SYSTEM AND METHOD FOR IC UNIT SINGULATION AND SORTING

Field of the Invention

The invention relates to the processing of IC units including separation (singulation) from a substrate and subsequently sorting said IC units for offloading.

Background

Maintaining UPH rates (units per hour) is a critical KPI for unit processing systems. Coupled with managing reject units before offloading, efficiently removing reject units without disrupting the UPH rate is an on-going problem.

However, the processing of IC units needs to be measured by actual delivered product. When rejecting units within the processing stream, individual packages may be missing units that have been removed from the processed batches. This involves customizing batches to ensure each package is complete, ultimately slowing the UPH.

It would be advantageous if a batch process could be maintained as part of the processing cycle, without resorting to customized processing to complete package quantities.

Summary of Invention

In a first aspect, the invention provides a unit sorting system comprising: a net table for receiving units and a unit lifter arranged to deposit said units on the net table; a gang pusher arranged to selectively push rows of said units from the net table to an offloader.

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In a second aspect, the invention provides a method for sorting units, the method comprising the steps of: engaging a batch of units using a unit lifter; depositing the batch on a net table; identifying defective units to be rejected; lifting the defective units from the net table so as to leave gaps in said batch; pushing rows of sub-batches of units into corresponding rows of an offloader; selectively declining one or more rows of a last sub-batch where the corresponding rows of the offloader have reached capacity.

Accordingly, by including the ability to selectively control the number of units being packaged, as part of the processing cycle, UPH levels are maintained and customised processing is not necessary.

Brief Description of Drawings

It will be convenient to further describe the present invention with respect to the accompanying drawings that illustrate possible arrangements of the invention. Other arrangements of the invention are possible, and consequently the particularity of the accompanying drawings is not to be understood as superseding the generality of the preceding description of the invention.

Figure 1 is an elevation of a pick & place and gang pusher arrangement according to one embodiment of the present invention;

Figure 2 is an isometric view of the pick & place and gang pusher arrangement of Figure 1;

Figure 3 is a back detail view of the pick & place and gang pusher arrangement of Figure 1;

Figure 4 is a side detail view of the pick & place and gang pusher arrangement of Figure 1;

Figure 5 is an isometric view of a net table sorting arrangement according to one embodiment of the present invention, and;

Figures 6A and 6B are isometric views of a net table sorting arrangement according to one embodiment of the present invention.

Detailed Description

Figures 1 to 4 show various views of a unit picker array 5 having a plurality of unit pickers 15. The figures further show a gang pusher 10. The gang pusher includes a pusher assembly 20 having a plurality of unit pushers 30 for pushing units into rows 90 of the offloader 100 (Figure 5).

The gang pusher is arranged to push sub-batches of the units onto the offloader. Each of the unit pushers 30 includes a pushing surface 60, with the surface 60 selectively movable through rotationally mounted pusher fingers 40. The pusher fingers, which are alignable with rows of the net table, rotate about a hinge 55 to lift the pushing surface clear of the net table rows 85. The pushing surface is selectively arranged to move from a first position such that the pushing surface is arranged to contact the units in the net table row, to a second position such that the pushing surface does not engage units in that row. That is, the system can selectively push sub-batches of units onto the offloader, or raise the pusher finger to clear the pusher surface above the net table and so not push the respective row. As there are a plurality of the rotationally mounted pusher fingers, the system can selectively push one or more rows, while bypassing other rows during the offloading process.

In operation, a unit lifter 15 picks up the individual units using a vacuum engagement 35, and then places them in two batches on each side 75A, 75B of the net table 70 as seen in Figure 5. The arrangement of the units in each array is in the form of a checkerboard pattern to provide greater clearance about individual units as compared to the prior art having a dense array of units with the possibility of interference when engaging the unit pickers.

As part of an upstream process which may be achieved by a prior art system, each of the units having being inspected upstream have already been characterised as being accepted or rejected. Prior to delivering the units to the net table 70, a control system will have already identified defective units that are to be rejected. The control system guides the unit pickers 35 to each of the rejected units to be removed. Thus, as shown in Figure 5, the net table 70 has the full load of units placed on the two halves 75A, 75B of the net table 70. Figures 6A and 6B show the net table prior to removal of the defect units (Figure 6A) and the result of the unit pickers having removed the rejected units from the net table 70 (Figure 6B) and therefore having gaps or voids 110 in the unit array.

As can be seen in Figure 5, the units 95 in the rows 90 of the delivery chute 100 correspond to a preceding batch of units. The rows of units being pushed onto the offloader may include voids 110 because of the removed units. Thus, as the units from the net table are loaded to the offloader, individual rows 92 may not have sufficient units to fill the package corresponding to that offloader row. To overcome this, all the units are pushed onto the offloader, with the system counting units in each row. On the final sub-batch of units, if a particular row already has sufficient units for that package, the pusher finger corresponding to that row is lifted, and so no further units are pushed onto the offloader row. The arrangement allows for the

maximum number of available units to be offloaded, with a final decision being taken on the last pass to decline pushing further units into any rows having sufficient units. These remaining units can then be offloaded onto a different row later in the process.

Thus, by having the selection process selecting which units to add, no customised process of adding additional units to the net table is necessary; the system completes the process. Maximising the units to be offloaded per row, then then deciding on the last pass if any rows need to be topped up, or whether there are already sufficient units, and so use the selectively rotation pusher fingers to prevent further units being added, on a row-by-row basis.

Claims

1. A unit sorting system comprising:

a net table for receiving units and a unit lifter arranged to deposit said units on the net table;

a gang pusher arranged to selectively push rows of said units from the net table to an offloader.

2. The unit sorting system according to claim 1, further including a control system for identifying defective units;

wherein said control system is arranged to control the unit picker to engage and remove said defective units from the net table.

3. The unit sorting system according to claim 1 or 2, wherein the gang pusher includes a plurality of pusher fingers, each pusher finger alignable with a row of said net table;

such that the pusher finger is arranged to push a row of units onto the offloader.

4. The unit sorting system according to claim 3, wherein the pusher fingers each include a pushing surface arranged to contact said units;

said pushing surface selectively arranged to move from a first position such that the pushing surface is arranged to contact the units, to a second position such that the pushing surface does not engage units in that row.

5. The unit sorting system according to claim 4, wherein the pushing surface are arranged to move from the first to the second position through rotational movement of the respective pusher finger.

6. A method for sorting units, the method comprising the steps of:

engaging a batch of units using a unit lifter;

depositing the batch on a net table;

identifying defective units to be rejected;

lifting the defective units from the net table so as to leave gaps in said batch;

pushing rows of sub-batches of units into corresponding rows of an offloader;

selectively declining one or more rows of a last sub-batch where the corresponding rows of the offloader have reached capacity.

7. The method according to claim 6, wherein the rows are pushed by a gang pusher having a plurality of pusher fingers, each pusher finger alignable with a row of said net table;

such that the pusher finger is arranged to push a row of units onto the offloader.

8. The method according to claim 6 or 7, wherein the pusher fingers each include a pushing surface arranged to contact said units;

said pushing surface selectively moving from a first position such that the pushing surface is contacting the units, to a second position such that the pushing surface is not contacting the units in that row.

9. The method according to claim 8, wherein the moving step from the first to the second position includes rotationally moving the respective pusher finger.