

WAFER BOX CONVEYOR

Technical Field

The present invention relates to the field of transportation and, in particular, to a cassette transport device.

Background

With the development of semiconductor technologies, 300 mm wafers will gradually replace 200 mm wafers to become the mainstream. Accordingly, the total weight of a wafer cassette fully loaded with wafers will increase from about 4 kg to about 8 kg, subjecting manual handling and transportation to low efficiency and the risk of operator injuries. Traditionally, such cassettes are transported manually using trolleys or carts. This approach is, however, associated with a number of drawbacks including low transportation efficiency, intensive labor, heavy contamination, a low degree of automation and great turning radii. These deficiencies are getting worse and worse in the context of increasingly demanding requirements for higher utilization of semiconductor fabrication plants (fabs).

In order to overcome the above problems, most contemporary 300-mm fabs employ automated material handling systems (AMHSs) in which overhead hoist transfer (OHT) vehicles follow overhead tracks to transport wafer cassettes between process equipment and temporary storage shelves. However, such systems are not affordable to most traditional semiconductor manufacturers because they require expensive fab retrofits for constructing AMHS tracks and other supporting facilities.

Content of the Invention

Problem to be solved

It is an objective of the present invention to overcome the above problem of requiring expensive construction of AMHS tracks for cassette transportation by providing a cassette transport device.

Technical Solution for solving the problem

To this end, the cassette transport device provided in the present invention including a smart cart; a base expansion frame mounted on the smart cart; and a cassette-loading frame fixed to the base expansion frame, the cassette-loading frame being partitioned into several segments each accommodating a plurality of cassette trays,

wherein each of the cassette trays defines, on a surface thereof, a first trough and a second in the first trough, the first trough being configured to retain a cassette of a first size, the second trough being configured to retain a cassette of a second size.

Optionally, in the cassette transport device, the second trough may be provided with at least two spring-based locking assemblies.

Optionally, in the cassette transport device, the second trough may be provided with four spring-based locking assemblies disposed at respective four corners of the second trough.

Optionally, in the cassette transport device, the first trough may be provided with at least three pin-based locking assemblies.

Optionally, in the cassette transport device, the first trough may be provided with three pin-based locking assemblies disposed to define a triangle.

Optionally, in the cassette transport device, each of the cassette trays may be provided with at least three stress sensors on a backside thereof, the at least three stress sensors being not arranged on a same line.

Optionally, in the cassette transport device, each of the cassette trays may be provided with three stress sensors on a backside thereof, the three stress sensors being disposed on a backside of the second trough corresponding to three edges of the second trough.

Optionally, in the cassette transport device, each of the cassette trays may be further provided with at least one photoelectric sensor on a backside thereof, the at least one photoelectric sensor configured for detecting presence of cassettes.

Optionally, in the cassette transport device, the cassette-loading frame may be provided with RFID sensors for obtaining ID information of cassettes.

Optionally, in the cassette transport device, each of the RFID sensors may include two antennas for obtaining ID information of the cassettes, one of the two antennas configured for detecting the cassette of the first size and the other one of the two antennas configured for detecting the cassette of the second size.

Optionally, in the cassette transport device, a plurality of buffers may be disposed between the smart cart and the base expansion frame.

Optionally, the cassette transport device may further include a plurality of obstacle avoidance sensors.

Optionally, in the cassette transport device, the plurality of obstacle avoidance sensors may include: ultrasonic sensors, horizontal sensors and vertical sensors, the ultrasonic sensors being disposed in symmetry on front and rear sides of the base expansion frame that oppose each other along a direction in which the smart cart travels, the horizontal sensors being disposed in symmetry on left and right sides of the base expansion frame, the vertical sensors being disposed in symmetry on left and right sides of the cassette-loading frame.

Optionally, in the cassette transport device, the first size may be 12 inch and the second size may be 8 inch.

Effects of the Invention

In the cassette transport device of the present invention including the smart cart, the base expansion frame mounted on the smart cart and the cassette-loading frame fixed to the base expansion frame, the cassette-loading frame is partitioned into several segments each accommodating multiple cassette trays, and each of the cassette trays defines, on its surface, a first trough for retaining a cassette of a first size a second trough that is surrounded by the first trough and configured to retain a cassette of a second size. With the first and second troughs, each of the cassette trays is able to retain a cassette of either the first or second size, making the cassette transport device possible to be used in transportation of the both types of cassettes with a high yield. Moreover, the smart cart is capable of automated transportation without human intervention or track construction while enabling savings in transportation cost, time and labor.

Brief Description of The Drawings

Fig. 1 is a schematic view of a cassette transport device according to a first embodiment of the present invention.

Fig. 2 schematically illustrates the authentication of a 12" cassette by an RFID sensor in accordance with the first embodiment of the present invention.

Figs. 3a to 3b are schematic views of a cassette tray according to the first embodiment or a second embodiment of the present invention.

Figs. 4a to 4b schematically illustrate the authentication of an 8" cassette by an RFID sensor in accordance with the second embodiment of the present invention.

Detailed Description of the Invention

The cassette transport device proposed in the present invention will be further described with reference to the following detailed description of several particular embodiments thereof, which is to be read in connection with the accompanying drawings. Features and advantages of the invention will be more apparent from the following detailed description, and from the appended claims. It is noted that the figures are provided in a very simplified form and not necessarily drawn to scale, with the only intention to facilitate convenience and clarity in explaining the embodiments.

EMBODIMENT 1

Referring to Figs. 1 and 3a, the cassette transport device includes: a smart cart 1; a base expansion frame 3 mounted on the smart cart 1; and a cassette-loading frame 2 fixed to the base expansion frame 3. The cassette-loading frame 2 is partitioned into several segments by support plates 10. Each of the support plates 10 bears a number of cassette trays 20. As shown in Fig. 3a, each of the cassette trays 20 defines, on its surface, a first trough 201 and a second trough 202 within the first trough 201. The first trough 201 corresponds to a cassette 4 of the first size, and the second trough 202 corresponds to a cassette 4 of the second size that is smaller than the first size. Preferably, at least two cassette trays 20 are borne on each of the support plates partitioning the cassette-loading frame 2 into several segments in order to achieve a high load capacity