

Description

Suction pipette for gripping electrical components

5 The invention relates to a pipette for gripping components by means of vacuum, in particular when mounting components on printed circuit boards.

 A pipette of this nature is known, for example, from German utility model 94 06 244. According to this
10 document, the pipette has a suction opening on its end side which faces toward the component. The component can be sucked onto a bearing surface, which surrounds the suction opening, of the end side. The bearing surface forms part of an elastomeric bearing member
15 which is inserted into the end side of a base body of the pipette and which projects slightly beyond the end side. The bearing member is designed as an O-ring which bears with a press fit against the inner wall of the base body. The O-ring improves the suction ability of
20 the pipette, since it rests more securely against the surface of the component which has been sucked on than does a hard component.

 Mounting of components on printed circuit boards increasingly involves the use of mounting
25 machines which have a movable revolver head which accommodates, stores and transports the components, rotates them to their desired installation position, adjusts their position and deposits them on the printed circuit board. The various movement operations result
30 in accelerations which are such that there is a risk of the position of the component changing with respect to the pipette. However, the permissible position deviation is so small that such a change in position must be avoided at all costs. In particular, it is also
35 necessary to keep the suction distance between the pipette and the component within tight tolerances, in order to allow the components to be picked up and set down without them being subject to shocks.

The deformability of the known O-ring is so high that such levels of accuracy cannot be reliably achieved. In particular, the centrifugal force of the components which have been sucked on in the radial direction, which force occurs when the revolver head rotates, may result in the O-ring which has been pressed in becoming detached.

The invention is based on the object of increasing the positional accuracy and the reliability of mounting. The invention achieves this object in accordance with claim 1.

As a result of the bearing member being supported on all sides in the base body, the bearing member cannot be deformed to such an extent and is held more securely in the base body. The lower deformability of the bearing member reduces the elastic deviation of the component which has been sucked on, so that this component can be fixed in a more accurate lateral and vertical position with respect to the pipette. Moreover, the fact that the bearing member is clamped inside the base body on all sides reduces the risk of a change in position being caused by rotation or by the bearing member being torn out.

Advantageous refinements of the invention are given in the subclaims:

As a result of the refinement according to claim 2, the base body is clamped so securely in the inserted area that it can only be subjected to at most slight deformation at its free surface.

The cross section according to claim 3 enables the bearing rib to be extremely weak in cross section, while the remainder of the bearing member may be of stronger design. Such a bearing member can be produced and inserted more easily in terms of manufacturing technology. Due to its small height, the bearing rib is only slightly deformed yet can nevertheless adapt to unevenness or inclined positions of the component. The correspondingly narrow bearing surface against the component reduces the adhesive action

to such an extent that the component no longer sticks to the pipette after it has been placed onto the printed circuit board.

5 The arc-shaped cross section according to claim 4 produces a particularly narrow linear contact between the component and the bearing rib.

The refinement according to claim 5 reliably avoids hard impacts when the component is placed onto the printed circuit board.

10 The refinement according to claim 6 produces uniform deformation conditions over the entire extent of the bearing member which is, for example, annular. As a result of the bearing member being molded on, a secure connection and a highly accurate arrangement are
15 achieved.

The rectangular receiving groove according to claim 7 can be produced easily by injection-molding means and produces good adhesion properties with respect to the elastomeric bearing member. These
20 adhesion properties are increased if the base body is reinforced, for example with glass fibers, the ends of which project slightly into the receiving groove, thus making it more difficult for the molded-in bearing member to be torn out. The flush alignment of the
25 outside with the base body results in an optimum support for the bearing rib.

The support member according to claim 8 has the result of increasing the supporting force with increasing deformation, so that the bearing ribs are
30 subjected to less deformation and the position deviations of the component with respect to the pipette, in particular the vertical position of the component, can be kept within tighter tolerances. Moreover, the lower support surfaces result in secure
35 contact between a component and the bearing rib even if the component has a convex surface.

The refinement according to claim 9 allows the support member to be produced in a single operation, together with the bearing member, without additional sprue points.

5 As a result of the refinement according to claim 10, the advantages of the design of the bearing member are also utilized by the support member, in particular with regard to the deformation and adhesion conditions.

10 The refinement according to claim 11 results in advantageous casting conditions, in which the support webs can easily be branched off from the bearing member.

15 The support ribs which slope obliquely downward according to claim 12 fit optimally to, for example, a component with a convex suction face. Thus, as the pressure increases, a contact area which continuously grows is achieved without there being any possibility of leakage along the outer bearing rib.

20 The invention is explained in more detail below with reference to an exemplary embodiment which is illustrated in the drawing, in which:

Figure 1 shows a view of an end side of a pipette for gripping electrical components,

25 Figure 2 shows a section through the pipette on line II/II in Figure 1, together with an electrical component.

In accordance with Figures 1 and 2, a pipette 1 comprises a base body 2 and an elastomeric insert 3 which is inserted into an end side 5, facing toward an electrical component 4, of the rotationally symmetrical base body 2. The end side 5 of the pipette 1 can be placed onto the component 4 in the direction of the vertical arrow shown in Figure 2. The base body 2 has a segmented, central suction opening 6 which leads all the way through to the end side 5 and is connected to a vacuum source of a mounting head (not shown) of a mounting machine for

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printed circuit boards. The base body 2 is provided with a holding ring 7 for attaching it to the mounting head.

The elastomeric insert 3 is formed as a single piece comprising an annular bearing member 8, which surrounds the suction opening 6, and support members 9, which extend in the form of spokes from the bearing member 8 toward the suction opening 6. The bearing member 8 and the support members 9 have ribs which project slightly beyond the end side and are semi-circular in cross section, for example 10, 11. These ribs, together with a thicker, web-like base part 12, are cast into correspondingly designed receiving grooves, which are rectangular in cross section, of the base body.

The bearing rib 10 assigned to the bearing member 8 is in the form of a continuous ring. Half its width projects beyond the end side. The support ribs 11 which are assigned to the support members run in the form of spokes which slope obliquely downward toward the inside starting from the bearing rib 10. This means that they become increasingly active as the pressure on the component 4 increases. The inwardly decreasing height of the support ribs ensures that a component with a convex surface bears securely on the bearing rib without any gaps being formed.



Patent claims

1. A pipette (1) for gripping a component (4) by means of vacuum, in particular when mounting components on printed circuit boards, the pipette (1) having a suction opening (6) in one end side (5) which faces toward the component (4), it being possible to suck the component (4) onto a bearing surface, which surrounds the suction opening (6), of the end side (5) and the bearing surface forming part of an elastomeric bearing member (8) which is inserted into the end side (5) of a base body (2) of the pipette (1) and projects slightly beyond the end side (5), characterized in that the base body (2) of the pipette (1) surrounds that part of the bearing member (8) which is inserted into the end side (5), except for the side facing toward the component (4), on all sides and without play.
2. The pipette as claimed in claim 1, characterized in that the bearing member (8) is surrounded by the base body (2) without there being any cavity.
3. The pipette as claimed in claim 1 or 2, characterized in that the bearing member (8) comprises a base part (12), which has a thick cross section, and a thin bearing rib (10) which is smaller than the base part and forms the bearing surface.
4. The pipette as claimed in claim 3, characterized in that the bearing rib (10) is curved in the shape of an arc in cross section, and in particular is of semi-circular design.



5. The pipette as claimed in one of the preceding claims, characterized in that the bearing surface projects beyond the end side (5) to such an extent that the component (4) does not touch the base body (2) even
5 under full pressure.

6. The pipette as claimed in one of the preceding claims, characterized in that the longitudinal extent of the web-like, thicker base part (12) follows the bearing rib (10), in that the base body (2) has at
10 least one suitable receiving groove for the base part (12), and in that the bearing body (8) is cast onto the base body (2).

7. The pipette as claimed in claim 6, characterized in that the receiving groove is
15 rectangular in cross section, and in that the end side of the base part (12) is at least approximately flush with the end side (5) of the base body (2), with the exception of the bearing rib (10).

8. The pipette for gripping a component (4) by
20 means of vacuum, in particular as claimed in one of the preceding claims, the pipette (1), on an end side (5) which faces toward the component (4), having a suction opening (6) and an elastomeric bearing member (8), which is inserted in a base body (2) of the pipette (1)
25 and is provided with a slightly projecting, continuously encircling bearing surface for the component (4), characterized in that, in addition to the bearing member (8), at least one elastomeric support member (9), with end-side support surfaces for
30 the component (4), is inserted into the end side (5) of the base body (2), and



in that the support surfaces are lower than the bearing surfaces of the bearing member (8).

9. The pipette as claimed in claim 8, characterized in that the support member (9) is joined to the bearing member (8) as a single piece.

10. The pipette as claimed in claim 8 or 9, characterized in that the support member (9) is of web-like design and has a cross section which is similar to that of the bearing member (8) with at least one support rib (11), the outside of which forms the support surface, and in that the support member (9) is arranged inside the area enclosed by the bearing rib (10).

11. The pipette as claimed in claim 10, characterized in that the bearing member (8) is of annular design, and in that the support member (9) is formed from spoke-like support webs which are fitted onto the bearing member (8) in the radial direction.

12. The pipette as claimed in claim 11, characterized in that the support ribs (11) are designed so as to slope obliquely downward toward the inside, starting from the bearing ribs (10).