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## Description

Device for holding a gripper for an electrical component on a fitting head

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The invention relates to a device for holding a gripper for the electrical component on a fitting head, it being possible for the gripper to be fitted detachably to an end section of a substantially cylindrical shaft  
10 of the fitting head.

Hitherto, it was common to plug grippers designed as suction pipettes and having a hollow cylindrical centering section onto a cylindrical end section of a  
15 rotatable shaft of the fitting head. A flat annular locating groove is let into the inner side of the socket section. An elastomeric O ring was inserted into an outwardly open annular groove of the shaft, and engages under tension in the locating groove. The  
20 annular groove and the locating groove are offset axially to such an extent that the gripper is pressed in the axial direction against a stop on the shaft, as a result of which the gripper axis and the shaft axis are aligned parallel to each other. A short centering  
25 section of the gripper bears with a close fit on a corresponding cylindrical section of the shaft, by which means the gripper is centered in the radial direction on the shaft.

30 In the event of an angular deviation of the pipette axis from the shaft axis, the circular running of the pipette tip, with a component held thereon, is impaired. Before being placed on a printed circuit board, the component has to be rotated from a fetching  
35 position into a placement position, it being possible for a corresponding lateral offset to occur. In particular in the case of very small components, eccentricity of the pipette tip can lead to said



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elements being sucked up eccentrically and drawn up into the suction channel and disrupting the pneumatic functioning of the fitting head.

The O-ring has relatively large production tolerances, which lead to the plug-on and pull-off forces varying over a wide range. Since the grippers have to be changed relatively frequently, depending on the components to be gripped, the O-ring has to be regreased frequently and carefully, with considerable expenditure on maintenance, in order to avoid correspondingly high frictional wear. Even the carefully maintained O ring is subjected to residual wear, which necessitates periodic replacement. Since the frequency of change of the individual pipettes cannot be monitored automatically, it is also correspondingly difficult to coordinate the maintenance intervals in such a way that the pressing function is fulfilled reliably at any time, so that an angular deviation between the axes of the shaft and of the suction pipette cannot always be avoided.

JP 2-67799 A has disclosed a holding device for fixing a suction pipette to a fitting head, which has a hollow cylindrical centering socket, into which a convex cylindrical connecting pin of the suction pipette can be inserted. The connecting pin has an annular groove, in which radially deflectable locating spheres belonging to the fitting head engage and, in the event of a pipette change, are released by pushing a clamping bush back. An active locating means of this type requires a relatively high mechanical outlay, with a correspondingly large external diameter in the area of the holding section. The requisite slimness of the pipette can be achieved only by means of a corresponding lengthening of the same, as a result of which, however, the pipette tip is further removed from the holding section, which reduces its positional accuracy.

The invention is based on the object of permitting secure and accurate fixing of the gripper on the shaft with little outlay on production and maintenance.

This object is achieved by the invention according to claim 1. The locating caps can be arranged in a precisely defined position and dimension on the shaft. They can have an abrasion-resistant and smooth surface, which is subject to low wear. The depth of the locating groove is so low that the required mutual deflection lies in the range of elastic compliance. In particular, the axial offset between the locating groove and the locating caps can be defined to a precise extent, so that the axial pressing forces can be limited considerably more accurately. The plug-on and pull-off forces can likewise be limited to a closer tolerance band, as a result of which the average actuation force can be reduced.

Advantageous developments of the invention are characterized in the subclaims:

The locating caps according to claim 2 result in point-like contact between the shaft and the gripper, which benefits the mutual deflection during location.

The annular groove according to claim 3 may be formed exactly concentrically with the cylindrical centering section, so that the metal spheres can be arranged precisely in their radially installed position.

The locating spheres according to claim 4 can be obtained cost-effectively as standard parts of high accuracy and high strength and good sliding characteristics. As a result of lining the entire annular groove, the spheres are firmly connected to the shaft.

The lining material according to claim 5 is of such a viscous consistency that it adheres in the annular groove without any further aid before being cured. The locating spheres can be inserted into this material by

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simply being pressed in.

By means of the configuration according to claim 6, the gripper wall can be bent out of its cylindrical shape to such an extent that sufficient compliance can be achieved without permanent deformation during the locating operation. It is particularly beneficial in this case if between three and five spheres are distributed in the annular groove. This results in secure centering with adequate compliance.

In the following text, the invention will be explained in more detail using an exemplary embodiment illustrated in the drawing, in which:

Figure 1 shows a longitudinal section through a fitting head having a shaft and a gripper,  
Figure 2 shows a cross section along the line II-II in figure 1,  
Figure 3 shows an enlarged detail through the parts from figure 1 in the area of the section of figure 2.

According to figures 1, 2 and 3, a moveable gripper 1 for an electrical component 8 is provided with a vertical, substantially cylindrical shaft 2, at whose lower end a gripper 3 designed as a suction pipette is replaceably held, being plugged by a thin-walled socket section onto the lower end of the shaft 2. Let into the latter is an annular groove 4, whose depth is somewhat less than the diameter of locating spheres 5 distributed peripherally in the annular groove 4. The inner part of the annular groove has a rounded cross section and has a slightly greater radius than the locating spheres, as a result of which secure contact in the base of the groove is possible.

According to figure 3, in the inner wall of the socket section of the gripper 3, at the level of the annular groove, a peripheral locating groove 6 is formed, in

which the locating spheres 5 engage with their outer caps. The annular groove is offset in the axial direction with respect to the locating groove, by the amount  $s$ , to such an extent that the upper end of the gripper 3 can be pressed against a peripheral collar-like stop 7 of the shaft 2. Between the stop 7

and the annular groove 4 there extends a centering section 9, in which the inner wall of the gripper 3 engages around the shaft 2 without play, so that the latter is centered accurately with respect to the shaft axis. As a result of the axial contact pressure on the stop 7, the gripper 3 is secured in its angular position with respect to the shaft 2, so that the gripper axis and the shaft axis can be aligned accurately with one another.

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These components to be gripped are sucked onto the lower end of the gripper 3. The component is then surveyed by means of a camera in terms of its relative position with respect to the gripper tip and is then rotated in accordance with the measured values. In the event of a deviation of the gripper axis from the shaft axis, there is a corresponding positional displacement, which reduces the placement accuracy. As a result of the accurate mounting of the gripper 3 on the shaft 2, this deviation is reduced to a minimum.

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## Patent Claims

1. Device for holding a gripper (3) for an electrical component (8) on a fitting head (1),  
5 it being possible for the gripper (3) to be fixed detachably to an end section of a substantially cylindrical shaft (2) of the fitting head (1), it being possible for the gripper (3) to be plugged onto the shaft (2) in the axial direction,  
10 the gripper (3) having in the area of the shaft (2) a hollow cylindrical centering section (9) resting on said shaft (2),  
the gripper having an annular locating groove (6) in the area of the centering section (9) or close to the  
15 latter,  
the shaft (2) being provided with locating means (e.g. 5) projecting radially and engaging in the locating groove (6), and  
the latching means being offset axially with respect to  
20 the locating groove (6) in such a way that the gripper (3) can be pressed in the axial direction against a stop (7) of the shaft (2),  
characterized in that the locating means are designed as peripherally distributed fixed short locating caps,  
25 which are permanently connected to the shaft (2) and engage in the flat locating groove (6).

2. The device as claimed in claim 1, characterized in that the locating caps are designed as spherical domes.

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3. The device as claimed in claim 2, characterized in that the locating caps are formed on metallic locating spheres (5), which are inserted into an annular groove (4) of the shaft (2) and are fixed therein, for example  
35 by means of adhesive bonding.

4. The device as claimed in claim 3,

characterized in that the locating spheres (5) are designed as steel spheres for ball bearings and are fixed in the annular groove (4) by means of casting.

5     5.     The device as claimed in claim 4, characterized in that the annular groove (4) is lined with a sealing material of the type of silicone rubber.

10     6.     The device as claimed in one of the preceding claims, characterized in that the gripper has a socket-like annular wall (9) in a fixing area, which engages around the shaft (2) from outside, and in that the wall thickness of the annular wall (9) is so low that it deforms under the stress of the locating caps  
15     to form a round corner.