

Description

Method and apparatus for feeding taped components

5 The invention relates to a method and apparatus for feeding taped components according to the preamble of claim 1 and of claim 4.

 When printed circuit boards are being fitted automatically with surface-mountable components, known
10 as SMD components, they are provided in the form of taped components. The delivery form in the tape is particularly suitable for automation, since the components are already separated, and the packaging in the tape ensures a great deal of security against
15 confusion. In the individual feed devices for taped components, the tapes with the components are unwound from a tape coil and then fed to a removal position for the components. In this removal position, the components are then picked up by the suction pipette of
20 a pick-and-place head and then positioned on a printed circuit board in a predefined fitting position. The covering films of the tape, which prevent the components falling out of the component compartments of the tapes, are pulled off before the removal position
25 is reached.

 EP 0 589 276 discloses a feed device for taped SMD components, which has a movable cover for the component compartments in the removal area. This cover is moved synchronously with the tape in the unwinding
30 direction of the tape until the foremost component compartment has reached the removal position. The cover is then moved in the opposite direction in order to open the foremost component compartment. The movable cover means that the SMD components are covered during
35 the transport in the removal area of a tape, that is to say the components are prevented from standing up or jumping out of the component compartments.

EP 0 817 560 likewise discloses a feed device for taped SMD components, which has a movable cover for the component compartments in the removal area. In this case, the cover is designed as a flat steel spring and
5 is moved, by means of drive means not specifically described, in such a way that the relevant component compartment is opened shortly before the removal of the components.

In particular in the case of small components,
10 the fact that the components are smaller than the component compartments accommodating them manifests itself as disadvantageous. Normally, the suction pipette in the removal position expects the component in the center of the component compartment. In the case
15 of large components (with an area of about 1 mm^2 , positional inaccuracies of the components in the component compartments are uncritical, since the pick-up area of the suction pipette is generally smaller than the component and is therefore placed at least
20 approximately in the center of the surface of the component. In the case of small components (area less than about 1 mm^2), the pick-up area of the suction pipettes is to some extent larger than the components themselves. This pipette overlap, as it is called, then
25 limits the packing density on the substrate to be populated. One speaks of "populating shadows". In the case of smaller components, whose actual position in the component compartment differs from the expected position in the center of the component compartment, it
30 may then occur that the components are not picked up correctly, and this leads, inter alia, to time losses caused by picking up new components or else to damage if a component which is picked up wrongly falls into the pick-and-place robot during the transport by the
35 suction pipette.

DE 36 07 242 discloses a method of positioning components in depressions in a holding device, in which by means of a separate suction pipette, the components are additionally attracted by suction before the actual

placement process and are moved into a predefined position in the depressions. Because of the additional suction pipette, such a method

is complicated in design terms and additionally requires too much time.

JP 0 815 3989 discloses a feed device for taped components which has a vibration device to drive the forward thrust devices. No statement is made about the position of the components in the feed device.

It is therefore an object of the invention to specify a method and an apparatus which ensures that small components in tapes will be fetched securely.

According to the invention, the object is achieved by a method and an apparatus of the type mentioned at the beginning and having the characterizing features of claims 1 or 4.

For this purpose, the movable cover advantageously has means with which the component is moved into a predefined, exactly determined position, for example one corner of the component pocket.

In the preferred refinements according to claims 2 and 5, the movement of the cover itself is used to move the component into the predefined position. This dispenses with complicated additional constructions.

In order to reduce the friction of the components in the component compartments, and therefore for the purpose of simpler movement, in an advantageous way according to claim 3, the component is acted on by a vibrational movement.

In the preferred refinement of the apparatus according to claim 6, a brush associated with the cover is used to shift the component into the predefined position. A brush is easy to fit to the cover.

A further advantageous refinement is, according to claim 7, used a suction pipe, in order to move the component into a predefined position by sucking in air or else by blowing. This means that the component can, if appropriate, be moved into the predefined position even without the movement of the cover.

In the preferred embodiment according to claim 8, a vibration device is provided in order that the friction of the component in the component compartment is reduced and therefore the movement is facilitated.

The invention will be explained in more detail in the figures of the drawing, using two exemplary embodiments. In the drawing:

Figure 1 shows a schematic cross section through a component tape with a closed cover with a brush,

Figure 2 shows a schematic cross section through a component tape with a free removal position and a cover with a brush,

Figure 3 shows a schematic cross section through a component tape with a suction pipe in the cover

Figure 4a shows a schematic plan view of any desired component lying in a component compartment

Figure 4b shows a schematic plan view of a component in a predefined position in the component compartment.

Figure 1 illustrates a cross section of a number of components 1 in a component tape 2, the components 1 lying in component compartments 3 matched to their size. The component compartments 3 are closed off by a covering film 4 which, upstream of the removal position 7 of the tape moved in a transport direction 9, is pulled off by a device which is not shown. In order that the components 1 do not fall out of the component compartments 3 or tilt in the component compartment 3, there is provided in the region of the removal position 7

a movable cover 5 which, before the removal of the component 1 by the suction pipette (not shown) of the pick-and-place robot, is moved in a movement direction 6 and therefore opens the component compartment 3 in the removal position 7, as illustrated in figure 2.

As figure 4 shows in a schematic plan view, the dimensions of the component compartments 3 are greater than the dimensions of the components 1. The components 1 lie in the component compartments 3 such that they can move freely. Above all in the case of small components (area less than about 1 mm^2 , or an edge length of less than about 0.5 mm), this results in difficulties when fetching the components 1, if the position of the components 1 in the component compartment 3 is not known. Components 1 are also to be viewed as small if they have a positional tolerance greater than 20% of their edge length in the component compartment 3, since their position is then inaccurate. The suction pipette moves to a predefined position, if the component 1 is not located at this predefined position, it is either not picked up at all or picked up so poorly that, for example, it is allowed to fall during further transport and possibly even leads to machine damage.

By means of a brush 8 (shown in figure 1) on the cover 5, the component 1 is moved into the predefined position shown in figure 2 at the edge of the component compartment. The predefined position can in this case be the rear edge of the component compartment 3, in relation to the transport direction 9, and also, for example, one of the rear corners of the component compartments 3, in relation to the transport direction 9, as illustrated in figure 4b. In the corners, a component 1 is held in the predefined position by two edges of the component compartment 2 which are substantially perpendicular to each other, which means that the predefined position is defined more accurately. The movement direction 6 needed for this may be implemented, for example, by means of a

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corresponding direction of movement 6 of the cover 5
with a brush stroke provided for the purpose.

In order to reduce the friction of the component 1 in the component compartments 3, in figure 2 a vibration device 11 (for example a piezo-electric vibrator) is provided, which sets the component tape 2 vibrating via an abutment 10 for mounting the component tape 2. This permits the components 1 to be moved more simply against the rear edge of the component compartment 3.

Figure 3 illustrates a further embodiment in cross section, in which a suction pipe 12 is arranged in the cover 5. Air is drawn in through the suction pipe, and the air flow pulls the component 1 against the rear edge or into one of the rear corners of the component compartment 3, depending on the position of the suction pipe. In addition, air flowing out of the pipe through holes which are then arranged on the opposite sides of the cover 5 permits the component 1 to be moved into the predefined position on the basis of the air flow. In this embodiment, the cover 5 does not have to be moved in order to move the component 1 into the predefined position, however a design with an air flow and simultaneous movement of the cover 5 is also possible.



Patent claims

1. A method of feeding taped components (1), in which
5 the components (1) are transported in component compartments (3) of a tape (2) to a removal position (7),
the components (1) are held in the component compartments (3) with the aid of a cover (5) which is
10 assigned to the removal position (7),
the cover (5) opens the component compartment (3) in the removal position,
characterized in that
the component (1) is moved into a predefined position
15 in the component compartment (3) by means associated with the cover (5).
2. The method of feeding taped components (1) as claimed in claim 1,
characterized in that
20 during the movement of the cover (5) in the removal position (7), the component is moved into a predefined position in the component compartment (3).
3. The method of feeding taped components (1) as claimed in claim one of claims 1 or 2,
25 characterized in that
in order to assist the movement into the predefined position, the component (1) is acted on by a vibrational movement.
4. An apparatus for feeding taped components (1),
30 having a movable cover (5) for component compartments (3) of a tape (2), the cover (5) being associated with a removal position (7),
characterized in that
the cover (5) has means (8, 12) for moving the
35 component (1) into a predefined position in the component compartment (2).



5. The apparatus for feeding taped components (1) as claimed in claim 4, characterized in that the means (8, 12) are configured in such a way that, during the movement of the cover (5) in the removal position (7), the component (1) is moved into the predefined position.
6. The apparatus for feeding taped components (1) as claimed in claim 5, characterized in that the means are formed as a brush (8), which shifts the component (1) into the predefined position.
7. The apparatus for feeding taped components (1) as claimed in one of claims 4 or 5, characterized in that the means are formed as a suction pipe (12), which moves the component (1) into the predefined position as the result of the formation of a vacuum in the suction pipe (12).
8. The apparatus for feeding taped components (1) as claimed in one of claims 4 to 7, characterized in that a vibration device (11) is provided which assists the movement of the component (1) into the predefined position.