the plates 8A that have not yet been lowered;

I) moving away of the chip gripper 16 with the semiconductor chip 5;

J) wherein the chip gripper 16 is positioned above the semiconductor chip 5 and lowered until it touches and tightly holds the semiconductor chip 5 at the latest before lowering of the last three plates 8A.

[0017] Fig. 5 shows a snapshot of the initial position.

CLAIMS

1. Method for detaching a semiconductor chip (5) from a foil (4) by means of a chip gripper (16) and a die ejector (1), with the die ejector (1) comprising first plates (8A) having a straight supporting edge and second plates (8B, 8C) having an L-shaped supporting edge, with the supporting edges (19) of the plates (8A, 8B, 8C) in an initial position forming a supporting plane on which the foil (4) rests, comprising the following steps:

A) lifting of the plates (8A, 8B, 8C), so that the supporting edges (19) of the plates (8A, 8B, 8C) assume a height H_1 above the surface (12) of the cover plate (3);

B) lowering of a first pair of plates (8B) with L-shaped supporting edge;

C) optionally, lowering of a second pair of plates (8C) with L-shaped supporting edge;

D) lifting of the plates that have not yet been lowered, so that the supporting edges (19) of the plates that have not yet been lowered assume a height $H_2 > H_1$ above the surface (12) of the cover plate (3);

E) staggered lowering of plates that have not yet been lowered in a specific sequence, with at least one or several plates (8A) not being lowered;

F) optionally, lowering of at least the plates that have not yet been lowered, so that the supporting edges (19) of the plates that have not yet been lowered assume a height $H_3 < H_2$ above the surface (12) of the cover plate (3);

G) lowering of the plates that have not yet been lowered until all plates (8A, 8B, 8C) are lowered, and

H) moving away of the chip gripper (16) with the semiconductor chip (5),

wherein the chip gripper (16) is positioned above the semiconductor chip (5) and lowered until it touches the semiconductor chip (5) at the latest before the lowering of the last three plates (8A).

2. Method according to claim 1, wherein the plates (8A, 8B, 8C) are fixed to a carrier (9), with the carrier (9) being displaceable perpendicularly to the surface (12) of the cover plate (3) and with the plates (8A, 8B, 8C) being liftable and lowerable relative to the carrier (9), with the carrier (9) being disposed in a predetermined position z_0 in the initial position and the plates (8A, 8B, 8C) being lifted relative to the carrier (9), so that the supporting edges (19) of the plates (8A, 8B, 8C) form a supporting plane on which the foil (4) rests, characterized in that:

the carrier (9) is lifted by a predetermined distance Δz_1 in step A;

the carrier (9) is lifted by a predetermined distance Δz_2 in step D, and

the carrier (9) is lowered by a predetermined distance Δz_3 in the optional step F.

CLAIMS

1. Method for detaching a semiconductor chip (5) from a foil (4) by means of a chip gripper (16) and a die ejector (1), wherein the die ejector (1) comprises inner plates (8A) having a straight supporting edge and outer plates (8B, 8C) having an L-shaped supporting edge, the inner and outer plates (8A, 8B, 8C) protruding into a central hole of a cover plate (3), and wherein the supporting edges (19) of the plates (8A, 8B, 8C) in an initial position form a supporting plane on which the foil (4) rests, the method comprising the following steps:

A) lifting the plates (8A, 8B, 8C), so that the supporting edges (19) of the plates (8A, 8B, 8C) assume a height H_1 above a surface (12) of the cover plate (3);

B) lowering an outermost pair of the outer plates (8C);

C) lifting at least the plates that have not yet been lowered, so that the supporting edges (19) of the plates that have not yet been lowered assume a height $H_2 > H_1$ above the surface (12) of the cover plate (3);

D) staggered lowering of the plates that have not yet been lowered in a specific sequence, with at least one or several of the plates not being lowered;

E) positioning the chip gripper (16) above the semiconductor chip (5);

F) lowering the chip gripper (16) into contact with the semiconductor chip (5) before the lowering of the last three plates;

G) lowering the plates that have not yet been lowered until all plates (8A) are lowered; wherein steps A to D are executed in the order listed above and before steps F and G.

2. Method according to claim 1, wherein two further outer plates are arranged to form a second pair of second outermost plates (8B), the method further comprising:

after steb B, lowering the second pair of outer plates (8B).

3. Method according to claim 1 or 2, further comprising:

after step D, lowering at least the plates that have not yet been lowered, so that the supporting edges of the plates that have not yet been lowered assume a height $H_3 < H_2$ above the surface of the cover plate (3).

4. Method according to claim 1 or 2, wherein the plates (8A, 8B, 8C) are fixed to a carrier (9), with the carrier (9) being displaceable perpendicularly to the surface (12) of the cover plate (3) and with the plates (8A, 8B, 8C) being liftable and lowerable relative to the carrier (9), with the carrier (9) being disposed in a predetermined position z_0 in the initial position and the plates (8A, 8B, 8C) being lifted relative to the carrier (9), so that the supporting edges (19) of the plates (8A, 8B, 8C) form a supporting plane on which the foil (4) rests, and wherein the method further comprises:

lifting the carrier (9) a predetermined distance Δz_1 in step A;
lifting the carrier (9) a predetermined distance Δz_2 in step C.

5. Method according to claim 3, wherein the plates (8A, 8B, 8C) are fixed to a carrier (9), with the carrier (9) being displaceable perpendicularly to the surface (12) of the cover plate (3) and with the plates (8A, 8B, 8C) being liftable and lowerable relative to the carrier (9), with the carrier (9) being disposed in a predetermined position z_0 in the initial position and the plates (8A, 8B, 8C) being lifted relative to the carrier (9), so that the supporting edges (19) of the plates (8A, 8B, 8C) form a supporting plane on which the foil (4) rests, and wherein the method further comprises:
lifting the carrier (9) a predetermined distance Δz_1 in step A;
lifting the carrier (9) a predetermined distance Δz_2 in step C; and
lowering the carrier (9) a predetermined distance Δz_3 in the 'after D step'.