

Apparatus for placing components on circuit bases

The invention relates to an apparatus for placing a number of electrical components, in particular SMD components, on circuit bases, having a placement unit for placing the components on the circuit base, and having a feed unit for feeding the components, which are provided in a magazine.

In order to place electrical components on circuit bases, the components are normally provided in magazines and are fed to a placement unit by means of a feed unit. In order to ensure fault-free and continuous feeding to the placement unit, the electrical components can be provided on belts in the form of strips, which can be unwound from a roll. In order to allow a high throughput rate, one placement unit has a number of associated feed units and magazines. In order to identify the correct association between a magazine and a corresponding feed unit when equipping or replenishing the placement unit, the magazine can be provided with a barcode tag which contains the component-related data. Such data can be read by means of a barcode reader to a data processing unit, and can then be compared with the predetermined nominal data. This method admittedly allows unambiguous identification of the type of components provided in the form of a magazine. However, this does not make it possible to reliably prevent the checked magazine from being assigned to the wrong feed unit.



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The object of the present invention is thus to develop an apparatus for placing components on circuit bases, in such a manner that incorrect placement is reliably avoided.

In order to achieve this object, the invention is characterized in that each magazine has an associated identification medium and each feed unit has an associated monitoring unit, and in that means are provided in such a manner that component-related data can be stored in the identification medium, and/or in that the monitoring unit is used to compare the component-related data for the magazine with placement-related data which are predetermined by a central data processing unit, and in that, if the component-related data match the placement-related data, the magazine is enabled by means of the feed unit to place the components in the placement unit.

The advantage of the invention is, in particular, that the identification medium for the magazine can be used more than once. After completion of the placement process, the identification medium can be removed from the magazine and can be assigned to a further magazine, which has not yet been fitted. The basic idea of the invention is that the checking of correct assignment of the magazine is carried out directly at the point where the components are fed to the placement unit. This uniquely allows incorrect placement to be avoided. In the process, the component-related data stored in the identification medium can be checked to ensure that they match predetermined placement-related data in a monitoring unit. If a match is found, the components in the corresponding magazine can be placed by the emission of an enable signal. Local and automatic checking thus allows any

incorrect manual placement resulting from incorrect assignment of a magazine to a feed unit to be reliably avoided.

5 According to one refinement of the invention, the identification medium is, on the one hand, detachably connected to the magazine so that it can be used for a further magazine once the first magazine has been emptied. On the other hand, the identification medium is connected in a captive manner to the
10 magazine, thus preventing it from being detached or removed from the magazine when this is not desired.

According to one development of the invention, each feed unit has an associated monitoring unit, with the identification medium being configured in such a
15 manner that it can be engaged with the monitoring unit in the placement position. This makes it possible to ensure that correct assignment of the magazine can be checked automatically when the components are being fitted in the magazine.

20 According to one refinement of the invention, the identification medium is formed in such a way that the magazine can be moved to the intended placement position only when the identification medium has engaged with the monitoring unit. For this purpose, the
25 identification medium has an angled shape, in which case a first end can be mechanically coupled to the magazine and a second end can be mechanically and electrically coupled to the monitoring unit. In this case, the second end has coupling elements which
30 interact with a write/read unit in the monitoring unit.

According to one refinement of the invention, the second end of the identification medium has contact surfaces on one face,

in order to make contact with correspondingly arranged contacts on the write/read unit. The component-related data are stored in an integrated circuit (chip) in the identification medium. The chip is preferably arranged
5 inside the identification medium, so that it is protected against damage.

Further advantages of the invention result from the further dependent claims.

One exemplary embodiment of the invention will
10 be described in more detail in the following text with reference to the drawings, in which:

Figure 1 shows a perspective illustration of a changeover table which is provided with a number of magazines, and feed units
15 associated with the respective magazines, for a downstream placement unit, and

Figure 2 shows a magazine with an identification medium, to which component-related data can be read.

20 The apparatus according to the invention for placing components on circuit bases essentially comprises a placement unit, which is not illustrated, and a number of feed units 1. Electrical components 2, in particular SMD components, are fed to the placement
25 unit in a manner known per se by means of the feed unit 1, and are positioned at a predetermined point on a circuit base that is provided, in particular a printed circuit board. Once the SMD components 2 have been fixed on

the circuit base by means of a solder paste, they can be finally secured on it, for example, by using a reflow soldering method with an electrically conductive connection being produced to the conductor tracks provided on the circuit base.

In order to place the SMD components 2 on the circuit base automatically, the components 2 are provided in the form of magazines 3, which each have an associated feed unit. In order to ensure as high a throughput rate as possible, a number of magazines 3 are placed on a changeover table 4 which is positioned in a feed area of the placement unit in such a manner that the magazines 3 are each arranged such that they are flush with the feed unit 1, which is in the form of a feed chute.

The magazines 3 each comprise a roll 5, on which a flexible belt 6 in the form of a strip is wound. The SMD components 2 are located at regular intervals on the belt 6.

The magazines 3, or the roll 5, is connected to an angled identification medium 7, which is essentially composed of a flat plastic material. A first end 8 of the identification medium 7 is detachably connected on the rotation axis of the roll 5 by means of a fastening element 9. A second end 10 of the identification medium 7 has a chip which is embedded in a cutout in the plastic material and is electrically connected to contact surfaces 12 which run flush with an upper face 11 of the identification medium 7. Both the configuration of the second end 10 and the arrangement of the contact surfaces 12 on it comply with the standards for a smart card.

This allows the second end 10 to be inserted into a conventional write/read unit 13 for smart cards.

In the present exemplary embodiment, every second end 10 of a magazine 3 has an associated write/read unit 13. The write/read units 13 are arranged in the form of a row and alongside one another.

The write/read unit 13 forms a monitoring unit which, firstly, has a contact-making unit for mechanical and electrical coupling of the second end 10 and, secondly, has a control unit with a microprocessor.

The setting-up process is described in the following text. In a first step, the component-related data, which are stored as a barcode 14 on a respective roll 5, are read to a central data processing unit 16 by means of a hand-held scanner 15. The data processing unit 16 may be in the form of a setting-up location computer and may be associated with a number of placement units. The data processing unit 16 has all the data relevant for the setting-up process, such as the type of placement unit, the arrangement of the feed units on specific sides of the placement unit, etc. These form the set-up-related data, which are required to associate the magazine 3 with the correct respective feed units 1. The component-related data are now written from the central data processing unit 16 to the chip of the identification medium 7 by means of a write/read unit, which is not illustrated. The chip in the identification medium 7 is preferably in the form of a memory chip with a nonvolatile memory (EEPROM). When the chip is being written to, the identification medium 7 will already have been connected mechanically and in a captive manner to the roll 5, which is fitted with the corresponding

components 2. This ensures that the component-related data, which are in the form of a barcode on the relevant magazine, namely the type of component 2, are identical to the component-related data read to the
5 chip.

In order to set up the apparatus, the operator uses the central data processing unit 16 to select the desired fit, and transmits the selected set-up-related data to the respective write/read units 13, which are
10 arranged on the changeover table 4. The set-up-related data form the nominal data for the respective magazine 3 which will later be mounted on the changeover table 4.

In a further step, the magazines 3 are
15 associated with the respective feed unit 1 in accordance with the requirement from the central data processing unit 16, and are positioned in the corresponding compartment on the changeover table 4. For correct positioning, the second end 10 must be
20 inserted into the write/read unit 13 intended for it. Once electrical contact has been made with the chip in the identification medium 7 in the write/read unit 13, the component-related data are read from the chip in the identification medium 7 to a memory in the
25 write/read unit 13. The microprocessor in the write/read unit 13 has an associated program, which allows the component-related data to be compared with the placement-related data stored in the corresponding write/read unit 13. If the component-related data
30 matches the placement-related nominal data, an enable signal is produced which signals to the operator that the magazine 3 is located in the intended chute of the changeover table 4, and is associated with the intended feed unit 1. This

comparison is carried out successively for each magazine 3.

Since the magazine 3 is not arranged in the correct position for the feed process until the second end 10 of the identification medium 7 has been inserted in the write/read unit 13, a check, as described above, of correct feeding is a condition for starting up the placement unit. This reliably makes it possible to avoid incorrect placement owing to non-placement.

Alternatively, the second end 10 can also be configured with contact surfaces arranged on one end face in the same way in form of a row, which can be positioned with respect to corresponding contact elements on a write/read unit. Alternatively, the comparison can also be carried out in the central data processing unit 16, provided the write/read units 13 are connected to it by means of electrical conductors. The essential feature of the apparatus according to the invention is that the identification medium 7 together with the stored component-related data are connected to the respective magazine 3 in a fixed manner, so that the mobile write/read units can check the component-related data at any time and independently of the location.

The placement of components 2 in magazines on a changeover table 4 is preferably enabled once a match between the component-related data and the nominal data has been found for all the magazines 3 on the changeover table 4.

Patent Claims

1. An apparatus for placing a number of electrical components, in particular SMD components, on circuit bases, having a placement unit for placing the components on the circuit base, and having a feed unit for feeding the components, which are provided in a magazine, with each magazine (3) having an associated identification medium (7) and each feed unit (1) having an associated monitoring unit (13), and in that means are provided in such a manner that component-related data can be stored in the identification medium (7), and/or in that the monitoring unit (13) is used to compare the component-related data for the magazine (3) with placement-related data which are predetermined by a central data processing unit (16), and in that, if the component-related data match the placement-related data, the magazine (3) is enabled by means of the feed unit (1) to place the components (2) in the placement unit, characterized in that a first end (9) of the identification medium (7) is detachably connected to the magazine (3), and in that the identification medium (7) has a second end, which is configured in accordance with the standards for a smart card and has an associated write/read unit (13).
2. The apparatus as claimed in claim 1, characterized in that the identification medium (7) is connected to the magazine (3) detachably and/or in a captive manner.
3. The apparatus as claimed in claim 1 or 2, characterized in that each feed unit (1)

has a single physically associated monitoring unit (13), and in that the identification medium (7) is configured in such a manner that it can be engaged with the monitoring unit (13) in the placement position.

5 4. The apparatus as claimed in one of claims 1 to 3, characterized in that the monitoring unit (13) is in the form of a write/read unit which can be electrically connected to the central data processing unit (16).

10 5. The apparatus as claimed in one of claims 1 to 4, characterized in that the magazine (3) is provided with a component-related barcode tag (14) which can be read by means of a scanner (15) for buffer-storage of the component-related data in the central data processing unit (16).

15 6. The apparatus as claimed in one of claims 1 to 5, characterized in that the identification medium (7) is flat, in which case a first end (8) can be mechanically coupled to the magazine (3) and a second end (10) can be mechanically and electrically coupled
20 to the monitoring unit (13).

7. The apparatus as claimed in one of claims 1 to 6, characterized in that the second end (10) is in the form of a card with contact surfaces (12), arranged on the upper face (11) of the second end (10), for making
25 contact with corresponding contact elements on the write/read unit (13).

8. The apparatus as claimed in one of claims 1 to 7, characterized in that the second end (10) has a memory chip in which the component-related data are stored.

5 9. The apparatus as claimed in one of claims 1 to 8, characterized in that the magazine (3) is provided together with the respectively associated identification media (7) and the write/read units (13) adjacent to one another on a common changeover table
10 (4).

10. The apparatus as claimed in one of claims 1 to 9, characterized in that the magazine (3) is in the form of a belt (6) which is provided with a large number of components (2) and is wound on a roll (5).