

Positioning device, transfer device and method for positioning a holder for electronic components

The present invention relates to a device for positioning a holder for electronic components with an engaging member for engaging the holder. The present invention also relates to a device for positioning and transferring a holder for electronic components, of which the positioning device forms part. The present invention moreover also relates to a method for positioning a holder for electronic components.

10 In the production and processing of electronic components, and more in particular semiconductors, it is desirable under determined conditions to accommodate a plurality of individual components (or semi-manufactured products of electronic components) in a joint holder. The components are thus for instance easier to handle during transport and/or storage than individually, and in a holder they are furthermore protected.

15 Protection must be understood to mean not only protection against mechanical loads and protection against contamination. The holder can also provide protection from other undesired influences, such as for instance (electromagnetic) radiation. Tubular holders (“tubes”) and platform-like holders, among others, are frequently applied in practice, though not exclusively. It is advantageous when the holders are actually positioned

20 accurately only at positions where position accuracy is important. The location for the loading/filling of a holder and the location for the unloading/emptying of a holder must be taken into particular consideration here. Outside such locations, where a high degree of positional accuracy is important, the holders can be in a less accurate position, wherein it is for instance possible to envisage transport routes and/or bulk storage of the

25 holders which may or may not be filled. If there are lesser requirements in respect of the positional accuracy of the holder during transport and storage, such activities also require less investment. A problem in the positioning and manipulating of holders for electronic components is that they usually have an outer side of complex form (with non-flat sides).

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The object of the present invention is to simplify the positioning with great accuracy of holders for electronic components.

The invention provides for this purpose a device for positioning a holder for electronic

components, comprising: a first engaging member for engaging the holder, with a contact surface which is adapted to engage on the holder with a first frictional resistance, a reference member for placing in a reference position a holder engaged by the first engaging member, and drive means for mutually displacing the first engaging member and the reference member, wherein the contact surface of the first engaging member is embodied such that the frictional resistance of the contact surface of the first engaging member on the holder is limited, as a result of which the holder is displaceable over the contact surface of the first engaging member to a reference position by the reference member. Such a device can move a holder in very simple manner from a less precisely determined position to a precisely controlled position. Different members are employed successively for the positioning. The holder is first engaged by the engaging member; this engaging member does not have to function very accurately; only a forced good connection of the holder to the contact surface is important. The positional accuracy in directions parallel to the contact surface is less relevant at this stage of positioning. Since not all degrees of freedom have to be available in respect of a great positional accuracy of the engaging member, it is easier (cheaper) to realize the desired positional accuracy in the degree of freedom (or degrees of freedom) where this is desired. The desired positional accuracy is subsequently effected in at least one other additional direction (degree of freedom) by the reference member. In respect of the positional accuracy of the reference member it is also the case that not all degrees of freedom have to be available, but only a selection thereof. The positional accuracy achieved at the first stage is maintained in ingenious manner during the second stage of positioning in that the holder is displaceable over the contact surface of the first engaging member by the reference member.

In a preferred embodiment of the positioning device the contact surface of the first engaging member is provided with at least one suction opening enclosed by the contact surface, which suction opening connects to a source of underpressure. Using a suction opening the holders can be engaged with underpressure, which combines the advantages of a simple construction (no or few movable parts) with a relatively small chance of damage to holders as a result of the engagement. It is also easy to unload the holders by releasing the underpressure. If desired, it is possible to embody an engaging member such that it is adapted to engage a single holder or that it is adapted for simultaneous engagement of a plurality of holders. The form of the suction opening(s) can be

optimized for a specific product. For engagement of a holder in the form of an elongate holder ("tube") it is thus found to be advantageous to also give the suction openings an elongate (for instance oval) form.

- 5 It is further advantageous if the suction opening is provided with a closing valve for sealing the suction opening in the non-active state of a suction opening. Such a closing valve can be operated mechanically by for instance a sensor pin, but it is also possible to control the closing valve electronically. The use of a closing valve prevents outside air from being drawn in.

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- In yet another embodiment variant the first engaging member is provided with an at least substantially metal contact surface. A metal contact surface has the advantage that it can be given a relatively smooth form such that the frictional resistance between the first engaging member and an engaged holder remains limited. In practice a bronze  
15 contact surface has been found to produce advantageous results in the engagement of elongate plastic holders ("tubes") in particular.

- The contact surface of the first engaging member can also be provided with a guide member protruding from the contact surface. The guide member can be functional  
20 during engagement and/or setting down of a holder, but it is also possible for the guide member to form a locking in a specific (undesired) direction of movement. For a good connection of the reference member to the holder, it can be provided with a stop with which a force is exerted on a holder engaged by the first engaging member. When the stop is also an exchangeable component of the reference member it is possible,  
25 depending on the conditions (such as for instance the dimensions of the holders for positioning), to mount a stop optimized for these conditions. A product-dependent component of the device can thus be readily exchanged with a different stop.

- The invention also provides a device for positioning and transferring a holder for  
30 electronic components, comprising: a first engaging member for engaging the holder with a contact surface adapted to engage on the holder with a first frictional resistance, a second engaging member for engaging on the holder with a contact surface adapted to engage the holder with a second frictional resistance, a reference member for placing in a reference position a holder engaged by the first engaging member, and drive means

for at least mutual displacement of the engaging members and mutual displacement of the first engaging member and the reference member, wherein the contact surfaces of the engaging members are embodied such that the frictional resistance of the contact surface of the first engaging member is smaller than the frictional resistance of the

5 contact surface of the second engaging member. Using such a transfer device the above described advantages of the positioning device according to the present invention can be obtained for a transfer device. Of essential importance here is that the great position accuracy of a holder obtained using the first engaging member and positioning member is not lost during transfer to holding by the second engaging member. It is therefore

10 advantageous to embody the contact surface of the second engaging member differently from the contact surface of the first engaging member. It is precisely at positions where displacement relative to the first engaging member is required that such a displacement relative to the second engaging member must be prevented.

15 The contact surfaces of both the first and the second engaging member can be provided with at least one suction opening enclosed by the contact surface, which suction opening connects to a source of underpressure. The advantage of one (or more) of such suction openings is that the orientation of the holder relative to the engaging member does not have to be wholly determined; a determined positional inaccuracy relative to

20 the engaging member can be compensated. The displacement of the holder relative to such an engaging member is also readily possible. When the suction openings are provided with a closing valve for sealing the suction opening in the non-active state of a suction opening, the underpressure on suction openings in optionally parallel disposition will not decrease (or less so) when a suction opening is not covered. The chance of

25 contamination of the engaging member is moreover limited.

Advantageous results have been achieved during tests with a first engaging member provided with an at least substantially metal contact surface and/or a second engaging member provided with an at least substantially resilient contact surface. A metal surface

30 results in a limited frictional resistance against displacement of a holder over the contact surface. A resilient contact surface has the advantage of being deformable, whereby a good connection to the holder is possible. In addition, a resilient contact surface provides the option of being embodied such that the frictional resistance between the second engaging member and an engaged holder is relatively great; the holder cannot

therefore be easily displaced relative to the second holder. In practice a rubber and/or plastic contact surface is found to produce advantageous results in the engaging of plastic holders. The contact surface of at least one of the engaging members can also be provided with a guide member protruding from the contact surface. As also already

5 described with reference to the positioning device, the reference member can also be provided with a stop with which a force is exerted on a holder engaged by the first engaging member, and the stop can be embodied as an exchangeable component of the reference member.

10 The invention furthermore provides a method for positioning a holder for electronic components, comprising the processing steps of: A) gripping a holder for positioning with a first engaging member, and B) urging a reference member against the holder such that the holder is displaced to a reference position relative to the first engaging member. Displacement of the holder relative to the first engaging member by the

15 reference member results in an accurately controlled position of the holder. This means that the positioning of the holder relative to the first engaging member prior to engagement is less critical; a correction of the mutual relation between the first engaging member and the holder is after all always still possible later. The preliminary feed route of the holder to the first engaging member can thus be embodied much more

20 simply and at less cost than if an accurate positioning were already necessary here. Once the accurately controlled position has been realized, it is evident that no further uncontrolled displacement of the holder may occur.

In a preferred application the method also comprises the processing steps of: C)

25 transferring a positioned holder from the first engaging member to a second engaging member, and D) gripping of the holder in a fixed position by the second engaging member. Transfer of the holder from the first engaging member to the second engaging member must be a controlled process such that the holder may not undergo any uncontrolled displacement here. The engagement of the second engaging member on

30 the holder must be ("fixed") such that no mutual displacement occurs; the controlled position of the holder is thus retained. The holder can be engaged by at least the first engaging member by means of underpressure. In respect of underpressure, advantageous test results have been achieved with an underpressure between 0.5-0.9 Bar, more preferably between 0.6-0.8 Bar.

The present invention will be further elucidated on the basis of the non-limitative exemplary embodiments shown in the following figures. Herein:

figures 1A-1C show schematically successive processing steps in the positioning of a

5 holder for electronic components according to the present invention;

figure 2 is a bottom view of a engaging member shown in perspective such as forms part of a positioning device according to the present invention;

figure 3 shows a cross-section through a suction opening provided with a closing valve;

figure 4 shows a schematic representation of a transfer device according to the present  
10 invention; and

figures 5A and 5B are perspective views of holders of the tubular type in which electronic components can be held.

Figure 1A shows a first engaging member 1 and a holder 2 for electronic components.

15 As shown in figure 1B, holder 2 is gripped by first engaging member 1 such that holder 2 lies against a contact surface 3 of the first engaging member 1. The first engaging member 1 can be displaced in relation to a reference member 4 in relative and controlled manner. As shown in figure 1C, the first engaging member 1 is moved toward reference member 4 as according to arrows  $P_1$  and  $P_2$  such that holder 2 makes  
20 contact with reference member 4. By also continuing the movement of the first engaging member 1 in the direction of arrow  $P_1$  after the first contact between holder 2 and reference member 4, holder 2 is displaced relative to the first engaging member 1 along contact surface 3 in a direction  $P_3$ . A precisely determined positioning of holder 2 can thus be achieved relative to the first engaging member 1.

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Figure 2 shows a perspective view of engaging member 10 for engaging a holder for electronic components not shown in this figure. Engaging member 10 is provided with a contact surface 11 in which oval recesses 12 are arranged. Connecting to these oval  
30 recesses 12 are suction openings 13 with which an underpressure can be created in oval recesses 12 providing they are covered on the side of contact surface 11 by a holder that is to be engaged. With an underpressure which can thus be created in oval recesses 12 it is possible to suction a holder against contact surface 11. Whether the holder can be displaced along contact surface 11 in the suctioned situation depends to a significant extent on the quality of contact surface 11, the quality of the holder, the level of

underpressure and the force exerted on a holder. Engaging member 10 is also provided with a number of guide members 14 protruding relative to contact surface 11. Using such guide members 14 the freedom of movement in a determined direction can be limited; for instance in a lateral direction such that an elongate holder (see figures 5A and 5B) can only be displaced in longitudinal direction along contact surface 11.

Figure 3 shows a cross-section through a suction head 20 having for instance a flexible dish 21 to which a suction opening 22 connects. Suction opening 22 communicates with a channel 23 to which a pump/extractor (not shown) is for instance connected. In order to now prevent air being drawn in with suction head 20 at a moment that no product lies against flexible dish 21, a closing pin 24 is arranged in head 20. Pin 24 will be lifted from a seat 25 by a product lying against dish 21 such that suction opening 22 is in open communication with channel 23. When closing pin 24 is not pressed in, suction opening 22 is on the other hand separated from channel 23.

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Figure 4 shows a schematic representation of a transfer device 30 with a supply container 31 in which are stored holders 32 for electronic components. Holders 32 are located in supply container 31 such that the longitudinal position thereof is not clearly defined. A holder 32 is removed from container 31 using a first engaging member 33. By means of a cylinder 35 a reference member 34 can be carried into a path whereby a holder 36 engaged by the first engaging member 33 is displaced along a guide 37 as according to arrow P<sub>4</sub>. Reference member 34 is provided with an exchangeable stop 38 which is specifically designed ("product-related") as contact part for co-action with a determined type of holder 32, 36.

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Due to a controlled co-action of the first engaging member 33 and reference member 34 the holder 36 engaged by the first engaging member 33 will be displaced over contact surface 39 of the first engaging member 33 to a precisely known position. The thus positioned holder 36 is then advanced further by the first engaging member 33 to a second engaging member 40. In this figure the second engaging member 40 consists of a mill 41 with six sides, on each of which a number of holders 42 (in this case three) can be engaged. A still unfilled receiving position 43 of the second engaging member 40 has two suction openings 44 with which a holder 42 can be engaged using underpressure. The second engaging member 40 can for instance be employed to fill holders 42 with

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electronic components and then set them down again. For the engagement of holders 42 at determined positions of mill 41 and setting down of holders 42 at other positions it is possible to control the underpressure of pick-up positions subject to the orientation of mill 41.

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Figures 5A and 5B show respectively perspective views of holders 50, 51 of the tubular type. Arranged in holders 50, 51 is a central passage 52, 53 into which electronic components 54 can be inserted. Holders 50, 51 have an external surface which can have such a complex form that it is advantageous to give a first and/or second engaging

10 member a form co-acting specifically therewith.

## Claims

1. Device for positioning a holder for electronic components, comprising:
  - a first engaging member for engaging the holder, with a contact surface which
  - 5       is adapted to engage on the holder with a first frictional resistance,
  - a reference member for placing in a reference position a holder engaged by the
  - first engaging member, and
  - drive means for mutually displacing the first engaging member and the
  - reference member,
  - 10       wherein the contact surface of the first engaging member is embodied such that the
  - frictional resistance of the contact surface of the first engaging member on the holder is
  - limited, as a result of which the holder is displaceable over the contact surface of the
  - first engaging member to a reference position by the reference member.
- 15   2.       Positioning device as claimed in claim 1, characterized in that the contact
- surface of the first engaging member is provided with at least one suction opening
- enclosed by the contact surface, which suction opening connects to a source of
- underpressure.
- 20   3.       Positioning device as claimed in claim 2, characterized in that the suction
- opening is provided with a closing valve for sealing the suction opening in the non-
- active state of the suction opening.
4.       Positioning device as claimed in any of the foregoing claims, characterized in
- 25       that the first engaging member is provided with an at least substantially metal contact
- surface.
5.       Positioning device as claimed in any of the foregoing claims, characterized in
- that the contact surface of the first engaging member is provided with a guide member
- 30       protruding from the contact surface.
6.       Positioning device as claimed in any of the foregoing claims, characterized in
- that the reference member is provided with a stop with which a force is exerted on a
- holder engaged by the first engaging member.

7. Positioning device as claimed in any of the foregoing claims, characterized in that the stop is an exchangeable component of the reference member.
- 5 8. Device for positioning and transferring a holder for electronic components, comprising:
- a first engaging member for engaging the holder, with a contact surface adapted to engage on the holder with a first frictional resistance,
  - a second engaging member for engaging the holder, with a contact surface adapted to engage on the holder with a second frictional resistance,
  - 10 - a reference member for placing in a reference position a holder engaged by the first engaging member, and
  - drive means for at least mutual displacement of the engaging members and mutual displacement of the first engaging member and the reference member,
- 15 wherein the contact surfaces of the engaging members are embodied such that the frictional resistance of the contact surface of the first engaging member is smaller than the frictional resistance of the contact surface of the second engaging member.
9. Transfer device as claimed in claim 8, characterized in that the contact surfaces of the first and second engaging member are provided with at least one suction opening enclosed by the contact surface, which suction opening connects to a source of underpressure.
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10. Transfer device as claimed in claim 9, characterized in that the suction opening is provided with a closing valve for sealing the suction opening in the non-active state of the suction opening.
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11. Transfer device as claimed in any of the claims 8-10, characterized in that the first engaging member is provided with an at least substantially metal contact surface.
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12. Transfer device as claimed in any of the claims 8-11, characterized in that the second engaging member is provided with an at least substantially resilient contact surface.

13. Transfer device as claimed in any of the claims 8-12, characterized in that the contact surface of at least one of the engaging members is provided with a guide member protruding from the contact surface.
- 5 14. Transfer device as claimed in any of the claims 8-13, characterized in that the reference member is provided with a stop with which a force is exerted on a holder engaged by the first engaging member.
- 10 15. Transfer device as claimed in claim 14, characterized in that the stop is an exchangeable component of the reference member.
16. Method for positioning a holder for electronic components, comprising the processing steps of:
- A) gripping a holder for positioning with a first engaging member, and
- 15 B) urging a reference member against the holder such that the holder is displaced to a reference position relative to the first engaging member.
17. Method as claimed in claim 16, characterized in that the method also comprises the processing steps of:
- 20 C) transferring a positioned holder from the first engaging member to a second engaging member, and
- D) gripping of the holder in a fixed position by the second engaging member.
18. Method as claimed in claim 16 or 17, characterized in that the holder is engaged
- 25 by at least the first engaging member by means of underpressure.