The problem is solved by means of a device for buffer-storing a multiplicity of wafer-type workpieces, comprising

- a frame,
- at least two transport elements which circulate in a vertical direction around in each case an upper and a lower deflection device connected to the frame and which are provided, at uniform intervals, with a multiplicity of bearing areas for the horizontal mounting of workpieces, wherein at least one of the deflection devices of each transport element is driven and wherein a free space is situated between the transport elements,
- a loading position between the upper deflection devices, in which position a respective workpiece can be placed onto the corresponding bearing areas, and
- a stationary removal device below the loading position, comprising a horizontal transport device, the first end of which lies within the free space between the transport elements,

wherein the transport elements are chains, in each case comprising a multiplicity of chain links connected by articulations, wherein the bearing areas are connected to the chain in a manner rotatable about the articulations and have cams, wherein the rotation of the bearing areas is limited by a first end stop of the bearing areas against the cams of the adjacent bearing areas and by a second end stop of the cams of the bearing areas against the chain links, wherein the bearing areas, upon circulation of the chains around the deflection devices on account of their weight, are situated against the first end stop in the upwardly moved chain strand and against the second end stop in the downwardly moved chain strand.

The problem is likewise solved by means of a method for buffer-storing *n* wafer-type workpieces individually one above another without touching adjacent workpieces in the above-described device, where *n* denotes an integer that is greater than 1, and wherein the method comprises the following steps in the specified order:

(a) insertion of a workpiece into the loading position,

(b) synchronous rolling of the transport elements such that the workpiece is progressively moved relative to the frame by exactly one vertical distance between the bearing areas perpendicular to the workpiece from the loading position downward and the loading position thereby becomes free again, and

(c) repetition of steps (a) and (b), until all *n* workpieces have been inserted, such that a stack of *n* workpieces arranged

one above another and bearing individually on the respective bearing areas has been formed.

Preferably, the method additionally comprises the following additional steps in the specified order:
(d) vertical movement of the stack by in each case one vertical distance between the bearing areas downward until the bottom-most workpiece bears on the removal device,
(e) removal of the bottom-most workpiece from the stack by means of a horizontal movement of the removal device and
(f) repetition of steps (d) and (e), until all *n* workpieces have been removed from the stack,
wherein a stack of workpieces is built up by carrying out steps (a) to (c) and at the same time one or a plurality of workpieces are removed again from the stack in the order of insertion by carrying out steps (d) to (f), and wherein the vertical movement of the stack in accordance with step (d) is effected by means of a vertical movement of the frame relative to the removal device.

Brief description of the figures

Figure 1: front view of an embodiment of the buffer store according to the invention.

Figure 2(A): side view of an embodiment of the device according to the invention in a first operating state.

Figure 2(B): side view of an embodiment of the buffer store according to the invention in a second operating state.

Figure 3(A): plan view of an embodiment of the buffer store according to the invention.

Figure 3(B): plan view of an embodiment of the buffer store according to the invention during the removal of a semiconductor wafer.

Figure 3(C): side view of an embodiment of the vertical transport element as a chain.

Figure 4: flowchart for a first embodiment of the method according to the invention (simultaneous loading and unloading of the buffer store).

Claims

1. A device for buffer-storing a multiplicity of wafer-type workpieces (17), comprising
- a frame (1),
- at least two transport elements (3) which circulate in a vertical direction around in each case an upper and a lower deflection device (5) connected to the frame and which are provided, at uniform intervals, with a multiplicity of bearing areas (4) for the horizontal mounting of workpieces (17), wherein at least one of the deflection devices (5) of each transport element (3) is driven and wherein a free space is situated between the transport elements (3),
- a loading position (33) between the upper deflection devices (5), in which position a respective workpiece (17) can be placed onto the corresponding bearing areas (4), and
- a stationary removal device below the loading position (33), comprising a horizontal transport device (7, 8, 9), the first end of which lies within the free space between the transport elements (3).

2. The device as claimed in claim 1, wherein the transport elements (3) are toothed belts, the teeth of which form the bearing areas (4) for the workpieces (17).

3. The device as claimed in claim 1, comprising four circulating transport elements (3), wherein two of the four transport elements (3) are in each case driven by deflection devices (5) which are fixed on a common shaft (12), and wherein the two transport elements (3) in each case have common bearing areas (4) which connect said transport elements (3).

4. The device as claimed in claim 3, wherein the bearing areas (4) in each case have a depression (65) adapted to the form of the workpiece (17).

5. The device as claimed in either of claims 3 and 4, wherein the transport elements (3) are chains, in each case comprising a multiplicity of chain links (70) connected by articulations, wherein the bearing areas (4) are connected to the chain in a manner rotatable about the articulations and have cams (66), wherein the rotation of the bearing areas (4) is limited by a first end stop of the bearing areas (4) against the cams (66) of the adjacent bearing areas (4) and by a second end stop of the cams (66) of the bearing areas (4) against the chain links (70), wherein the bearing areas (4), upon circulation (6) of the chains around the deflection devices (5) on account of their weight, are situated against the first end stop in the upwardly moved chain strand and against the second end stop in the downwardly moved chain strand.

6. The device as claimed in any of claims 1 to 5, wherein the frame (1) is movable by means of a drive (34) in a vertical direction relative to the removal device (7, 8, 9).

7. The device as claimed in claim 6, wherein the frame (1) is connected via at least one threaded bush (10) to a threaded rod (15), which can be caused to rotate by a drive (34) such that the frame (1) can be moved in a vertical direction.

8. The device as claimed in any of claims 1 to 5, wherein the frame (1) is stationary.

9. A method for buffer-storing *n* wafer-type workpieces (17) individually one above another without touching adjacent workpieces in a device as claimed in claim 1, where *n* denotes an integer that is greater than 1, and wherein the method comprises the following steps in the specified order:
(a) insertion of a workpiece (17) into the loading position (33),

(b) synchronous rolling of the transport elements (3) such that the workpiece (17) is progressively moved relative to the frame (1) by exactly one vertical distance between the bearing areas (4) perpendicular to the workpiece (17) from the loading position (33) downward and the loading position (33) thereby becomes free again, and

(c) repetition of steps (a) and (b), until all *n* workpieces (17) have been inserted, such that a stack of *n* workpieces (17) arranged one above another and bearing individually on the respective bearing areas has been formed.

10. The method as claimed in claim 9, wherein the method comprises the following additional steps in the specified order:

(d) vertical movement of the stack by in each case one vertical distance between the bearing areas (4) downward until the bottom-most workpiece (17) bears on the removal device (7, 8, 9),

(e) removal (37) of the bottom-most workpiece (17) from the stack by means of a horizontal movement of the removal device (7, 8, 9) and

(f) repetition of steps (d) and (e), until all *n* workpieces (17) have been removed from the stack.

11. The method as claimed in claim 10 using a device as claimed in claim 6, wherein a stack of workpieces (17) is built up by carrying out steps (a) to (c) and at the same time one or a plurality of workpieces (17) are removed again from the stack in the order of insertion by carrying out steps (d) to (f), and wherein the vertical movement of the stack in accordance with step (d) is effected by means of a vertical movement of the frame (1) relative to the removal device (7, 8, 9).

12. The method as claimed in claim 11, wherein, between steps (a) and (b), the frame (1) is moved upward relative to the

removal device (7, 8, 9) by one vertical distance between the bearing areas (4).

13. The method as claimed in claim 10, wherein, firstly, a complete stack of *n* workpieces (17) is built up by carrying out steps (a) to (c) and, afterward, the *n* workpieces (17) are removed again from the stack in the order of insertion by carrying out steps (d) to (f), wherein the frame (1) is not moved relative to the removal device (7, 8, 9) and wherein the vertical movement of the stack in accordance with step (d) is effected by means of synchronous rolling (6) of the transport elements (3) and hence movement of the stack relative to the frame (1) downward.

14. The method as claimed in any of claims 10 to 13, wherein each of the workpieces (17) passes through the following steps after step (e) in the specified order:
(g) transport of the workpiece (17) through a cleaning device (21) and cleaning of the workpiece (17) individually in a continuous method, and
(i) sorting of the workpiece (17) individually into a cassette (29) by means of a sorting device (26) in the order of passing through the cleaning device (21).

15. The method as claimed in claim 14, wherein a further step (h) is effected between step (g) and step (i), the workpiece (17) being dried in said further step (h).

Claims

1. A device for buffer-storing a multiplicity of wafer-type workpieces, comprising
- a frame,
- two or more transport elements which circulate in a vertical direction around in each case an upper and a lower deflection device connected to the frame and which are provided, at uniform intervals, with a multiplicity of bearing areas for the horizontal mounting of workpieces, wherein one or more of the deflection devices of each transport element is driven and wherein a free space is situated between the transport elements,
- a loading position between the upper deflection devices, in which position a respective workpiece can be placed onto the corresponding bearing areas, and
- a stationary removal device below the loading position, comprising a horizontal transport device, the first end of which lies within the free space between the transport elements,
wherein the transport elements are chains, in each case comprising a multiplicity of chain links connected by articulations, wherein the bearing areas are connected to the chain in a manner rotatable about the articulations and have cams, wherein the rotation of the bearing areas is limited by a first end stop of the bearing areas against the cams of the adjacent bearing areas and by a second end stop of the cams of the bearing areas against the chain links, wherein the bearing areas, upon circulation of the chains around the deflection devices on account of their weight, are situated against the first end stop in the upwardly moved chain strand and against the second end stop in the downwardly moved chain strand.

2. The device as claimed in claim 1, comprising four circulating transport elements, wherein two of the four transport elements are in each case driven by deflection devices which are fixed on a common shaft, and wherein the two transport elements in each case have common bearing areas which connect said transport elements.

3. The device as claimed in claim 2, wherein the bearing areas in each case have a depression adapted to the form of the workpiece.

4. The device as claimed in claim 1, wherein the frame is movable by means of a drive in a vertical direction relative to the removal device.

5. The device as claimed in claim 4, wherein the frame is connected via one or more threaded bush to a threaded rod, which can be caused to rotate by a drive such that the frame can be moved in a vertical direction.

6. The device as claimed in any of claims 1, 2 or 3, wherein the frame is stationary.

7. A method for buffer-storing n wafer-type workpieces individually one above another without touching adjacent workpieces using a device as claimed in claim 4, where n denotes an integer that is greater than 1, and wherein the method comprises the following steps in the specified order:
(a) insertion of a workpiece into the loading position,
(b) synchronous rolling of the transport elements such that the workpiece is progressively moved relative to the frame by

exactly one vertical distance between the bearing areas perpendicular to the workpiece from the loading position downward and the loading position thereby becomes free again,
(c) repetition of steps (a) and (b), until all n workpieces have been inserted, such that a stack of n workpieces arranged one above another and bearing individually on the respective bearing areas has been formed,
(d) vertical movement of the stack by in each case one vertical distance between the bearing areas downward until the bottom-most workpiece bears on the removal device,
(e) removal of the bottom-most workpiece from the stack by means of a horizontal movement of the removal device and
(f) repetition of steps (d) and (e), until all n workpieces have been removed from the stack,
wherein a stack of workpieces is built up by carrying out steps (a) to (c) and at the same time one or a plurality of workpieces are removed again from the stack in the order of insertion by carrying out steps (d) to (f), and wherein the vertical movement of the stack in accordance with step (d) is effected by means of a vertical movement of the frame relative to the removal device.

8. The method as claimed in claim 7, wherein, between steps (a) and (b), the frame is moved upward relative to the removal device by one vertical distance between the bearing areas.

9. The method as claimed in Claim 7 or 8, wherein each of the workpieces passes through the following steps after step (e) in the specified order:
(g) transport of the workpiece through a cleaning device and cleaning of the workpiece individually in a continuous method, and

(i) sorting of the workpiece individually into a cassette by means of a sorting device in the order of passing through the cleaning device.

10. The method as claimed in claim 9, wherein a further step (h) is effected between step (g) and step (i), the workpiece being dried in said further step (h).