AUTOMATED PASSING OF SPECIAL CONTACT ELEMENTS FOR ELECTRONIC ASSEMBLY

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Abstract: *Electronic assembling is strongly automated. In 1980 the use of SMD technology for electronic assembly began on a mass scale. This technology is currently used in more than 90% of the cases. It requires a precise passing of SMD components so that it can assemble with high speed and precision. The technology is hardly applicable for non-standard component such as contact components. In the production of flame detectors by the firm of "UniPOS" non-standard contact components are used. These components have to be positioned and soldered precisely because after that there will be no opportunity for automated assembling of the final products. At first these components were put by hand and they were soldered by SMD technology. This led to a lot of labor expense, a low quality and a lot of rework, which made the products more expensive. By a vibration and a specially created strip for leading and positioning the contact elements conditions for automated SMD assembly were created. This enabled a large decrease in the prime cost of the products and an increase in the productivity of the whole production.*

Keywords: SMD, contact, vibration, assembly, position

1. Introduction

The assembly of non-standard components is a problem for every automated technology [1]. In the electronic technologies for assembling components packages such as real, stick and tray are mostly used. For components with special forms a tray is used but the assembly is slower and it requires specialized (optional) equipment.

In the firm of "UniPOS" specialized contacts (a contact component) are used. Their form is shown on fig. 1.

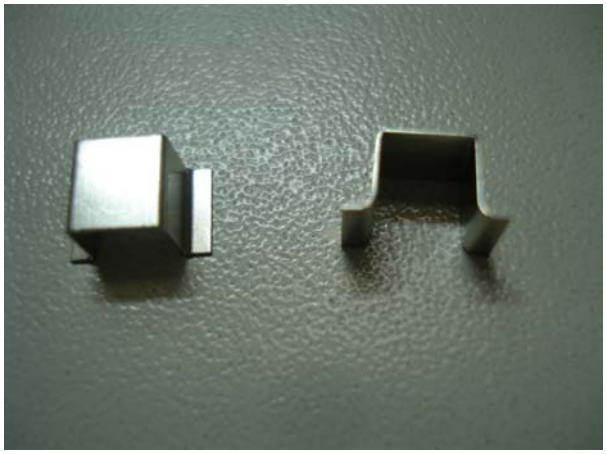
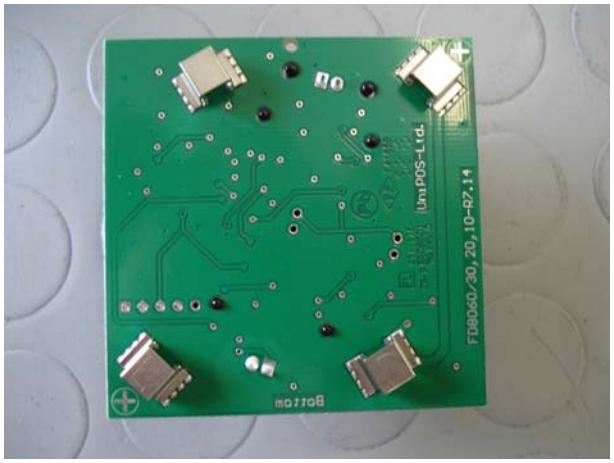


Fig.1. *Contact components for UniPOS products*

On fig. 2 a plate (PCB) with assembled (soldered) contact components is shown.



Фиг.2. *PCBA with contacts*

On fig. 3 a final product with assembled contact components is shown.

Фиг.3. *Product with contacts*

At first this contact component was assembled by hand and it was soldered automatically by reflow process. This led to its imprecise positioning and to a lot of repairs, respectively.

As the volume of the production increased, it was necessary to automate the mechanical assembly of the products [2]. The main reason for its development was the wrongly positioned contact component, which required a lot of repairs because of the impossibility of assembling the final product in moving the contact component on PCB (printed circuit board) by more than 0,2 mm.

We decided to accomplish it by SMD technology [3]. We had to decide how to pass the contact component to pick position of the machine.

We directed our attention to the use of a tray. It turned out that it was impossible because of the following reasons:

- The trays cannot be loaded with contact components automatically;
- The pick of the contact component from the tray is unreliable because it is difficult to carry out precise positioning and the edges of the tray catch the contact component;
- A change of the place and the position of the contact component when it is transported.

Putting in a reel tape was impossible because the contact component didn't have a shifted center of gravity and it was positioned with difficulty.

The possibility of passing from a tube left. It turned out that the use of strips and tubes didn't give a result because of:

- Stopping the motion in the tube due to heaping the components one on top of the other and fixing the components on the walls of the tube/strip;
- Difficult filling of the tubes/strips.

It was necessary to design a special strip and to decide its filling.

2. A strip and vibrobunkers for passing a contact component

It was necessary to create a strip which can adapt to a linear vibratory feeder of SMD automatic machine.

After a lot of trials an optimal form and corresponding dimensions for a strip were found. The strip is shown on fig. 4.

Fig.4. A strip for passing contact components.

On fig. 5 the initial part and the end part of the strip are shown. The strip is suitable for assembling a linear vibratory feeder.

Fig.5. *Start and end of a strip*

On fig. 6 a strip which is adapted to a vibratory feeder is shown.

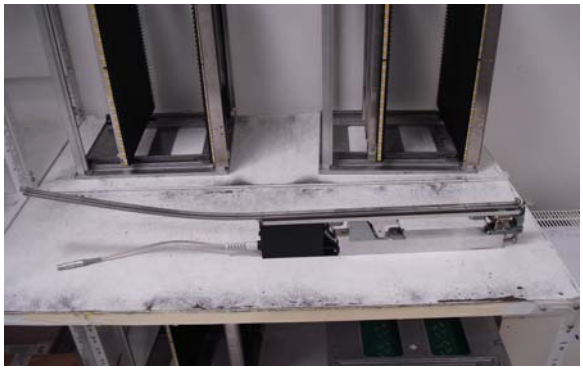


Fig.6. *Vibratory feeder with a strip*

The next task was the construction of a device which filled the strip with bulky contact components. Trials were made and the decision that included a vibrobunker turned out to be successful. After a lot of trials an optimal leading construction for arranging the components was chosen. Also, it had to serve as a gauge that didn't miss components with dimensions and didn't remove them from the vibrobunker. This vibrobunker is shown on fig. 7.

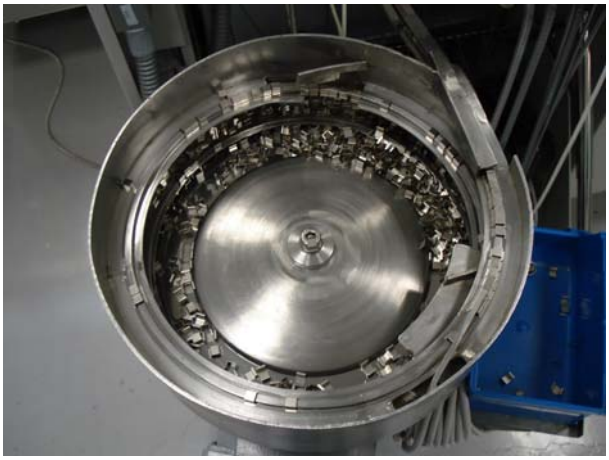


Fig.7. *Vibrobunker*

The blue box is the place where the components with unsuitable size are put.

The controller that controls the vibrobunker is shown on fig. 8 and a change of the frequency and the amplitude is envisaged in it.

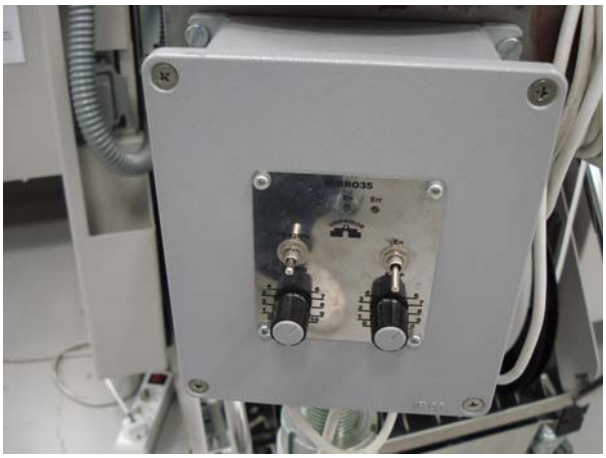


Fig.7. *Vibrobunker control panel*

An optimal frequency and an optimal amplitude for achieving a stable and fast passing of components in the strip. A speed of 120 components per minute was reached, which was enough for the case.

3. Adaptation of a strip and a vibrobunker to SMD vibrofeeder

The described modules were adapted to SMD vibrofeeder through appropriate stands and connections between the modules. It turned out that a vibrobunker and a vibrofeeder work with different frequencies and for this reason there shouldn't have been a mechanical connection between them. A construction was created. This construction allows an adjustment of the distance between them so that there is a stable motion of the components. In the adjustment of the system it turned out that a lot of components didn't have to be heaped on the strip because this led to its blocking. An optimal filling was determined and an automation that was capable of supporting it was created.

On fig. 8 the described system is shown.

Fig.8. *Vibrobunker system*

On fig. 9 the strip with the components, which are passed to pick position of SMD placer ASM Siplace D1, is shown.

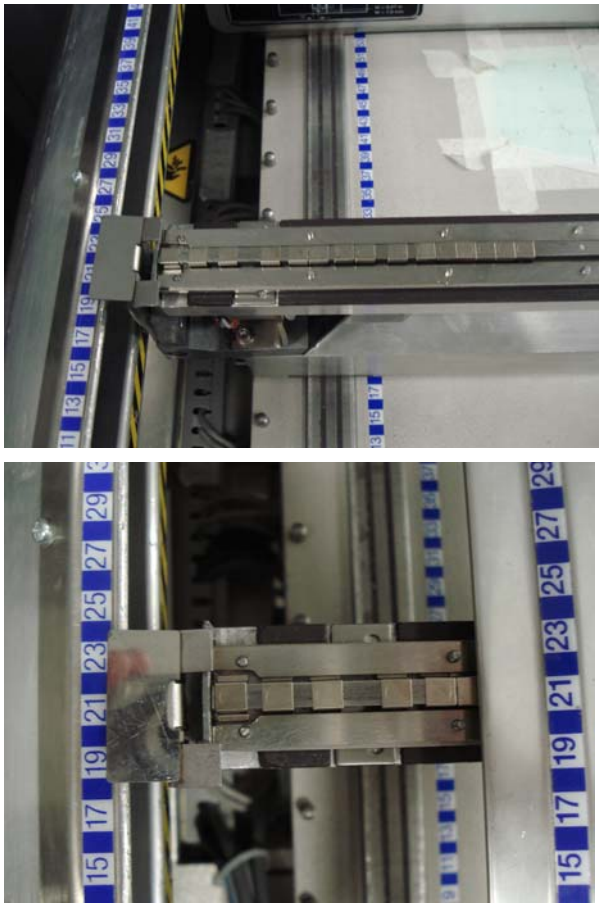


Fig.9. *ASM Siplace D1 pick position*

4. Results

The results of the described automation of the process of passing the components are:

- a system of a strip and a vibrobunker for a stable passing of components for SMD assembly was created;

- an optimal frequency and an optimal amplitude for work of a vibrobunker were determined;

- the optimal connections between the strip and the vibrobunker for a maximum speed of passing and moving the components were determined;

- an additional automation for a stable filling of the strip with components was created.

5. Conclusions

The conclusions of the system for an automatic passing of components are:

- An automatic assembly of final products was possible as the problem regarding the precise assembly of contact components was solved;
- The productivity increased 8 times, which enabled the accomplishment of the increased volume of production;
- The labor considerably reduced, which reduced the prime cost of the product considerably – the cost of an assembly reduced 40 times;
- The rework rate considerably decreased (200 times). This guarantees a lack of refusals among the clients;
- The possibility of stopping work of an assembly line decreases.

Acknowledgement

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References

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