

Description



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Insertion head for inserting electrical components on substrates

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The invention relates to an insertion head for inserting electrical components on substrates according to the preamble of Claim 1.

10 EP 1 050384 A1 discloses an insertion head for inserting components on substrates, wherein the individual components are held at a gripping mechanism in the nature of a vacuum nozzle, which is in turn attached to a quill or spindle in such a way that it can be replaced. The quill is located in
15 the insertion head in such a way that it can be rotated and it is driven by a motor, which drives a reduction ring gear connected via a toothed belt to the quill in such a way that it cannot be rotated. To change the rotational position of the quill and the component held by suction to the vacuum
20 nozzle, the motor is controlled by means of an electronic control device. The quill and the vacuum nozzle connected to it can be moved in the insertion head in a direction that is perpendicular to the substrate by means of a slide that can be controlled by the electronic control device. A component
25 held by suction to the vacuum nozzle can therefore be rotated about the axis of the quill and moved perpendicular to it. The insertion head can also be moved parallel to the plane of the substrate in the known manner.

30 One problem with such a known insertion head is that its structure is relatively complex, bulky and expensive and that because it is driven by the toothed belt, it is relatively susceptible to failure from the motor onward.



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The object of the present invention is therefore to configure an insertion head for inserting components on substrates such that it is comparatively simple and economical to produce.

- 5 This object is achieved by an insertion head with the features of Claim 1.

One important advantage of the insertion head according to the invention is that it can be produced in a relatively
10 simple and economical design, because toothed wheels and toothed belts are not required to drive the quill or drive shaft bearing the gripping mechanism. A further important advantage of the invention is that no additional bearing arrangements are required for the drive shaft bearing the
15 gripping mechanism, as the drive shaft is formed by the rotor shaft of the motor. As only very small rotational forces are required to rotate the components, the external dimensions of the motor, in particular the external diameter, can be kept very small.

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One particular advantage is that the entire rotational unit can be configured as very compact and of low mass. It is therefore particularly suitable for forming a insertion head with a plurality of gripping mechanisms for a plurality of
25 components. With such a insertion head the dimensions and in particular the distances between the gripping mechanisms can be kept very small. The mass of the insertion head, which has to be accelerated very significantly, remains correspondingly low.

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With the insertion head according to the invention the angular position measuring system, which indicates the angle of rotation of the drive shaft, can advantageously be integrated directly in the drive motor.

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A further advantage is that due to the configuration of the drive shaft of the drive motor as a quill, a pneumatic connection that is extremely favorable for assembly purposes can be fitted at the back end of the drive shaft.

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Advantageous embodiments of the invention follow from the subclaims.

The invention and its embodiments are described in more detail below in relation to the figures, in which:

Figure 1 shows a schematic illustration of the side view of an insertion head according to the invention and Figure 2 shows a top view of the insertion head in Figure 1.

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The following considerations gave rise to the invention. As with regard to known insertion heads, with which the quill or spindle bearing the vacuum nozzle is driven for example via ring gears and a toothed belt from its own drive motor, there are problems in respect of the relatively complex and bulky design, susceptibility to failure due to the relatively large number of components and production costs, the idea was initially conceived of using the drive shaft of the drive motor as the spindle or quill bearing the vacuum nozzle. This results in a whole range of advantages.

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The transmission mechanism present in known insertion heads between the drive motor and the spindle bearing the vacuum nozzle (ring gears on the spindle and on the drive motor, toothed belt) are not required. The entire arrangement of the insertion head can therefore be configured in a more compact manner.

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As the spindle bearing the gripping mechanism is formed directly by the drive shaft of the drive motor, the bearing elements required with the prior art to support the spindle are no longer required.

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A special angular position measuring system, which measures the rotation of the spindle bearing the gripping mechanism with known insertion heads, can be directly integrated in the drive motor with the present invention. For example this
10 motor can be configured as a stepper motor, whereby the individual rotational steps are counted for angle measurement purposes.

As the transmission mechanism between the motor and drive
15 shaft as mentioned above is no longer required, the errors generally occurring in relation to such a transmission mechanism can be avoided. With the present invention the drive shaft is supported in the drive motor itself with zero backlash.

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As with the present invention the drive shaft can be in the form of a continuous hollow shaft with the vacuum nozzle attached to one side of it, the other side of the hollow shaft can be used to fit a pneumatic connection, e.g. by
25 simple insertion.

The present invention can advantageously be used with different types of single and multiple insertion heads.

30 The insertion head according to the invention is marked 10 in Figures 1 and 2. It is used for inserting components 6 on a substrate 7, for example a printed circuit board. The insertion head 10 essentially comprises a slide device 8, 9, which has two slide components 8 and 9 that can be moved
35 toward each other in a Z direction, whereby the drive motor 1

is attached to one slide component 9. The drive motor 1 is preferably a stepper motor for example.

The drive shaft marked 2 of a rotor of the drive motor 1 is
5 configured as a hollow shaft and can therefore be used as a quill or spindle, which can bear a gripping mechanism 5 configured as a vacuum nozzle on the side facing the substrate 7, when low pressure is generated in it. At the end of the drive shaft 2 away from the substrate 7 is a pneumatic
10 connection 3, which is pushed onto the end area of the drive shaft 2 for example in the form of a connecting sleeve.

The slide component 8 can be moved in directions X and Y in the particular manner known shown in particular in Figure 2,
15 so that a component 6 held at the gripping mechanism 5 can be moved by appropriate control of the insertion head 10 to any position on the substrate 7 and be deposited by moving the slide component 9 in the Z direction on the substrate 7. The correct rotational position of the component 6 is achieved by
20 rotating the drive motor 1 and the drive shaft 2.

As the drive shaft 2 is configured as relatively thin, it is expedient for the vacuum nozzles 5 not to be linked directly but via an adapter 4 to the drive shaft 2.

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The adapter 4 is connected permanently to the end area of the drive shaft 2 facing the substrate 7 and has a connecting area 11, the diameter of which is greater than the external diameter of the drive shaft 2. The gripping mechanism 5 can
30 be fitted to the connecting area 11.

Reference characters

	1	Drive motor
	2	Drive shaft
5	3	Pneumatic connection
	4	Adapter
	5	Gripping mechanism
	6	Component
	7	Substrate
10	8	Slide component
	9	Slide component
	10	Insertion head

Claims

1. Insertion head (10) for inserting components (6) on substrates (7),
5 whereby the insertion head has at least one drive shaft (2), to which a gripping mechanism (5) for the components (5) can be fixed, and whereby the drive shaft (2) is capable of being driven by a drive motor (1),
10 characterized in that the drive shaft (2) is configured as a component of a rotor of the drive motor (1).
2. Insertion head according to Claim 1, characterized in that the drive motor (1) with the drive
15 shaft (2) is attached to a slide component (9) that can be moved in a direction (Z) perpendicular to the substrate (7) in relation to a further slide component (8).
3. Insertion head according to Claim 1 or 2,
20 characterized in that an adapter (4) is arranged on the side of the drive shaft (2) facing the substrate (7), said adapter having a connecting area (11) for the vacuum nozzle (5), the external diameter of which is greater than the external diameter of the drive shaft (2).
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4. Insertion head according to one of Claims 1 to 3, characterized in that the drive shaft is configured in a continuously hollow manner and that a pneumatic connection (3) is provided on the side of the drive shaft (2) away from
30 the vacuum nozzle (5).
5. Insertion head according to one of Claims 1 to 4, characterized in that the drive motor (1) is a stepper motor.

6. Insertion head according to one of Claims 1 to 5,
characterized in that an angular position measuring device is
integrated in the drive motor (1) to measure the rotational
position of the drive shaft (2) and a component (6) held by
5 suction at the vacuum nozzle (5).

7. Insertion head according to Claim 6,
characterized in that the angular position measuring device
determines the rotational position by detecting the
10 rotational steps through which the drive shaft (2) is
rotated.