

Conveying system for electronic components

The present invention concerns a conveying system for electronic components, in particular a conveying system for sorting electronic components.

Electronic component processing lines generally comprise a main
5 processing line, for example circular, along which the electronic components undergo a series of operations, for example electric or mechanical tests, or conditioning operations. The number of processing stations that can be arranged along these processing lines is generally limited, in particular along a circular line comprising usually a barrel on the periphery
10 of which a determined number of locations corresponding to the steps of its indexed rotational movement are available.

Following tests, for example, it may be desirable to separate the electronic components into different categories, for example according to the tests' results. It is thus necessary to bring each component to an exit
15 station reserved to components of its category, for example a receptacle or a conditioning station. In order to avoid occupying a location along the main line for each exit station, it is possible to use an additional conveyor whose one extremity occupies a single location, for example the location following the location of the last processing station determining the
20 sorting criteria. The electronic components to be sorted are placed from the main processing line onto the additional conveyor, along which the different exit stations are arranged. Each electronic component to be sorted is brought on the additional conveyor to the exit station corresponding to its category. Such a conveyor is outlined for example in patent US-4485914.

25 A critical point of any conveying system for electronic components, and in particular of a conveying system for sorting electronic components as mentioned here above, concerns the device for evacuating the components towards the exit station or stations. Such a device must be accurate and fast in order to evacuate the desired electronic component
30 towards the correct exit station without slowing down the rate of the

processing line. Thus, for example, use of slow and complex mechanical elements is to be avoided.

With the prior art devices for evacuating electronic components, such as for example grasping devices, for example pincers, or nozzles
5 aspirating the electronic components through air vacuum, generally entail an appropriate number of moving mechanical parts and their processing speed is consequently often restricted. Furthermore, because of their complexity, these devices are often expensive, which is a non-negligible inconvenient, in particular in a conveying system for sorting electronic
10 components in which the number of exit stations, and consequently the number of evacuation devices, can be relatively high.

One aim of the invention is thus to propose a conveying system for electronic components comprising a simple device for evacuating electronic components.

15 Another aim of the invention is to propose a conveying system for electronic components comprising a fast component evacuation device.

Another aim of the invention is to propose a conveying system for electronic components comprising an accurate component evacuation device.

20 Another aim of the invention is to propose a conveying system for electronic components comprising a component evacuation device entailing a minimum number of moving mechanical parts.

These aims are achieved by a conveying system for electronic components having the characteristics of the independent claim, the
25 characteristics of preferred variant embodiments of the invention being described in the dependent claims.

In particular, these aims are achieved by a conveying system for electronic components comprising a conveyor, at least one component-

holder for transporting electronic components and at least one compressed-air exit for evacuating the electronic components of the component-holder or holders, thus allowing a fast and accurate evacuation of the components, without using any moving mechanical parts.

- 5 The present invention will be better understood with the aid of the description of a preferred embodiment given by way of illustrative but by no means limiting example, illustrated by the figures 1 to 4.

Fig. 1 is a cross sectional view from above along the axis I-I of the conveying system according to the preferred embodiment of the invention.

- 10 Fig. 2 is a lateral sectional view along the axis II-II of the conveying system according to the preferred embodiment of the invention.

Fig. 3 is a detailed view showing more particularly the electronic component evacuation device.

- 15 Fig. 4 is a sectional view along the axis IV-IV of the evacuation device.

- In its preferred embodiment, the conveying system according to the invention illustrated in Figure 2 comprises a conveyor in the form of a conveyor line 1 on which component-holders 2 are regularly placed. Preferably, each component-holder 2 is designed to receive a single
 20 electronic component 9. The electronic components 9 are placed on the conveyor line 1 for example from a main processing line on which, for example, they have been tested electrically. The main processing line 8 comprises for example a circular conveyor in the shape of a barrel whose rotational movement is indexed so as to present at each step one of its
 25 component-holders 80 above the conveyor line 1. The movement of the conveyor line 1 is preferably also indexed and synchronized with the movement of the main processing line 8, thus presenting a new component-holder 2 under the barrel's component-holder 80 at each step of the conveyor of the main processing line 8. Each electronic component 9

transported by the main processing line 8 can thus be placed on an empty component-holder 2 of the conveyor line 1.

Exit stations, for example receptacles 4 capable of receiving several components, are placed along the conveyor line 1. In its preferred embodiment, the conveying system according to the invention can thus serve for example to sort the electronic components 9 it transports by evacuating each into one of the receptacles 4 according to certain characteristics, for example according to the results of previous tests. To each receptacle 4 corresponds a compressed-air exit 30 allowing an electronic component 9 of a component-holder 2 to be evacuated towards the corresponding receptacle 4, as indicated by the arrows b of Figure 1. The air exits 30 are placed so as to allow the electronic components 9 to be evacuated during the stopping time of the conveyor line 1. The air exits 30 are preferably constituted of tubes whose lower part is held along an angle more or less equal to 45° relative to the vertical axis in a frame 3 covering the portion of conveyor line 1 that is between the exit stations 4.

The conveyor line 1 is driven in the direction of arrow a by an indexed motor represented diagrammatically by the wheels 11 (Figure 2).

With reference to Figures 3 and 4, the component-holder 2 is fastened, for example glued, screwed or riveted, to the belt 10 of the conveyor line 1. The belt 10 slides in a rail 12 that serves both as guide and as support ensuring thus a correct positioning of the component-holder 2 relative to the receptacle 4 and to the compressed-air exit 30 and ensuring also its stability during evacuation of the electronic component 9.

The evacuation device of the electronic components 9 comprises essentially a compressed-air exit 30 associated to the resting surface 20 of the component-holder 2 as well as guides constituted by the lateral sides 21 of the component-holder 2. The compressed-air exit is preferably constituted of a tube 30 whose lower part is held along an angle more or less equal to 45° relative to the vertical axis in the frame 3 and connected by its upper extremity to a pneumatic system, not represented. The lower

extremity of the tube 30 is held at close distance to the component-holder 2, close to the extremity of the resting surface 20 opposite the opening 40 of the receptacle 4. If the electronic component 9 that is on the component-holder 2 is to be evacuated into the receptacle 4, a blast of compressed air is insufflated into the tube 30. The air blast is guided between the lateral sides 21 of the component-holder 2 along the resting surface 20 in the direction of the electronic component 9 which it drives towards the opening 40 of the receptacle 4. The frame 3 comprises a clearance 31 opposite the opening 40 of the receptacle 4 allowing access of the electronic component 9 to the receptacle 4. The resting surface 20 onto which the electronic component 9 is deposited is preferably elliptical and concave, thus giving the electronic component 9 an elliptical trajectory during its evacuation, preventing it from being projected horizontally through the opening 40 against the opposite side of the receptacle 4.

Thanks to the symmetrical shape of the resting surface 20 relative to the traveling direction of the belt 10, the electronic component 9 can be evacuated indifferently on one side or the other of the resting surface 20 according to the position of the compressed-air exit 30, thus making it possible to place receptacles 4 on both sides of the conveyor line 1. Except for its part comprising the clearance 31, the frame 3 covers the component-holder 2 so as to prevent the electronic components 9 from coming out involuntarily, for example when the conveyor line 1 is moving.

Thanks to the concave shape of the resting surface 20, the electronic component 9 has a tendency to slide towards the center of the component-holder 2 under the pull of gravitational force only, whatever the accuracy with which it was deposited on it, thus ensuring that it is correctly positioned before being evacuated by the compressed-air blast.

After having been deposited by the main processing station 8 on the component-holders 2, the electronic components 9 are transported by the conveyor line 1 towards a series of receptacles 4 into which they are evacuated according to characteristics previously determined, for example according to the results of electric tests performed on the main processing

line 8. To each receptacle 4 corresponds a compressed-air exit 30, thus constituting each time an evacuation device such as described above. When an electronic component 9 finds itself opposite the compressed-air exit 30 corresponding to the receptacle 4 into which it is to be evacuated, a blast
 5 of compressed air is rapidly discharged by the relevant compressed-air exit 30. The air sweeps the resting surface 20 of the component-holder 2 from the compressed-air exit 30 towards the receptacle 4, driving with it the electronic component 9 that is thus evacuated into the receptacle 4. The lateral sides 21 of the component-holder 2 serve as guide to the blast of
 10 compressed-air and prevent the electronic component 9 from leaving its trajectory. The clearance 31 in the frame 3 also makes it possible to ensure the trajectory of the electronic component 9 and to allow its access to the opening 40 of the receptacle 4.

The evacuation of the electronic components 9 from their
 15 component-holders 2 thus entails no movement of a mechanical element. The evacuation of the electronic component 9 is fast and its accuracy is ensured by the shape of the resting surface 20, associated to the direction of the compressed-air exit 30.

The position of the air exits 30 over one of the extremities of the
 20 component-holders 2 allows the electronic components 9 to be evacuated on one side or the other of the conveyor line 1. The orientation of the lower part of the tubes 30, which is preferably inclined towards the resting surfaces 20 along an angle more or less equal to 45 degrees relative to the vertical axis, associated to the elliptical shape of the resting surfaces 20,
 25 allow a fast and efficient evacuation of the electronic components 9, without however the compressed-air blasts being directly aimed at them, thus preventing them from being evacuated too directly or too suddenly, which could damage them. In fact, the air blast of each evacuation device is preferably aimed towards a part of the resting surface 20 that is free from
 30 any electronic component, preferably just before the electronic component 9 to be evacuated. As the air blast arriving against this part of the resting surface 20 with a certain incident angle, the shock wave constituted by the air blast immediately after coming out of the tube 30 is considerably

lessened. The breath of air thus glides along the resting surface 20, lifting the electronic component 9 whilst pushing it laterally towards the opening 40 of the receptacle 4, thus also avoiding that it remains blocked on the component-holder 2, for example because of an asperity on the resting surface 20. The one skilled in the art will however recognize that other orientations of the air exits 30 can be conceived. In particular, the lower part of the tubes 30 can be positioned vertically over one of the extremities of the resting surface 20. The air exits can also be situated under the electronic components to be evacuated, albeit at the cost of an adaptation of the component-holders 2.

The indexed and synchronized movement of the main processing line 8 and of the conveyor line 1 makes it possible for a controller, not represented, to know at each moment the exact position of each electronic component 9, thus allowing these electronic components 9 to be sorted into the different receptacles 4 according to certain parameters. The controller is for example informed by the test stations of the main processing line 8 of the results of the tests performed on each electronic component 9. The controller thus determines, according to these results and to pre-established criteria, towards which receptacle 4 each electronic component 9 is to be evacuated. Being aware at any time of the position of each electronic component 9, the controller gives, at each step of the conveyor line 1, the order to the pneumatic system to expulse an air blast through each compressed-air exit 30 close to which an electronic component 9 to be evacuated towards the corresponding receptacle 4 is located. In a variant embodiment of the invention, the movement of the conveyor line 1 is continuous, which makes it easier to drive it but requires a greater accuracy of the controller.

In the preferred embodiment of the invention, the trajectory of the electronic components 9 during their evacuation is partially determined by the lateral sides 21 of the component-holder 2 which thus acts as a guide. The one skilled in the art will however recognize that this guiding function can be fulfilled by other types of guides, such as for example rails or slides formed directly onto the resting surface 20, portions of the frame

3, a tube into which the electronic component 9 is placed and at the extremity of which a blast of compressed air is insufflated to evacuate the electronic component 9 through the other extremity, etc.

5 The preferred embodiment of the inventive conveyor described here above is given by way of illustrative example. The one skilled in the art will easily understand that the principle of the evacuation device can be realized in different manners. In particular, it is possible to orient the air exits in other directions as that described here above, for example to orient them vertically. It is also possible to orient the air exits directly on the side
10 or under the electronic component 9 to be evacuated. The shape of the resting surface of the component-holders can also be modified, in particular it can be adapted to the orientation of the air exits.

The one skilled in the art will be recognized that, similarly, the air exits 30 can be replaced by breathers connected to a pneumatic system
15 allowing the electronic components 9 to be aspirated towards the corresponding receptacles 4, this embodiment having however the main disadvantage that the control of the trajectory and of the evacuation force of the electronic components is made harder to control, thus risking damaging the components.

20 The one skilled in the art will also recognize that the conveyor of the conveying system according to the invention can also be different from a conveyor line. It could for example be a circular conveyor comprising a barrel, etc.

In another embodiment of the invention, the resting surfaces
25 onto which the electronic components are deposited are integrated to the conveyor. They are for example directly formed on the upper surface of the conveyor line's belt or on the periphery of the circular conveyor. In another embodiment of the invention, the conveyor is a conveyor line whose belt is formed of a succession of component-holders connected flexible to one
30 another.

Claims

1. Conveying system for electronic components comprising a conveyor (1), said conveyor (1) comprising at least one component-holder (2) for transporting at least one electronic component (9), characterized in that it comprises at least one compressed-air exit (30) for evacuating said at
5 least one electronic component (9) from said at least one component-holder (2).
2. Conveying system according to the preceding claim, comprising a plurality of compressed-air exits (30) for evacuating said at least one
10 electronic component (9) into different receptacles (4) under the command of a controller.
3. Conveying system according to the preceding claim, for sorting a plurality of electronic components (9) according to predetermined characteristics.
4. Conveying system according to one of the preceding claims, said
15 at least one component-holder (2) comprising a portion towards which said at least one electronic component (9) tends to slide of itself under the pull of the gravitational force, said at least one compressed-air exit (30) being placed so as to be able to dislodge said at least one electronic component (9) from said portion in order to evacuate said at least one electronic
20 component (9) from said at least one component-holder (2).
5. Conveying system according to one of the preceding claims, said conveyor being a conveyor line (1).
6. Conveying system according to one of the preceding claims, said
25 at least one compressed-air exit being directed towards part of said at least one component-holder (2) free from any electronic component.
7. Conveying system according to one of the preceding claims, said compressed-air exit (30) being oriented along an angle more or less equal

to 45 degrees relative to the vertical axis over the upper side of said at least one component-holder (2).

8. Conveying system according to the preceding claim, said compressed-air exit being positioned over one of the extremities of said at
5 least one component-holder (2).

9. Conveying system according to one of the preceding claims, said component-holder (2) comprising a resting surface (20) at least partially elliptical.

10. Conveying system according to the preceding claim, said
10 component-holder (2) comprising at least one guide (21) determining the trajectory of said at least one electronic component (9) during its evacuation.

11. Conveying system according to the preceding claim, said at least one guide being constituted by the lateral sides (21) of said at least one
15 component-holder (2).

12. Component-holder (2) for conveying system for electronic components comprising a resting surface (20) for transporting at least one electronic component (9), said resting surface (20) comprising a portion towards which said at least one electronic component (9) tends to slide of
20 itself under the pull of the gravitational force, characterized in that the shape of said resting surface is chosen so that said at least one electronic component (9) can be evacuated according to a determined trajectory of said component-holder (2) by the force of a blast of compressed air coming from a compressed-air exit placed over said resting surface (20).

25 13. Component-holder (2) according to the preceding claim, said resting surface (20) being at least partially elliptical.

14. Component-holder (2) according to one of the claims 12 or 13, comprising at least one guide (21) for guiding the trajectory of said at least

one electronic component (9) during the evacuation of said at least one electronic component (9) from said component-holder (2).

15 15. Component-holder according to the preceding claim, said at least one guide (21) being constituted by the lateral sides of said component-holder (2).

10 16. System for processing electronic components, comprising a main processing line (8), a conveying system according to one of the claims 2 to 11 and a controller, characterized in that the evacuation of said at least one electronic component (9) towards said different receptacles (4) is
10 commanded by the controller according to characteristics determined on said main processing line (8).

17. System according to the preceding claim, said characteristics being the results of tests.

15 18. System according to the preceding claim, said characteristics
15 being the results of electric tests.