

Description

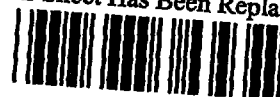
Device for producing electrical subassemblies

5 The invention relates to a device for producing
electrical subassemblies, in particular for fitting
circuit boards with electrical components, the device
having a chassis with two essentially parallel, linear
longitudinal guides for at least two carriages in the
10 form, for example of beams, that can be moved thereon
and are each provided with a crossbar which has a
transverse guide, transverse to the longitudinal guide,
for at least one processing head for the subassembly.

 A device of this kind has been disclosed by
15 US 5,002,448 for example. According to this, the two
beam-like carriages are guided on two parallel guide
rails of the chassis, each carriage having at one end a
double bearing which serves to ensure accurate
longitudinal guidance and maintenance of the angular
20 position of the carriage relative to the guide rail. A
single bearing on the other side in each case is used
to support the crossbar on this guide rail.

 Although the single bearing also has guiding
properties in this case, they lead to overdefinition of
25 the bearing system and are not fundamentally necessary.
Here, the bearings are associated with one another in
such a way that in each case a double bearing of the
first carriage is arranged on one side and the single
bearing of the other carriage is arranged on the
30 opposite side. Each of the double bearings is assigned
a drive unit which drives the carriage in the direction
of the longitudinal guide. The two crossbars are
provided with transverse guides, on each of which there
is a movable triple fitting head that can be moved
35 between a component feed and a processing site on the
chassis for the subassembly

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so as to transport components collected from the component feeds to the position where they are fitted on the circuit board.

If it is assumed that the single bearing (as, 5 for example, in US 4,836,111) is not to have a guiding function but merely a supporting function, then it is possible to specify that each carriage should be guided on one side on a longitudinal guide. Thus, the two carriages project from their longitudinal guides toward 10 the opposite longitudinal guides, i.e. in opposite directions.

There is a fitting site for a subassembly between the two longitudinal guides. The operation of the two carriages is coordinated in such a way that 15 they each alternately mount the components on the circuit board and collect components from the component feeds.

EP 0 315 799, for example, has disclosed an automatic fitting device for circuit boards, in which 20 the fitting head is designed as a turret head which can simultaneously pick up 12 components for example. Here, the two fitting heads may mount components simultaneously on the circuit board and hinder one another in the process, especially in the case of 25 relatively large circuit boards.

The object on which the invention is based is to increase the fitting capacity of the device, to reduce the outlay required to produce the device and to facilitate access to the device.

30 This object is achieved by the invention in accordance with claim 1.

The processing heads can be of different designs, such that they can be used not only for fitting but also for iron soldering, measuring, 35 checking or testing the circuit board or subassembly. Other processing heads can be provided, for example,



for applying flux, adhesive or solder paste.

By virtue of the central arrangement of the guide rails and the fact that the crossbars of the carriages, which are, for example, beam-like, point away from one another it is possible for a comparable outlay in terms of equipment to operate two subassemblies at the same time while excluding the possibility that the processing heads will hinder one another. Another advantage is that only a single common control device is required for the two processing sites.

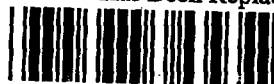
This makes it possible to increase the processing capacity of the machine considerably. The central arrangement of the longitudinal guides considerably improves access to the machine from the outer sides and it is then possible to arrange the component feeds at the outer sides of the machine, which extend parallel to the longitudinal guides. Centralizing the longitudinal guides also allows the feedlines leading to the drives to be gathered together in the center. The members for the two longitudinal guides can be connected to one another structurally in such a way that they reinforce one another.

Advantageous developments of the invention are characterized in Claims 2 to 12:

The common longitudinal member as claimed in claim 2 results in a supporting structure of sturdy and compact construction, allowing the chassis to be made economically. It also results in a favorable center of gravity at the center, improving vibration behavior and increasing the stability of the chassis.

By virtue of the drive units as claimed in claim 3, the drive units and the guide means for the carriages can be combined in a compact form, allowing a weight-saving and sturdy design.

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By virtue of the arrangement of the component transport, which is, for example, linear, as claimed in claim 4, the circuit boards can be guided to both processing sites along one line of transport.

5 The arrangement as claimed in claim 5 makes it possible to increase the processing capacity of the machine even further. It is even possible here, for example, to assign the two longitudinal guides a different number of carriages. Furthermore, the
10 processing heads can perform different functions. In this way, it is possible to form an optimum configuration of processing heads for different processing tasks.

 The development as claimed in claims 6 and 7
15 makes it possible for the crossbar to be designed as a cantilever at its free end, with the result that no guide ways or support ways are required there. This further improves access to the working area of the machine. It is now also possible to arrange peripheral
20 devices, such as additional component magazines or other auxiliary equipment, on the outer sides of the device which are associated with the free ends.

 The support ways and guide ways as claimed in claim 8, which are situated perpendicularly one above
25 the other, require less installation width than in the case of a horizontal arrangement. This allows the overall width of the machine to be reduced accordingly. In addition, all the support ways and guide ways of both longitudinal guides can be grouped more favorably
30 in a support component of compact construction.

 The linear motors as claimed in claim 9 facilitate the use of a plurality of carriages on one longitudinal guide since the linear motors do not require any additional drive means, such as spindles or
35 toothed belts. A linear motor of this kind comprises a stationary part, e.g. a magnet rail extending over the entire length of the longitudinal guide. The



carriage is assigned an electromagnetically active part which is closely associated in terms of effect with the magnet rail and can be driven in such a way that the carriage can be moved precisely into a predetermined position.

By virtue of the arrangement of the linear motor as claimed in claim 10, the guidance and drive means for the carriage are grouped into a compact and space-saving arrangement.

As claimed in claim 11, the guide elements of the longitudinal guide and the parts of the linear motor interact in a particularly advantageous manner. The magnetic forces of the linear motor are used to pull the support and guide elements of the carriage in a defined manner and without play against the support ways and guide ways of the longitudinal guide, the transverse guidance of the carriage thus being kept in an accurate angular and vertical position and it being possible to dispense with guide means that reach behind it. The longitudinal guide thus only requires a guide way which is, for example, of the rail type and the support way running parallel thereto for accurate longitudinal guidance and for maintenance of the angular position of the crossbar relative to the chassis. The permanent forces of attraction of the magnet rail are sufficient to hold the carriage reliably on the longitudinal guide even after the linear motor has been switched off.

By virtue of the development as claimed in claim 12, only a single stationary part is required for the mobile parts of the linear motors. This is designed as a simple magnet rail, for example, and is embedded in the longitudinal member, thus saving space.

The invention is explained in greater detail below with reference to an embodiment example illustrated in the drawing, in which:

Figure 1 shows a side view of a device for equipping circuit boards,

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Figure 2 shows a plan view of the device shown in Figure 1.

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According to Figures 1 and 2, a device for fitting circuit boards 1 with electrical components 2 has a chassis 3 with a longitudinal member 4, the circuit boards 1 and the components 2 being assembled to form a subassembly 1, 2. Horizontally extending guide ways 5 and support ways 6 are arranged perpendicularly one above the other on the longitudinal member 4 in such a way that together they form a perpendicular guide plane of a linear longitudinal guide 7 for at least one carriage 8 which can accordingly be moved horizontally in this direction and has a crossbar 9 extending horizontally and perpendicular to the guide ways 7.

Said crossbar is provided with a transverse guide (not shown in detail) for a processing head 10, which is designed as a fitting head, e.g. as a turret head, and has a multiplicity of suction pipettes 11, distributed in a star pattern, for gripping the component 2. Arranged in the central work area of the processing head 10 is a processing site 12 of the chassis 3, which is designed as a lifting table and raises the circuit board 1 to be processed to a processing height.

A linear subassembly transport 13 extends perpendicularly to the longitudinal guide 7 over the entire width of the chassis 3. Arranged on both sides of the circuit board transport 13 are component feeds 14, from which the processing head 10 collects components 2 as required and places them on the circuit board 1 to be equipped on the lifting table 12.

The longitudinal member 4 is provided on both sides with the longitudinal guides 7, in which at least one further carriage 8 is guided on the side opposite the first carriage 8. The two carriages 8 project outward in opposite directions from the central longitudinal guides 7. In corresponding fashion, there is a further processing site 12 on this side for fitting the circuit boards 1 with the components 2,



the transport 13 being guided over both processing sites. This makes it possible to operate simultaneously with two processing heads 10 at two processing sites, for example, and to increase the fitting rate
5 accordingly.

The arrangement furthermore has the advantage that the number of component feeds can be doubled, making it possible to supply a considerably wider range of components for processing on a machine. Here, two
10 carriages 8 are provided with the processing heads 10 on each of the longitudinal guides 7, thereby increasing the fitting capacity of the device even further. The two fitting heads are then controlled in such a way that they alternately perform fitting and
15 collect components 1 from the component feeds 14.

A drive unit for moving the carriage 4 is here designed as a linear motor 15, 16, which is made up of an electromagnetically active, mobile part 15 and a stationary magnet rail 16 which extends over the entire
20 length of the longitudinal guide 7 and is recessed into the central longitudinal member 4. The guide ways and support ways 5 and 6 are arranged one above the other to save space. The linear motor 15, 16 has a matching vertical magnetic gap between the mobile part 15 and
25 the magnet rail 16. The mutual contact surfaces of the longitudinal guide and the gap of the linear motor form a continuous common interruption. This has the effect that guide and support elements of the carriage 4 are pulled without play against the guide ways and support
30 ways 5 and 6 of the longitudinal guide 7 by the magnetic attraction between the parts of the linear motor 15 + 16.

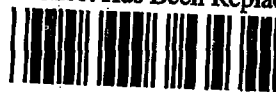
These forces are so high that the other end of the carriage, that is to say the free end of the
35 crossbar 9, does not have to be supported and can thus be designed as a cantilever. On this side, therefore, no support ways are required and this



improves access to the working area of the machine. The permanent magnetic forces of the linear motor hold the carriage in its horizontal position even when the power is switched off.

- 5 Here, all the carriages are of identical construction and are arranged in a rotationally symmetrical manner on both sides. The linear motors assigned to the individual carriages 8 are designed in such a way that they use the magnet rail 16 jointly.

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Patent Claims

1. A device for producing electrical subassemblies (1, 2), in particular for fitting circuit boards (1) with electrical components (2), the device having a chassis (3) with two essentially parallel, linear longitudinal guides (7) for at least two carriages (8) in the form, for example of beams, that can be moved thereon and are each provided with a crossbar (9) which has a transverse guide, transverse to the longitudinal guide (7), for at least one processing head (10) which can be moved thereon and is intended for the circuit board, the carriages (8) being guided in the longitudinal guides in an end region, the two crossbars (8) projecting in opposite directions from the respective longitudinal guide (7), and the chassis having at least one processing site (12) for at least one of the subassemblies (1, 2), characterized in that the two longitudinal guides (7) are arranged directly next to one another, in that the two crossbars (9) each project from their longitudinal guides (7) in the direction opposite to the adjacent longitudinal guides (7), and in that at least two processing sites (12) are provided on both sides of the longitudinal guide elements (7).

2. The device as claimed in claim 1, characterized in that the two longitudinal guides (7) are formed on a common longitudinal member (4) of the chassis (3).

3. The device as claimed in claim 1 or 2, characterized in that

25 2. The device as claimed in claim 1, characterized
in that the two longitudinal guides (7) are formed on a
common longitudinal member (4) of the chassis (3).

3. The device as claimed in claim 1 or 2, characterized in that

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drive units are provided for moving the carriages (8), these drive units being assigned to the associated longitudinal guides (7).

4. The device as claimed in claim 1, 2 or 3, characterized in that a subassembly transport (13) has a direction of transport aligned perpendicularly to the longitudinal guides (7) and serves both processing sites (12).

5. The device for producing electrical subassemblies (1, 2), in particular for fitting circuit boards (1) with electrical components (2), the device having a chassis (3) with at least one linear guide (7) for at least one carriage (8), e.g. a beam-like carriage, which can be moved thereon, characterized in that at least two carriages (8), which can be moved independently of one another, are guided on the longitudinal guide (7).

6. The device for producing electrical subassemblies (1, 2), in particular for fitting circuit boards (1) with electrical components (2), the device having a chassis (3) with at least one linear guide (7) for at least one carriage (8), e.g. a beam-like carriage, which can be moved thereon, characterized in that the longitudinal guide (7) is provided with at least one support way (6) and at least one guide way (5) for corresponding support and guide elements of the carriage, and in that the support and guide elements are arranged at one end of the carriage (8).

7. The device as claimed in claim 6, characterized in that the other end of the carriage (8) is designed as a cantilever.

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8. The device as claimed in claim 6 or 7, characterized in that, when viewed in cross section, the support way (6) and guide way (5) of the longitudinal guide (7) are arranged perpendicularly one
5 above the other and form a guide plane which is aligned in a correspondingly perpendicular manner.

9. The device as claimed in claim 6, 7 or 8, characterized in that the drive unit of the carriage (8) is designed as a linear motor (15, 16) and is
10 assigned to the linear guide (7).

10. The device as claimed in claim 9, characterized in that the linear motor (15, 16) is arranged between the support way (6) and guide way (5).

11. The device as claimed in claim 10,
15 characterized in that there is a gap between a mobile part (15) and a stationary part (e.g. 16) of the linear motor in the region of the support way and guide way (6 and 5), and in that the gap and the mutual contact surfaces between the guide elements of the longitudinal
20 guide form a continuous common interruption.

12. The device as claimed in claim 9, 10 or 11, characterized in that the continuous stationary part (e.g. 16) is provided as a common stationary element for a plurality of independently actuatable linear motors
25 of the carriages (8), and in that the stationary part (e.g. 16) is firmly connected to the longitudinal member (4) of the chassis (3).

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