Device and method for removing tested semiconductor components

The disclosure~~invention~~ relates to a device and to a method for a removal of tested semiconductor components~~, according to the preamble of Claim 1 or according to the preamble of Claim 9 respectively~~.

After their production, electronic semiconductor components, such as integrated circuits, processors, sensor elements etc., are usually subjected to specific tests to verify their functions. This includes both the electronic and, for example, sensor-related functions. Recently, so-called clamping carriers have become known, on which a plurality of electronic component devices can be attached. These carriers are then passed to a so-called handler in which they are positioned exactly for testing.

The handler has a fixed test head, to which a test socket, also fixed, is connected. For electronic tests this test socket is designed such that normally all semiconductor components on the clamping carrier are contacted and can be tested simultaneously.

During the test a file is stored for each clamping carrier, in which either the test result for each semiconductor component of the clamping carrier is recorded, or which only contains the information for each semiconductor component as to which category the semiconductor component is to be classified in. This file is stored either on a central computer, the clamping carrier itself or in a cassette which receives a plurality of such clamping carriers.

Various embodiments seek~~The object of the invention is~~ to provide a device or a method respectively, in order to remove the semiconductor components from the clamping carrier and to feed the semiconductor components assessed as good to a package based

on their classification. The packaged semiconductor components are intended to be able to be processed in standard automatic placement machines.

~~The object is solved according to the invention by a device having the features of Claim 1 and/or by a method having the features of claim 9.~~

According to ~~the invention a first exemplary embodiment has~~a first aspect, there is provided a device for removing tested semiconductor components from a clamping carrier, having fixed stop elements and movable clamping elements, pre-tensioned by spring elements, characterized by the following features: an actuation device arranged above the clamping carrier, which moves the clamping elements into an opening position enabling the clamping carrier to be discharged and then after discharge into a rest position, an intermediate carrier positioned under the clamping carrier during the discharge, onto which ~~intermediate carrier~~ the clamping carrier is emptied, a data memory in which data about each semiconductor component, are stored ~~for each semiconductor component~~, and a removal device which removes the semiconductor components from the intermediate carrier and sorts them into at least two different categories according to the data stored in the data memory.

In this aspect~~exemplary embodiment~~ either the clamping carrier can already be fed in such a manner that the semiconductor components are located at its underside. If the clamping carrier is fed in normal orientation, with the semiconductor components on its top face, an additional device must be provided which rotates the clamping carrier about a horizontal axis prior to its discharge.

In both cases, after the opening of the clamping elements the semiconductor components will detach themselves from the clamping carrier under the force of gravity alone and will fall into the intermediate carrier. The semiconductor components are now oriented in a direction opposite to their orientation on the clamping carrier. In this orientation they can be fed to the package.

Data about each semiconductor component can be stored on the clamping carrier. The data can be generated during the testing of the semiconductor components and written directly to a memory there on the clamping carrier. Usually, the test data are stored on a central computer and are assigned to a

clamping carrier using an identification code. As soon as the clamping carrier is detected using this code in the removal device, the data for the semiconductor components of this clamping carrier are retrieved from the central computer.

The data stored for each semiconductor component can contain different information. Thus the data can be the pure test results which are first evaluated in the removal device, in order then to make a decision about the further treatment of the semiconductor component. This decision can however also be taken earlier in the central computer or in the test device, so that the data read in by the removal device now only relate to the category to which the respective semiconductor component has been assigned.

The categories into which the semiconductor components are sorted in the removal device, are at least one category which indicates that all functions of the semiconductor component are fulfilled, and a further category, which must be disposed of as wastage.

According to a second aspect, there is provided a device for removing tested semiconductor components from a clamping carrier, having fixed stop elements and movable clamping elements, pre-tensioned by spring elements, characterized by~~exemplary embodiment of the invention has~~ the following features: an actuation device which moves the clamping elements into an opening position enabling the clamping carrier to be removed and then moves the clamping elements after removal into a rest position, a data memory in which data about each semiconductor component are stored, a removal device which removes the semiconductor components from the clamping carrier, and a rotation device for rotating semiconductor components removed from the clamping carrier about an axis perpendicular to the direction of removal.

A rotation device here is understood as a device which accepts the semiconductor components such that they can be stored in a rotated orientation, i.e. with what was previously the underside now facing upwards.

In this aspect~~exemplary embodiment~~ the clamping carriers are fed to the removal device such that the semiconductor components are located on the top of the clamping carrier. Because the semiconductor components here are removed

In the case of a device according to the second aspect~~exemplary embodiment~~ the alignment device is represented by the removal device. Since the semiconductor components here are directly removed from the clamping carrier by the removal device, they can be inserted into another clamping carrier again in the same orientation. The rotation of the semiconductor components here is therefore only necessary for the packaging but not for the re-testing.

Advantageously a holder for cassettes is provided, from which empty clamping carriers can be removed and into which clamping carriers populated with semiconductor components to be tested again can be inserted. This enables the automated collection of such semiconductor components to be re-tested. The cassette can then be subjected to the completely standard test procedure again, without the need for special measures to be taken.

The transfer between a handler, in which the semiconductor components are tested, and the removal device could be performed directly, by each clamping carrier being passed by the handler directly to the removal device after the test. However, it has been established that when such a direct transfer is used, if a fault occurs in one of the two devices this can result in long downtimes. Since the removal device essentially always works at the same speed, but the testing speed is strongly dependent on the tests to be carried out, when using direct transfer no corresponding adjustment could be made either. According to the invention a holder for cassettes is therefore provided, from which clamping carriers populated with tested semiconductor components can be removed. Since the handler also deposits the tested semiconductor components on the clamping carriers in cassettes, in this way an arbitrarily large buffer store is realised, via which the various device speeds can be equalised.

In order to dispose of the bad semiconductor components that do not fulfil the required functions in a controlled manner, a container is provided in which those tested semiconductor components are deposited, which according to the data stored in the data store are unusable.

While the "bad" semiconductor components must be disposed of, the "good" semiconductor components must be packaged. To do this, they must be loaded, for example, into belts that are compatible with the standard automatic placement machines. A packaging device is therefore advantageously provided, which picks up those tested semiconductor components which according to the data stored in the data store are in good condition, and transfers them to a package.

If the clamping carrier itself is not equipped with a data store or there is no data store attached to the cassette, then the data on the semiconductor components mounted on the clamping carrier must be scanned by a central computer. In order to be able to assign the scanned data to the respective clamping carrier, a reader is provided for reading a code attached to the clamping carrier. The code can be configured, for example, as a hole code for a transmitted light scanner or as a barcode for an incident-light scanner.

According to a third aspect, there is provided a method for removing tested semiconductor components from a clamping carrier having fixed stop elements and movable clamping elements, pre-tensioned by spring elements, characterized in thatthe invention a clamping carrier with tested semiconductor components is removed from a cassette, accurately positioned, identified by means of a code, and data on each tested semiconductor component are scanned in. The clamping elements of the clamping carrier are moved into an opening position enabling the removal of the semiconductor components, the semiconductor components are dischargedemptied from the clamping carrier onto an intermediate carrier and the clamping elements are moved into a rest position. The empty clamping carrier is inserted into a cassette and the semiconductor components are removed from the intermediate carrier, and according to the scanned data, sorted into at least two different categories. This first method can be carried out, for example, on a device according to the first aspectexemplary embodiment.

According to a fourth aspect, there is provided a method for removing tested semiconductor components from a clamping carrier having fixed stop elements and movable clamping elements, pre-tensioned by spring elements.

In a second method, which can be carried out for example on the device according to the second aspectexemplary embodiment, a clamping carrier with tested semiconductor components is removed from a cassette, is precisely positioned and is identified by a code. Data on each tested semiconductor

the process before population of the clamping carriers, or must be subjected to an individual test.

Further details and advantages ~~of the invention~~ are obtained from the dependent claims in combination with the description of an exemplary embodiment, which will be described in detail with reference to the drawing.

Shown are:

Fig. 1 a plan view of a clamping carrier populated with semiconductor components,

Fig. 2 a magnified excerpt of the clamping carrier of Fig. 1,

Fig. 3 the excerpt of Fig. 2 without a cover plate,

Fig. 4 a schematic representation of a first exemplary embodiment of the device according to the invention,

Fig. 5 a second exemplary embodiment with a rotation device for the semiconductor components and

Fig. 6 a side view of the second exemplary embodiment in the direction of the arrows A in Fig. 5.

In Fig. 1 the clamping carrier 1, which here contain 80 individual semiconductor components 2, can be identified. A positioning opening 3 serves to allow precise positioning of the clamping carrier 1. Due to the very small size of the semiconductor components 2 this very accurate positioning is necessary both during the population of the clamping carrier 1 and the removal of the semiconductor components 2 from the clamping carrier 1, but in particular also during the testing of the semiconductor components 2. The extremely small contacts of the semiconductor components 2 must be precisely met by the test probes.

The extract from the clamping carrier 1 illustrated in Fig. 2 shows that the semiconductor components 2 are pressed by a transverse clamping element 6 and a longitudinal clamping element 9 against two fixed stop edges, which are