

An Assembly and Method of Handling Wafers

Field of the invention

[0001] The present invention concerns an assembly and method of handling semiconductor wafers; and in particular to an assembly and method in which a wafer comprising components to be picked is loaded
5 onto a second wafer holder at a loading station, while components are picked from a wafer on a first wafer holder located at a picking station.

Background to the invention

[0002] Existing assemblies and method for handling semiconductor wafers typically comprise a carrier which receive a wafer at a loading station and transport that wafer to a picking station; at the picking station
10 semiconductor components on the wafer are picked and moved onto a rotatable turret which transports each of the respective picked components to a series of processing/testing stations located at the periphery of the turret.

[0003] Disadvantageously when all of the semiconductor components
15 on the wafer have been picked the turret and processing/testing stations suffer idle downtime during the period when the carrier moves from the picking station to the loading station, during the period when the carrier is reloaded with a new wafer (having more semiconductor components to be picked) at the loading station, and during the period when the carrier is
20 moving back from the loading station to the picking station again.

[0004] Furthermore, in existing assemblies and methods for handling semiconductor wafers, the loading and unloading of wafers from the carrier is time consuming and often requires complex assemblies.

[0005] It is an aim of the present invention to obviate or mitigate at least some of the disadvantages associated with existing wafer handling assemblies and existing methods for handling wafers.

Summary of the invention

[0006] According to the present invention there is provided an assembly
5 for handling semiconductor wafers having the features recited in independent claim 1; and a method of handling semiconductor wafers which involves carrying out the steps recited in claim 13.

[0007] The dependent claims recite optional features of preferred embodiments.

10 Brief description of the drawings

[0008] Exemplary embodiments of the invention are disclosed in the description and illustrated by the drawings in which:

Figures 1 and 2 provide a perspective view of an assembly 1 according to an embodiment of the present invention;

15 Figure 3 provides a perspective view of the first and second wafer holders and the carrier used in the assembly of Figures 1 and 2;

Figure 4 illustrates the step of the carrier moving a wafer holder from the picking station to the intermediate rest station of the assembly;

20 Figures 5 and 6 illustrates the operation of the actuator and the cam of the assembly as the carrier moves a wafer holder into the intermediate rest station;

Figure 7a illustrates a step in which the first wafer holder in the intermediate rest station is lifted by the first pair of clamping members so that the first wafer holder is removed from the carrier; Figure 7a also illustrates that the second wafer holder in the loading station has been moved to an elevated position by the second pair of clamping member so as to provide space to allow the carrier to be moved under the second wafer holder; Figure 7b illustrate the carrier moving under the second wafer holder.

Figure 8 illustrates a step in which the second wafer holder in the loading station is moved downwards, away from the elevated position shown in Figure 7, onto the carrier; and the operation of the actuator on the carrier is also illustrated after the second wafer holder has been placed on the carrier;

Figure 9 illustrates a step in which the second wafer holder which was already loaded with a wafer having semiconductor components to be picked (see figure 7) is moved from the loading station to the picking station;

Figure 10 illustrates steps in which the first wafer holder is moved by the transfer arm, from the intermediate rest station to the loading station;

Figure 11 illustrates a step wherein the first wafer holder is transferred from the transfer arm to the first pair of clamping members located at the loading station;

Figure 12 illustrates a step wherein empty wafer (i.e. the wafer from which all of the semiconductor components have been picked) on first wafer holder is removed from the first wafer holder and placed into a magazine;

Figure 13 illustrates a step wherein a wafer having semiconductor components to be picked, is loaded from a magazine onto the first wafer holder;

5 Figure 14 illustrates a step wherein the first wafer holder is configured to clamp the wafer and stretch the wafer foil; and the first wafer holder is lifted by the first pair of claiming members so as to provide space to allow the carrier to be moved under the first wafer holder.

Detailed description of the drawings

10 **[0009]** Figures 1 and 2 is a perspective view of exemplary embodiment of a wafer handling assembly 1 according to an exemplary embodiment of the present invention, which can be used to perform a method according to the accord to an exemplary embodiment of the present invention.

15 **[0010]** Referring to figures 1 and 2 it can be seen that the assembly 1 comprises, a first wafer holder 2a and second wafer holder 2b, each of which can hold a respective wafer 3 which comprises semiconductor components 3a.

20 **[0011]** The assembly 1 further comprises a carrier 5 which is selectively operable to carry one of said wafer holders 2a,2b to move said wafer holder to predefined, different locations within the assembly 1.

25 **[0012]** The assembly comprises a picking station 7, a loading station 8, and an intermediate rest station 9. The picking station 7 comprises means to pick semiconductor components from a wafer on the wafer holder 2a,2b which has been brought to the picking station by the carrier 5. The loading station 8 comprises means to load a wafer having semiconductor components onto a wafer holder 2a,2b which is located at the loading

station 8. The intermediate rest station 9 comprises an area in which a wafer holder 2a,2b can be parked.

[0013] It should be understood that the components 3a could be picked using any suitable means, in this example the components are picked using a component handling head on a picking tool; the component handling head on the picking tool is then moved to bring the picked component to a position below a respective component handling head on a rotatable turret; the component handling head on the rotatable turret then picks the component from the component handling head on the picking tool. There are a plurality of different processing and/or testing stations located at the periphery of the rotatable turret, and the turret rotates interactively to transport each picked component to each respective processing and/or testing station.

[0014] The assembly 1 further comprises a transfer means 10 which is selectively operable to move a wafer holder 2a,2b from the intermediate rest station 9 to the loading station 8. In this example the transfer means 10 comprises a first pair of clamping members 11a,b located at the intermediate rest station 9, a second pair of clamping members 12a,b located at the loading station 8, and a transfer arm 13. The transfer arm 13 is configured such that it can be selectively moved to first and second positions, wherein in said first position the transfer arm 13 can mechanically cooperate with a wafer holder 2a,b held by the first pair of clamping members 11a,b, to hold said wafer holder, and in said second position the second pair of clamping members 12a,b located at the loading station 8 can clamp the wafer holder 2a,b held by the transfer arm 13.

[0015] The assembly further comprises a controller 20 which is configured to operate said carrier 5 and the transfer means 10, so that, the carrier 5 moves the second wafer holder 2b from the loading station 8 to the picking station 7, wherein at the picking station 7 semiconductor components 3a on a wafer 3 held on the second wafer holder 2b can be picked from the wafer; and so that the transfer means 10 moves the first

wafer holder 2a from the intermediate rest station 9 to the loading station 8, after the carrier 5 has moved the second wafer holder 2b from the loading station 8, so that a wafer 3 comprising semiconductor components 3a which are to be picked, is loaded onto the first wafer holder 2a while
5 the semiconductor components 3a on a wafer 3 held on the second wafer holder 2b are picked at the picking station 7.

[0016] In this assembly 1 embodiment the controller 20 is further configured to operate said carrier 5 and the transfer means 10, so that, the carrier 5 moves the second wafer holder 2b from the picking station 7 to
10 the intermediate rest station 9, after all the semiconductor components 3a on the wafer 3 on the second wafer holder 2b have been picked; so that the second wafer holder 2b (which now holds an empty wafer 3 (i.e. the wafer 3 which has no more semiconductor components 3a)) is located at the intermediate rest station 9 at same time the first wafer holder 2a is
15 located at the loading station 8.

[0017] It should be understood that in the present application, preferably the wafer 3 comprises a wafer foil which is attached to a wafer ring; the semiconductor components 3 are located on the wafer foil.

[0018] Figure 3 provides a perspective view of the first and second wafer holders 2a,b (in Figure 3 the first wafer holder 2a is located at the intermediate station 9 and the second wafer holder 2b is located at the loading station 8) and a perspective view of the carrier 5. Each of the first and second wafer holder 2a,b comprise, a base platform member 31, which comprises a projecting portion 33 on which a wafer foil 3 having
20 semiconductor components 3a attached thereto, can be supported; and a top member 34, wherein the top member has an aperture 32 defined therein which can receive the projection portion 33 of the base platform member 31.
25

[0019] The base platform member 31 further comprises a first rim 35, and the top member 34 comprises a second rim 36, and wherein base
30

platform member 31 and the top member 34 can be selectively arrange to clamp a wafer ring to which the wafer foil 3 is attached); and wherein when base platform member 31 and the top member 34 are be selectively arrange to clamp the wafer ring the projecting portion 33 of the base
5 platform member 31 projects into the aperture 32 defined in the top member 34 so that a wafer foil which is attached to the wafer ring is stretched.

[0020] Each of the first and second wafer holders 2a,b comprise a rotatable stage 39 wherein the base platform member 31 is attached to the
10 stage 39; wherein said stage 39 comprises a rim member 38.

[0021] Figure 3 also shows that the carrier 5 comprises an actuator 37; the actuator 37 can mechanically cooperate with the rim member 38 of a respective wafer holder 2a,b when the wafer holder 2a,b is supported on the carrier 5; and the actuator can be selectively operated to rotate the
15 stage 39 of that wafer holder 2a,b. As shown the actuator 37 comprises a wheel member 40 which comprises a groove 41 and wherein the groove 41 has dimensions such that when the wafer holder 2a,b is supported on the carrier 5 the rim member 38 of the stage 39 abuts a surface which defines the groove 41; when the actuator 37 is actuated the wheel member 40
20 rotates and the rotation of the wheel member 40 applies a force to the rim member 38 of the stage 39 of the wafer holder 2a,b to effect rotation of the stage 39.

[0022] The actuator 37 further comprises a biasing means 43 (which in this example comprises a spring 43) which biases the wheel member 40
25 towards abutting rim member 38 of the stage 39 when the wafer holder 2a,b is supported on the carrier 5. The actuator 37 further comprise a lever member 43b which is configured such when a force is applied to the lever member 43b the wheel member 40 is moved against the biasing means 43 in a direction away from the rim member 38.

[0023] Referring again to Figure 1 it can be seen that the assembly 1 further comprise a first cam member 48a and second cam member 48b. The first cam member 48a is located so that when the carrier 5 moves into the intermediate rest station 9 the movement of the carrier 5 into the intermediate rest station 9 causes the first cam member 48a to apply a force to the lever member 43b belonging to the actuator 37 of the carrier 5, so that the wheel member 40 is moved against the biasing means 43 in a direction away from the rim member 38 of the wafer holder 2a,b which is supported on the carrier 5, before the first pair of clamping members 11a,b located at the intermediate rest station 9 move the wafer holder 2a,b off of the carrier 5. The assembly further comprises a second cam member 48b. The second cam member 48b is located so that when the carrier 5 moves into the loading station 8 the movement of the carrier 5 into the loading station 8 causes the second cam member 48b to apply a force to the lever member 43b belonging to the actuator 37 of the carrier 5, so that the wheel member 40 is moved against the biasing means, so that the wheel member 40 is moved out of the way of the rim member 38 of the stage 39 of the wafer holder 2a,b which is being delivered onto the carrier 5 at the loading station 8; subsequently, when the carrier 5 is moved out of the loading station 8 the force which the second cam member 48b applied to the lever member 43b is removed and the biasing means 43 moves the wheel member 40 to abut rim member 38 of the stage 39 of the wafer holder 2a,b which was delivered to the carrier 5 at the loading station 8.

[0024] The assembly 1 can be used to perform a method of wafer handling according to a further aspect of the present invention. It should be understood that the method of the present invention is not limited to requiring the use of the assembly 1, rather, any suitable assembly can be used to perform said method of the present invention. An exemplary embodiment of the method will be described which uses the assembly 1 described above. In the following a specific embodiment of the method will be described, however it should be understood that only those method steps recited in the independent method claim of this application are essential to the invention, all other method steps described are optional steps.

[0025] The preferred embodiment of the method of the present invention comprises the steps of,

moving the first wafer holder 2a from the picking station 7 to the intermediate rest station 9 after the semiconductor components 3a on the wafer 3 on the first wafer holder 2a have been picked at the picking station (as illustrated in Figure 4);

transferring the first wafer holder 2a from the carrier 5 to the transfer means 10 at the intermediate rest station 9; Figures 5 and 6 illustrates the operation of the actuator 37 of the carrier 5 and the first cam 48a as the carrier 5 moves the first wafer holder 2a into the intermediate rest station; so at this stage of the method the first wafer holder 2a is located at the intermediate rest station 9 at same time as the second wafer holder 2b is located at the loading station 8. Figures 5 and 6 illustrates the operation of the actuator 37 of the carrier 5 and the first cam 48a as the carrier 5 moves the first wafer holder 2a into the intermediate rest station. As illustrated in Figures 5 and 6, the movement of the carrier 5 into the intermediate rest station 9 causes the first cam member 48a to apply a force to the lever member 43b belonging to the actuator 37 of the carrier 5, so that the wheel member 40 is moved against the biasing means 43 in a direction away from the rim member 38 of the first wafer holder 2a which is supported on the carrier 5; then before the first pair of clamping members 11a,b located at the intermediate rest station 9 move the first wafer holder 2a off of the carrier 5 (as shown in Figure 7a).

[0026] The first pair of clamping members 11a,b located at the intermediate rest station 9 move the first wafer holder 2a is transferred from the first pair of clamping members 11a,b to the transfer arm 13; so that the transfer arm 13 now holds the first wafer holder 2a. As shown in Figure 7b after the first pair of clamping members 11a,b move the first wafer holder 2a off of the carrier 5 the carrier then moves from the intermediate rest station 9 to a position under the second wafer holder 2b at the loading station 8. Importantly the second wafer holder 2b has been loaded with a wafer 3 comprising semiconductor components 3a to be picked, and has been moved by the second pair of clamping members 12a,b to an elevated position in the loading station 8 to allow sufficient space for

the carrier to move beneath the second wafer holder 2b (thus the method further comprises the steps of loading the second wafer holder 2b with a wafer 3 comprising semiconductor components 3a to be picked, and moving the second wafer holder 2b using the second pair of clamping members 12a,b to a position in the loading station 8 to allow sufficient space for the carrier to move beneath the second wafer holder 2b). As illustrated in Figure 8 the second pair of clamping members 12a,b then move to deliver the second wafer holder 2b onto the carrier 5 at the loading station. Figure 8 also illustrates the operation of the actuator 37 on the carrier 5 and the second cam 48b as the carrier 5 moves into the loading station and the second wafer holder is placed onto the carrier 5. When the carrier 5 moves into the loading station 8 the movement of the carrier 5 into the loading station 8 causes the second cam member 48b to apply a force to the lever member 43b belonging to the actuator 37 of the carrier 5, so that the wheel member 40 is moved against the biasing means 43, so that the wheel member 40 is moved out of the way of the rim member 38 of the stage 39 of the second wafer holder 2b which is being delivered onto the carrier 5 at the loading station 8; subsequently, when the carrier 5 is moved out of the loading station 8 the force which the second cam member 48b applied to the lever member 43b is removed and the biasing means 43 moves the wheel member 40 to abut rim member 38 of the stage 39 of the second wafer holder 2b.

[0027] The method further comprises the steps of,
using the carrier to move the second wafer holder 2b from the loading station 8 to the picking station 7 after a wafer 3 comprising semiconductor components 3a to be picked has been loaded onto the second wafer holder 2b (as illustrated in Figure 9);
using the transfer means 10 to move the first wafer holder 2a from the intermediate rest station 9 to the loading station 8, after the carrier 5 moves the second wafer holder 2b from the loading station (as illustrated in Figure 10 and 11);
picking the semiconductor components 3a from the wafer 3 held on the second wafer holder 2b at the picking station;
loading a wafer 3 comprising semiconductor components 3a

which are to be picked onto the first wafer holder 2a at the loading station 8 (as illustrated in Figures 12-14), while semiconductor components 3a on a wafer 3 held on the second wafer holder 2b are picked from the wafer at the picking station 7.

- 5 **[0028]** The preferred method further comprises the steps of,
 moving the second wafer holder 2b from the picking station 7 to
 the intermediate rest station 9 after the semiconductor component 3a on
 the wafer 3 on the second wafer holder 2b have been picked; so that at this
10 stage of the method the second wafer holder 2b is located at the
 intermediate rest station 9 at same time as the first wafer holder 2a is
 located at the loading station 8;
 transferring the second wafer holder 2b from the carrier 5 to the
 transfer means 10 at the intermediate rest station 9;
 moving the carrier 5 from the intermediate rest station 9 to the
15 loading station 8, and transferring the first wafer holder 2a onto the carrier
 5 at the loading station 8 (after a wafer 3 having semiconductor
 components 3a which are to be picked has been loaded onto the first wafer
 holder 2a);
 using the carrier 5 to move the first wafer holder 2a (which now
20 holds a wafer 3 having semiconductor components 3a which are to be
 picked at the picking station 7) from the loading station 8 to the picking
 station 7;
 using the transfer means 10 to move the second wafer holder 2b
 from the intermediate rest station to the loading station 8, after the carrier
25 moves the first wafer holder 2a from the loading station 8;
 picking the semiconductor components from a wafer 3 held on
 the first wafer holder 2a at the picking station 8;
 loading a wafer 3 comprising semiconductor components 3a
 which are to be picked onto the second wafer holder 2b at the loading
30 station 8, while semiconductor components 3a on a wafer 3 held on the
 first wafer holder 2a are picked at the picking station 7.

[0029] In the most preferred embodiment the above mentioned steps
are repeated a plurality of times.

[0030] As already mentioned, preferably the wafer 3 comprises a wafer foil which is attached to a wafer ring; the semiconductor components 3 are located on the wafer foil.

[0031] The step of loading a wafer 3 comprising semiconductor components 3a which are to be picked onto the first wafer holder 2a at the loading station 8, preferably comprises transferring a wafer 3 which comprises a wafer ring which comprises a wafer foil attached thereto and comprises semiconductor components attached to the wafer foil, onto the base platform member 31 of the first wafer holder 2a; and moving a top member 34 of first wafer holder 2a so that the wafer ring is clamped between the base platform member 31 and the top member 34 of the first wafer holder 2a; and moving a projecting portion 33 of the base platform member 31 into an aperture 32 defined in the top member 34 so that the wafer foil is stretched. Similarly, the step of loading a wafer 3 comprising semiconductor components 3a which are to be picked onto the second wafer holder 2b at the loading station 8, comprises transferring a wafer 3 which comprises a wafer ring which comprises a wafer foil attached thereto and which comprises semiconductor components attached to the wafer foil, onto a base platform member 32 of the second wafer holder 2b; and moving a top member 34 of second wafer holder 2b so that the wafer ring is clamped between the base platform member 31 and the top member 34 of the second wafer holder 2b; and moving a projecting portion 33 of the base platform member 31 into an aperture 32 defined in the top member 34 so that the wafer foil is stretched.

[0032] The steps of loading a wafer 3 comprising semiconductor components 3a which are to be picked onto the first wafer holder 2a at the loading station 8 are illustrated in Figures 12-14; more precisely, Figure 12 illustrates the unloading of the empty wafer (i.e. a wafer from which all of the semiconductor components have already been picked at the picking station 7) and Figures 13 the loading of a new wafer comprising semiconductor components 3a which are to be picked onto the first wafer holder 2a and Figure 14 illustrates the closing of the first wafer holder so that the wafer is securely held on the first wafer holder and the wafer foil

of the wafer is stretched. It should be understood that while Figures 12-14 illustrate the steps of loading a wafer 3 comprising semiconductor components 3a which are to be picked onto the first wafer holder 2a at the loading station 8 the same steps are performed when loading a wafer 3 comprising semiconductor components 3a which are to be picked onto the second wafer holder 2b at the loading station 8. Referring to figure 12, to unload an empty wafer from the first wafer holder 2a the top member 34 of the first wafer holder 2a is moved away from the based platform member 31 so that the wafer ring 60 of the empty wafer 3 on the first wafer holder 2a is unclamped; once unclamped the empty wafer 3 is moved from the first wafer holder 2a into a magazine 61a. Referring Figure 13, a new wafer 3 comprising semiconductor components 3a which are to be picked, is then moved from the magazine 61a into the first wafer holder 2a; specifically the new wafer 3 is moved onto the based platform member 31 of the first wafer holder 2a so that the new wafer 3 is positioned between the top member 34 and the based platform member 31 of the first wafer holder 2a. Referring to Figure 14, the top member 34 of the first wafer holder 2a is moved towards the based platform member 31 so that the wafer ring 60 of the new wafer 3 is clamped between the first rim 35 of the base platform member 31 and the second rim 36 of the top member 34; this clamping ensures that the new wafer 3 is held securely on the first wafer holder 2a. Additionally, as the top member 34 of the first wafer holder 2a is moved towards the based platform member 31 the projecting portion 33 of the base platform member 31 projects into the aperture 32 defined in the top member 34 so that a wafer foil 60b of the new wafer 3 which is attached to the wafer ring 60 of the new wafer, is stretched.

[0033] The step of transferring the second wafer holder 2b from the carrier 5 to the transfer means 10 at the intermediate rest station 9 comprises, clamping the second wafer holder 2b using a first pair of clamping members 11a,b located at the intermediate rest station 9; moving the second wafer holder 2b using the first pair of clamping members 11a,b towards a transfer arm 13 so that the transfer arm 13 mechanically cooperates with the second wafer holder 2b; and then moving the first pair

of clamping members 11a,b away from the second wafer holder 2b so that the second wafer holder 2b is held exclusively by the transfer arm 13.

[0034] The step of transferring the first wafer holder 2a from the carrier 5 to the transfer means 10 at the intermediate rest station 9 comprises,
5 clamping the first wafer holder 2a using a first pair of clamping members 11a,b located at the intermediate rest station 9; moving the first wafer holder 2a using the first pair of clamping members 11a,b towards a transfer arm 13 so that the transfer arm 13 mechanically cooperates with the first wafer holder 2a; and then moving the first pair of clamping members 11a,b
10 away from the first wafer holder 2a so that the first wafer holder 2a is held exclusively by the transfer arm 13.

[0035] In an embodiment the step of using the transfer means 10 to move the first wafer holder 2a from the intermediate rest station 9 to the loading station 8, comprises moving the transfer arm 13, so that the
15 transfer arm 13 moves the first wafer holder 2a from the intermediate rest station 9 to the loading station 8. As illustrated in Figure 10, the first pair of clamping members 11a,b at the intermediate rest station 9 lift the first wafer holder 2a from the carrier 5; the first pair of clamping members 11a,b move the first wafer holder 2a so that the first wafer holder 2a is
20 transferred to the transfer arm 13. The transfer arm 13 then moves along a track 13b, from the intermediate rest station 9 to the loading station 8 thereby transporting the first wafer holder 2a from the intermediate rest station 9 to the loading station 8. At the loading station 8 the second pair of clamping member 12a,b move to clamp the first wafer holder 2a which
25 is held by the transfer arm 13, once the second pair of clamping members 12a,b have clamped the first wafer holder 2a the first wafer holder 2a is then released from the transfer arm 13 so that the first wafer holder 2a is held exclusively by the second pair of clamping members 12a,b. The transfer arm 13 then moves along the track 13b, from the loading station 8
30 back to the intermediate rest station 9. In the preferred embodiment, as shown in Figure 11, the second pair of clamping members 12a,b move the first wafer holder 2a downwards, away from the transfer arm 13, so that the first wafer holder 2a does not obstruct the movement of the transfer

arm 13 from the loading station 8 back to the intermediate rest station 9. Similarly, in an embodiment the step of using the transfer means 10 to move the second wafer holder 2b from the intermediate rest station 9 to the loading station 8, comprises moving the transfer arm 13, so that the transfer arm 13 moves the second wafer holder 2b from the intermediate rest station 9 to the loading station 8. It should be understood that the same steps as described above are performed when moving the second wafer holder 2b from the intermediate rest station 9 to the loading station 8.

10 **[0036]** The method preferably comprises the step of clamping the second wafer holder 2b using a second pair of clamping members 12a,b located at the loading station 8 after the transfer means 10 moves the second wafer holder 2b from the intermediate rest station 9 to the loading station 8; and moving the second wafer holder 2b, using the second pair of clamping members 12a,b away from the transfer arm 13 so that the second wafer holder 2b is held exclusively by the second pair of clamping members 12a,b. Similarly the method preferably comprises the step of clamping the first wafer holder 2a using a second pair of clamping members 12a,b located at the loading station 8 after the transfer means 10 moves the first wafer holder 2a from the intermediate rest station 9 to the loading station 8; and moving the first wafer holder 2a, using the second pair of clamping members 12a,b away from the transfer arm 13 so that the first wafer holder 2a is held exclusively by the second pair of clamping members 12a,b. In these embodiments after the first wafer holder or second wafer holder have been loaded with a wafer which comprises semiconductor components to be picked, the carrier 5 receives the loaded wafer holder 2a,b from the clamping members 12a,b before transporting the loaded wafer holder 2a,b to the picking station 7.

30 **[0037]** In an embodiment the step of loading a wafer comprising semiconductor components which are to be picked onto the second wafer holder 2b at the loading station 8, is done as the second wafer holder 2b is held exclusively by the second pair of clamping members 12a,b. Similarly the step of loading a wafer comprising semiconductor components which

are to be picked onto the first wafer holder 2a at the loading station 8, is done as the first wafer holder 2a is held exclusively by the second pair of clamping members 12a,b.

[0038] Various modifications and variations to the described
5 embodiments of the invention will be apparent to those skilled in the art without departing from the scope of the invention as defined in the appended claims. Although the invention has been described in connection with specific preferred embodiments, it should be understood that the invention as claimed should not be unduly limited to such specific
10 embodiment.

Claims

1. An assembly which comprises,
at least a first and second wafer holder each of which can hold a wafer
which comprises semiconductor components;
5 a carrier which is selectively operable carry one of said wafer holders to
move said wafer holder;
an picking station wherein the picking station comprises means to pick
semiconductor components from a wafer on the wafer holder ; a
loading station, wherein the loading station comprises means to load a
10 wafer having semiconductor components onto a wafer holder;
an intermediate rest station which comprises an area in which a wafer
holder can be parked;
a transfer means which is selectively operable to move a wafer holder
from the intermediate rest station to the loading station;
15 a controller which is configured to operate said carrier and the transfer
means, so that,
the carrier moves the second wafer holder from the loading station to
the picking station, wherein at the picking station semiconductor
components on a wafer held on the second wafer holder can be picked
20 from the wafer;
the transfer means moves the first wafer holder from the intermediate
rest station to the loading station, after the carrier moves the second wafer
holder from the loading station, so that a wafer comprising semiconductor
components which are to be picked, is loaded onto the first wafer holder
25 while the semiconductor components on a wafer held on the second wafer
holder are picked from the wafer.
2. An assembly according to claim 1 wherein the controller is further
configured to operate said carrier and the transfer means, so that, the
carrier moves the second wafer holder from the picking station to the
30 intermediate rest station after the semiconductors on the wafer on the
second wafer holder have been picked; so that the second wafer holder is

located at the intermediate rest station at same time the first wafer holder is located at the loading station.

3. An assembly according to any one of the preceding claims wherein the transfer means comprises a first pair of clamping members located at the intermediate rest station, a second pair of clamping members located at the loading station, and a transfer arm; wherein the transfer arm is configured such that it can be selectively moved to first and second positions, wherein in said first position the transfer arm can mechanically cooperate with a wafer holder held by the first pair of clamping members, to hold said wafer holder, and in said second position the second pair of clamping members located at the loading station can clamp the wafer holder held by the transfer arm.
4. An assembly according to any one of the preceding claims wherein each of the first and second wafer holders comprise, a base platform member, which comprises a projecting portion on which a wafer foil having semiconductor components attached thereto, can be supported; and a top member, wherein the top member has an aperture defined therein which can receive the projection portion of the base platform member.
5. An assembly according to claim 4 wherein the base platform member further comprises a first rim, and the top member comprises a second rim, and wherein base platform member and the top member can be selectively arrange to clamp the wafer ring; and wherein when base platform member and the top member are be selectively arrange to clamp the wafer ring the projecting portion of the base platform member projects into the aperture defined in the top member so that a wafer foil which is attached to the wafer ring is stretched.
6. An assembly according to claim 4 or 5 wherein each of the first and second wafer holders comprise a rotatable stage wherein the base platform member is attached to the stage; wherein said stage comprises a rim member.

7. An assembly according to claim 6 wherein the carrier comprises an actuator which can mechanically cooperate with the rim member when the wafer holder is supported on the carrier; and wherein the actuator can be selectively operated to rotate the stage.
- 5 8. An assembly according to claim 7 wherein the actuator comprises a wheel member which comprises a groove and wherein the groove has dimensions such that when the wafer holder is supported on the carrier the rim member of the stage abuts a surface which defines the groove.
- 10 9. An assembly according to claim 7 or 8 wherein the actuator further comprises a biasing means which biases the wheel member towards abutting rim member of the stage when the wafer holder is supported on the carrier; and wherein the biasing means further comprise a lever member which is configured such when a force is applied to the lever member the wheel member is moved against the biasing means in a
15 direction away from the rim member.
- 20 10. An assembly according to claim 9 wherein the assembly further comprises a first cam member, wherein the first cam member is located so that when the carrier moves into the intermediate rest station the movement of the carrier into the intermediate rest station causes the first cam member to apply a force to the lever member, so that the wheel member is moved against the biasing means in a direction away from the rim member, before the first pair of clamping members located at the intermediate rest station move the wafer holder away from the carrier.
- 25 11. An assembly according to claim 9 wherein the assembly further comprises a second cam member, wherein the second cam member is located so that when the carrier moves into the loading station the movement of the carrier into the loading station causes the second cam member to apply a force to the lever member, so that the wheel member is moved against the biasing means, so that the wheel member is moved

out of the way of the rim member of the stage of the wafer holder being delivered onto the carrier at the loading station.

12. An assembly according to claim 11 wherein when the carrier is moved out of the loading station the force which the second cam applied to the
5 leaver member is removed and the biasing means moves the wheel member to abutting rim member of the stage of the wafer holder which was delivered on to the carrier.

13. A method of handling semiconductor wafers using the assembly according to claim 1, the method comprising the steps of,
10 using the carrier to move the second wafer holder from the loading station to the picking station;
using the transfer means to moves the first wafer holder from the intermediate rest station to the loading station, after the carrier moves the second wafer holder from the loading station;
15 picking the semiconductor components from a wafer held on the second wafer holder at the picking station;
loading a wafer comprising semiconductor components which are to be picked onto the first wafer holder at the loading station, while semiconductor components on a wafer held on the second wafer holder
20 are picked from the wafer.

14. A method according to claim 13 further comprising the steps of,
moving the second wafer holder from the picking station to the intermediate rest station after the semiconductors on the wafer on the second wafer holder have been picked, so that the second wafer holder is
25 located at the intermediate rest station at same time the first wafer holder is located at the loading station;
transferring the second wafer holder from the carrier to the transfer means at the intermediate rest station;
moving the carrier from the intermediate rest station to the loading
30 station, and transferring the first wafer holder onto the carrier;
using the carrier to move the first wafer holder from the loading station

to the picking station;

using the transfer means to move the second wafer holder from the intermediate rest station to the loading station, after the carrier moves the first wafer holder from the loading station.

- 5 15. A method according to claim 13 or 14 further comprising the steps of,
picking the semiconductor components from a wafer held on the first
wafer holder at the picking station;
loading a wafer comprising semiconductor components which are to be
picked onto the second wafer holder at the loading station, while
10 semiconductor components on a wafer held on the first wafer holder are
picked from the wafer.

16. A method according to claims 13, 14 and 15, wherein the method
further comprises repeating the steps of claims 13-15 a plurality of times.

17. A method according to claims 13 wherein the step of loading a wafer
15 comprising semiconductor components which are to be picked onto the
first wafer holder at the loading station, comprises transferring a wafer
ring which comprises a wafer foil attached thereto and said wafer
comprising semiconductor components attached to the wafer foil, onto a
base platform member of the first wafer holder; and moving a top member
20 of first wafer holder so that the wafer ring is clamped between the base
platform member and the top member of the first wafer holder; and
moving a projecting portion of the base platform member into an aperture
defined in the top member so that the wafer foil is stretched.

18. A method according to claims 15 wherein the step of loading a wafer
25 comprising semiconductor components which are to be picked onto the
second wafer holder at the loading station, comprises transferring a wafer
ring which comprises a wafer foil attached thereto and said wafer
comprising semiconductor components attached to the wafer foil, onto a
base platform member of the second wafer holder; and moving a top
30 member of second wafer holder so that the wafer ring is clamped between

the base platform member and the top member of the second wafer holder; and moving a projecting portion of the base platform member into an aperture defined in the top member so that the wafer foil is stretched.

19. A method according to claims 14 wherein the step of transferring the second wafer holder from the carrier to the transfer means at the intermediate rest station comprises, clamping the second wafer holder using a first pair of clamping members located at the intermediate rest station; moving the second wafer holder using the first pair of clamping members towards a transfer arm so that the transfer arm mechanically cooperates with the second wafer holder; moving the first pair of clamping members away from the second wafer holder so that the second wafer holder is held exclusively by the transfer arm.

20. A method according to claims 14 wherein the step of using the transfer means to move the second wafer holder from the intermediate rest station to the loading station, comprises moving the transfer arm, so that the transfer arm moves the second wafer holder from the intermediate rest station to the loading station;

21. A method according to claim 20 comprising the steps of, clamping the second wafer holder using a second pair of clamping members located at the loading station; moving the second wafer holder using the second pair of clamping members away from the transfer arm so that the second wafer holder is held exclusively by the second pair of clamping members.

22. A method according to claim 21 wherein the step of loading a wafer comprising semiconductor components which are to be picked onto the second wafer holder at the loading station, is done as the second wafer holder is held exclusively by the second pair of clamping members.