

LEADFRAME HANDLING SYSTEM AND METHOD THEREFOR

Field of the Invention

5 **[0001]** The present invention relates to leadframe handling system. Particularly, the present invention relates to a Leadframe handling system and method having a belt index pallet transfer.

Background

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[0002] The increasing demand over the electronic sectors has risen the need for high volume leadframe handling apparatus. One of the leadframe handling process includes laser processing. To laser process the leadframes, which come in bulk, the leadframes are to be loaded on pallet of a suitable size and configuration. The pallet
15 carries the leadframe along the laser processing path such that the laser processing can be performed automatically.

[0003] Loading and unloading the leadframe on/from the pallet can be labour intensive and time consuming. An efficient leadframe processing may require multiple
20 laser device to process multiple lead frames simultaneously, which increase the footprint.

[0004] During the leadframe handling operations, it is often required that each component on the leadframe is being processed. For example, when laser cutting operation is carried out, each package on the leadframe will be undergoing the laser
25 process, and the laser has to be positioned over each and every single package. That put

a lot of burden on the machinery holding the laser device to process the leadframe is a high speed and precision.

Summary

5 **[0005]** In one aspect, the present invention provides a leadframe handling system comprises a central controller; a pallet for holding leadframe to be processed and handled; a two-tier conveyor loop having an handling track, a return lift, a return track and a supplying lift arranged in that manner forming a loop for conveying the pallet over the loop; and a laser disposed along the handling track, operably process the leadframe
10 loaded on the pallet. When the pallet reaches at the end of the handling track, the leadframe is unloaded from the pallet is conveyed to the return lift, and the return lift lifts the pallet to load onto the returning track, the returning track conveys the pallet the supplying lift to load a new leadframe, thereby recycling the pallet endlessly for loading and assembling parts and components along the assembly track.

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[0006] In one embodiment, each of the return lift and the supplying lift comprises a magnetic drive unit for driving the pallet in and out of the lifts, and each of the return track and supplying lift comprises a plurality of magnetic drive units for conveying the pellets over the convey paths, each of the magnetic drive units is controllable bi-
20 directionally and independently by the central controller.

[0007] In an alternative embodiment, the system further comprises a conveying vehicle adapted as a based platform for the pallet, wherein the conveying vehicle is moveably mounted along conveying loop through guiding rails, and movement of the
25 conveyor vehicle is driven by the magnetic drive units.

[0008] In a further embodiment, the lifts are driven by telescopic piston.

Brief Description of the Drawings

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[0009] This invention will be described by way of non-limiting embodiments of the present invention, with reference to the accompanying drawings, in which:

[0010] FIG. 1 illustrates a schematic diagram of a leadframe handling system in
10 accordance with an embodiment of the present invention;

[0011] FIG. 2 illustrates a perspective view of the lead frame handling conveyor of the lead frame handling system in accordance with an embodiment of the present invention;

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[0012] FIG. 3 illustrates a side view of a conveying vehicle mounting on magnetic drive assembly in accordance with an embodiment of the present invention; and

20 **[0013]** FIG. 4A illustrates a conveying flow of conveyor loop in accordance with an embodiment of the present invention.

FIG. 4B illustrates a conveying flow of conveyor loop in accordance with an alternate embodiment of the present invention.

Detailed Description

[0014] In line with the above summary, the following description of a number of specific and alternative embodiments are provided to understand the inventive features of the present invention. It shall be apparent to one skilled in the art, however that this invention may be practiced without such specific details. Some of the details may not be described at length so as not to obscure the invention. For ease of reference, common reference numerals will be used throughout the figures when referring to the same or similar features common to the figures.

10 [0015] FIG. 1 illustrates a schematic diagram of a leadframe handling system **100** in accordance with an embodiment of the present invention. For easy of illustrations, the leadframe handling system **100** is a system adapted for processing a leadframe **105** with laser. In other embodiment, the leadframe handling system **100** may comprising other handling tools for processing leadframe. The system **100** comprises pallets **101**, pallet
15 conveying loop, a leadframe tray **106**, a leadframe picker **108**, and a laser **150**. The pallet conveying loop comprises a handling track **122**, a returning lift **124**, a returning track **126** and a supplying lift **128**, arranged in that order forming a conveying loop. The handling track **122** and returning track **126** are arranged as two-tiers track. Preferably, the handling track **122** is arranged on top of the returning track **126**. In such
20 configuration, the footprint of the leadframe handling system **100** can be reduced. The handling track **122** and returning track **126** may each comprise a plurality of magnetically driving device having coils for moving the pallet along the guiding track.

[0016] The leadframes **105** to be processed are loaded on the leadframe tray **106**
25 to standby. The pallet **101** are conveyed to a loading bay, wherein the leadframe picker

108 picks an unprocessed leadframe **105** and loads the same onto the pallet **101**. The pallet **101** loaded with the leadframe **105** is then conveyed onto the handling track **122**. The handling track **122** is a magnetically driven conveyor comprising magnetic drivers. The magnetic drivers are electrically connected and controlled by a controller. To function with the magnetically driving device, the pallet is mounted on permanent magnets having magnetic pole that creates a magnetic flux 90 degree relative to the coils. In this configuration, the system utilizes static coils to move/drive permanent magnets in a linear direction. The drive system is bidirectional such that the pallets can freely move linearly back and forth at each handling/processing bay.

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[0017] The handling track **122** conveys the pallet **101** to a laser bay on the other end, whereby the laser **150** is positioned above thereof. Once the leadframe **105** is processed by the laser **150**, the pallet **101** conveyed further to an unloading bay to empty the pallet **101**. Preferably, the unloading bay is positioned at the returning lift **124**, wherein once unloads, the emptied pallet **101** is lifted to the returning track **126**. As illustrated, the emptied pallet **101** is lifted down to the returning track **126** because the returning track **126** is disposed at the lower tier of the two-tier track system, i.e. below the handling track **122**.

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20 [0018] Without limitations, the laser **150** is adapted to provide handling such as laser marking, welding and/or trimming or the like.

[0019] It follows that when the emptied pallet **101** reaches the returning track **126**, it is conveyed over the returning track **126** towards the supplying lift **128**. The supplying lift **128** then, at an appropriate time, lifts it up and then to the loading bay.

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[0020] The system **100** is adapted to move each individual pallet flexibly and orderly to ensure smooth and efficient operations. This is achievable as the handling track **122** and the returning track **126** comprising a plurality of magnetic drive modules, whereby each of the driving modules can be turned on or off independently to control the flow of the conveying pallets.

[0021] In one embodiment, the system **100** comprises shuttles that movably coupled with the magnetic drive of the handling track **122** and the returning track **126**, and the returning and supplying lifts. The shuttles provide a unifying platforming for mounting the pallets of the different sizes and configurations.

[0022] In one embodiment of the present invention, most part of the system **100** can be enclosed within a housing to keep debris, if any, within the housing.

[0023] In a further embodiment, the leadframe tray **106** is disposed outside of the housing for loading and unloading.

[0024] In yet a further embodiment, the handling system **100** may further comprise an inspection system and an inspection bay along handling track. More handling tools and handling bay may also be adapted in the present system **100**.

[0025] FIG. 2 illustrates a perspective view of the lead frame handling conveyor of the lead frame handling system **100** in accordance with an embodiment of the present invention. The conveyor **200** is driven by magnetic force, which has the advantage conveying means with no or minimal wear and tear. Further, magnetic drive can also be performed in a high speed and precision. The conveyor **200** comprises a plurality of

conveying vehicles **250**, a supplying lift **210**, a first magnetic drive assembly **220**, a returning lift **230** and a second magnetic drive assembly **240**. The first magnetic drive assembly **220** is located above the second magnetic drive assembly **240** in parallel. The first magnetic drive assembly **220** is adapted to operably conveyed in a forward direction and the second magnetic drive assembly **240** is adapted to operably conveyed in a backward direction. The supplying lift **210** and the returning lift **230** are positioned at the respective ends of the two magnetic drive assemblies, connecting thereof to form a conveying loop. The plurality of the conveying vehicles **250** are adapted to be conveyed on the conveying loop.

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[0026] The first and second magnetic drive assemblies **220** and **240** comprises magnetic drivers **222** mounted along the conveying paths of the conveyor loop. The first and second magnetic drive assemblies may further comprise a secondary guide rail to provide that gives extra support and movement guidance to the conveying vehicles **250**.

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[0027] The supplying and returning lifts **210** and **230**, each comprises a supporting frame **211**, a telescopic piston **222** standing adjacent to the supporting frame **211**, a lift carrier **224** attached to the telescopic piston **222** to drive it moving up and down between the first magnetic drive assembly **220** and the second magnetic drive assembly **240**. Each of the carrier **224** may further comprise a magnetic driver for controlling movements of the conveying vehicles **250** on the carrier **224**. The magnetic driver on the carriers assist loading and unloading of the conveying vehicles **250** from/to the conveyor loop.

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[0028] FIG. 3 illustrates a side view of a conveying vehicle **250** mounting on magnetic drive assembly **320** in accordance with an embodiment of the present invention. As shown, the magnetic drive assembly **320** comprises a magnetic drive unit **322** is mounted above a pair of guiding rails **324** on a supporting frame **326**. The two guiding rails **324** provide a moveable support to the conveying vehicles **250**, while the magnetic drive unit **322** operationally drives the conveying vehicles **250** contactlessly. Magnetic drive unit **322** has advantages of moving the conveying vehicles **250** in high speed and precision. Each of the drive unit **322** is highly controllable independently which offer a great flexibility over conveying the conveyor vehicles **250** that suite the production needs.

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[0029] FIG. 4A illustrates a conveying flow of conveyor loop in accordance with an embodiment of the present invention. The conveyor loop comprises two linear conveyors G and D and two conveying paths connecting the two linear conveyors G and D to form the conveyor loop. On a main conveying path, there is provided three processing bays A, B and C, and a return conveying path, another two processing bays E and F. Each of the linear conveyor and processing bays may comprise one or more magnetic drive motors to work in conjunctions with the magnets of the shuttles for precision movements and controls. Leadframe handling and processing can be done over main convey path, and if required, certain handling or processing can be performed over the return convey path. The shuttle that conveys over the conveyor loop is movable in bi-directions controllable by a center controller (not shown). Such convey loop offers a great flexibility and highly customizable.

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[0030] In one embodiment, the conveyor loop is configured in a horizontal arrangement.

[0031] In another embodiment, the conveyor loop is configured in a vertical arrangement with the two conveying paths disposed on top of another. Specifically, FIG. 4A can be the conveying path A, B, C position on top of conveying path E and F, and the linear conveyor D and G are lifts or elevating conveyor connecting the two ends of the conveying paths to form the conveying loops. When a shuttle reaches the end of a conveying path, it is conveyed onto the lift and subsequently transport it to the next conveying path. The configuration accomplishes a forward and return conveying loops for conveying and transporting the shuttles endlessly over the loops.

[0032] FIG. 4B illustrates a conveying flow of conveyor loop in accordance with an alternative embodiment of the present invention. Similarly, the entire conveyor loop is adapted with individually controlled and driven magnetic drives throughout the conveyor loop. In this illustrated embodiment, it too comprises two conveying paths that run across handling and processing bays A, B, C, F, and G. The two respective ends of the conveying paths are connected by curve conveyors to form the conveyor loop. The two curve conveyors may comprise handling and processing bays D, E and H. Each of the conveying parts and conveyors loops comprises one or more magnetic drive motors to work in conjunctions with the magnets of the shuttles for precision movements and controls. The shuttle that conveys over the conveyor loop is movable in bi-directions controllable by a center controller (not shown).

[0033] In the above embodiment, the conveying loop is configured in a horizontal arrangement.

[0034] The bidirectional linear movements driven by the magnetic drive motors offers a high speed and high precision movements in assisting the handling tools to be carried out over all the packages or die on each the leadframe at each handling/processing bay.

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[0035] While specific embodiments have been described and illustrated, it is understood that many changes, modifications, variations and combinations thereof could be made to the present invention without departing from the scope of the invention.

Claims

1. A leadframe handling system comprising:
 - a central controller;
 - a pallet for holding leadframe to be processed and handled;
 - 5 a two-tier conveyor loop having an handling track, a return lift, a return track and a supplying lift arranged in that manner forming a loop for conveying the pallet over the loop;
 - a laser disposed along the handling track, operably process the leadframe loaded on the pallet;
 - 10 wherein, when the pallet reaches at the end of the handling track, the leadframe is unloaded from the pallet is conveyed to the return lift, and the return lift lifts the pallet to load onto the returning track, the returning track conveys the pallet the supplying lift to load a new leadframe, thereby recycling the pallet endlessly for loading and assembling parts and components along the assembly track.
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2. The leadframe handling system according to claim 1, where each of the return lift and the supplying lift comprises a magnetic drive unit for driving the pallet in and out of the lifts, and each of the return track and supplying lift comprises a plurality of magnetic drive units for conveying the pellets over the convey paths, each of the magnetic drive
20 units is controllable bi-directionally and independently by the central controller.
3. The leadframe handling system according to claim 2, further comprising a conveying vehicle adapted as a based platform for the pallet, wherein the conveying vehicle is moveably mounted along conveying loop through guiding rails, and movement
25 of the conveyor vehicle is driven by the magnetic drive units.

4. The leadframe handling system according to claim 1, wherein the lifts are driven by telescopic piston.