

DESCRIPTION

Magazine System

5 The invention relates to a magazine system for production lines for planar substrates, in particular wafers, solar cells or printed circuit boards, comprising at least one substrate magazine, which has two side walls, which are arranged opposite one another and which are vertically aligned, as well as a plurality of compartments, which are formed between the side walls and into which one or several substrates can in each case be inserted, wherein each compartment has two guide rails, which are arranged on the side parts at a distance from and parallel to one another.

10 Magazine systems of the above-mentioned type are known from the prior art. During the production of wafers, solar cells, printed circuit boards or other planar substrates, the substrates are often stored in substrate magazines for temporary storage or for the transport. Substrate magazines were thereby initially produced in such a way that a plurality of guide rails, which are arranged parallel to one another and which lie spaced apart from one another in height, are in each
15 case arranged on two mutually opposite side walls, wherein two guide rails, which in each case lie at the same height and which are arranged on the mutually opposite side walls, together form a compartment for a substrate. The substrate can thereby simply be inserted onto the guide rail into the substrate magazine, and can also be removed from the substrate magazine again by means of shifting. A substrate magazine is moreover known from the not yet published DE 10 2019 211
20 603, in the case of which several substrates can be advantageously arranged lying next to one another in one compartment. For this purpose, latching means are in each case assigned to the guide rails, which lie in the movement path of the substrates along the guide rails and which can be moved out of the movement path by means of the substrates under elastic deformation. The substrates can thus be shifted on the guide rails and the latching elements can be overcome by
25 applying a corresponding pushing force. It is attained by means of the latching elements that the substrates do not unintentionally shift along the guide rails. It is in particular prevented thereby that adjacent substrates are inadvertently pushed one on top of the other, for example during the transport of the substrate magazine.

30 The invention is based on the object of creating an improved magazine system, which allows for a higher flexibility and usability of the magazine system.

The object on which the invention is based is solved by means of a magazine system comprising the features of claim 1. This has the advantage that the magazine system can be adapted in such a way that it cannot only be used as storage position for planar substrates, but also for substrate stacks, thus for a plurality of substrates stacked one on top of the other. It is attained by means of the magazine system according to the invention that an existing substrate magazine can be adapted in a simple manner in such a way that a switch can be made between the operation for receiving individual substrates to an operation for receiving substrate stacks. According to the invention, this is attained in that the magazine system has at least one adapter plate for each of the side walls, wherein the respective adapter plate has fastening means for releasable fastening to one of the side walls, and wherein on a respective side, the adapter plates in each case have one or several carrying rails, which in the fastened state on the side walls, together in each case form a support for a substrate stack. The side walls can thus be adapted to receive substrate stacks by means of the adapter plates. For this purpose, the adapter plates can be releasably fastened to the side walls and, in turn, have carrying rails. In the assembled state of the adapter plates on the side walls, these carrying rails lie opposite one another and at the same height, so that, together, they form a support for a substrate stack. An adaptation of the substrate magazine to individual substrates or substrate stacks is thus made possible by means of a few aid and a few steps.

According to a preferred further development of the invention, each adapter plate has at least one assembly hook for suspension on the respective side wall. The suspension of the respective adapter plate allows for a simple assembly on the side walls and a secure hold. The suspension furthermore also allows for a simple disassembly of the adapter plates, in that the assembly hooks are unhooked from the respective side wall. According to one embodiment, further fastening means are forgone.

According to a further embodiment of the invention, each adapter plate has at least one elastically displaceable latching element for the positive locking to the side wall in addition or alternatively to the already mentioned assembly hook. An unintentional release from the respective side wall is securely prevented by means of the latching element. In contrast to the suspension, the use of the latching element moreover allows for a simple translatory assembly joining or movement, while the suspension also requires a pivoting of the adapter plate. Depending on the installation space or formation of the substrate magazine, a purely translatory assembly movement can prove to be an advantage.

Each adapter plate particularly preferably has the at least one assembly hook at a first end, and the at least one latching element at the second end facing away from the first end. The respective

adapter plate can thus be suspended on the respective side wall at the one end, and can be locked in a positive manner to the side wall at the other end by means of the latching element. An unintentional release of the printed circuit board is thus securely prevented. The fastening furthermore also allows that rattling noises or movements of the adapter plate are prevented in response to a movement of the substrate magazine. Elastic cushioning means, which act between the adapter plate and the respective side wall to prevent rattling noises and movements, are optionally assigned to the assembly hook and/or to the respective latching element. In the case of arrangement of the adapter plate on a side wall as intended, the cushioning elements are optionally elastically deformed or pre-tensioned, respectively, so that a particularly fixed arrangement of the respective adapter plate on the respective side wall is ensured.

According to an advantageous further development of the invention, several carrying rails are arranged parallel to one another on each adapter plate, wherein adjacent carrying rails of the respective adapter plate have a distance from one another, which is larger than a distance of adjacent guide rails from one another. Due to the increased distance, the reception of substrate stacks is made possible. Due to the presence of several carrying rails, it is ensured that several substrate stacks can be received in the substrate magazine by means of the adapter plates. The distance of the adjacent carrying rails or guide rails is to thereby be understood as the distance of the rails at the height in the case of arrangement of the adapter plate on the respective side wall as intended.

According to a preferred further development of the invention, the adapter plates arranged on the substrate magazine form at least two carrying compartments, which lie one on top of the other. At least two adapter plates of the magazine system thus in each case have two carrying rails, which lie opposite one another at the same height in the case of use as intended, so that two carrying compartments are created.

It is furthermore preferably provided that the respective adapter plate is formed as adapter sheet, and the respective carrying rail is formed as cropped and bent-out sheet metal tongue in the adapter sheet. Due to the formation of the respective adapter plate as adapter sheet, a structurally simple and cost-efficient realization of the adapter plates is ensured. By bending out the carrying rails as sheet metal tongues, the number of the individual parts of the magazine system is furthermore minimized. The carrying rails are optionally releasably held on the respective adapter plate. It is attained thereby that the carrying compartments of the adapter plates can be adapted to expected substrate stacks. For example, the height distance of the carrying rails on an adapter plate can thus

in particular be selected in several stages in order to prepare the substrate magazine to receive certain substrate stack sizes.

It is furthermore preferably provided that elastically displaceable, in particular elastically deformable retaining means for a substrate stack are assigned to the respective carrying rail. The retaining means are located in the substrate stack in the respective substrate magazine and can be deformed or displaced into a release position by applying a sufficient pushing force on the respective substrate stack. The retaining means are, for example, elastic latching lugs, which, in the unloaded state, lie in the movement path of the substrate stack along the respective carrying rail. Several retaining means are in particular assigned to each carrying compartment in such a way that two or more substrate stacks can also be arranged next to one another in the respective carrying compartment spaced apart from one another, and are held at a distance from one another by means of the retaining means.

It is furthermore preferably provided that at least one side wall of the substrate magazine is supported in a shiftable manner in such a way that a clear width between the side walls can be changed. An adaptation of the clear width between the adapter plates, which are optionally arranged on the side walls, is thus likewise possible. It is thus ensured that substrate stacks as well as individual substrates of this substrate stack can be safely received and transported in the same substrate magazine.

Each side wall preferably has at least one opening or receptacle for at least one assembly hook. The respective assembly hook can be inserted and suspended into the respective opening. An incorrect assembly of the adapter plates on the respective side wall is avoided by means of the provided opening or receptacle.

Each side wall particularly preferably has at least one counter latching element for cooperating with the latching element of an adapter plate. For example, the latching element is an elastically displaceable latching protrusion or a latching protrusion receptacle, and the counter latching element is a latching protrusion receptacle or an elastically deformable or displaceable latching protrusion, wherein the latching protrusion and the latching protrusion receptacle are formed to form a releasable engagement for the positive connection.

It is furthermore preferably provided that the at least one latching element of the adapter plate is formed in one piece with the adapter plate. The latching element is thus in particular formed as

further bent-out sheet metal tongue of the adapter plate, whereby the number of parts is further minimized and a simple assembly of the respective adapter plate is ensured.

The at least one assembly hook is in particular also formed in one piece with the respective adapter plate, which results in an assembly, which is simple as a whole, and production of the magazine system.

The invention will be described in more detail below on the basis of the drawings, in which

Figures 1A and 1B show an advantageous substrate magazine system in different states,

Figure 2 shows an adapter plate of the magazine system in a perspective illustration and

Figure 3 shows two adapter plates of the magazine system in a perspective top view.

Figures 1A and 1B in each case show an advantageous magazine system 1 for planar substrates, which can be handled individually as well as as substrate stack. The magazine system 1 has a substrate magazine 2, which has two side walls 3, 4, which are arranged opposite one another and which are arranged vertically in a frame 5 parallel to one another. According to the exemplary embodiment at hand, the side wall 3 is thereby fixedly arranged in the frame 5, while the opposite side wall 4 is held in the frame 5 so as to be capable of being transversely shifted by means of a rail system 6, so that a clear width between the side walls 3, 4 can be changed by means of a shifting of the side wall 4 according to arrow 7. Between the side walls, a plurality of compartments 10 is formed, which are arranged lying one on top of the other and the width of which can be changed by means of a shifting of the side wall 4. The compartments 10 are thereby formed by means of guide rails 11, which are arranged on the respective side wall 3, 4, and which are aligned parallel to one another evenly spaced apart in height, wherein two guide rails 11 in each case lie on the side walls 3, 4 at the same height, so that, together, they form a sliding support for an individual planar substrate, such as, for example, a printed circuit board, wafer or solar cell. The respective guide rails 11 located thereabove limit the height of the loading space of the sliding receptacle located therebelow and thus in each case form a compartment 10 with the guide rails 11 located therebelow.

Figure 1B shows the magazine system 1 in a further state. Two adapter plates 12, 13, which serve the purpose of adapting the substrate magazine 2 to receive substrate stacks of the planar

substrates, are arranged on the substrate magazine 2. A substrate stack is thereby understood to be a plurality of individual substrates, which are stacked directly one on top of the other and which are handled together. The individual substrates are thereby in particular aligned flush to one another in the substrate stack, so that the outer contour of the substrate stack corresponds to the outer contour of an individual substrate, wherein the height of the substrate stack is determined by the number of the individual substrates lying one on top of the other.

The adapter plates 12, 13 are in particular formed in the same way, preferably identically. For the description of the adapter plates 12, 13, Figure 2 shows the adapter plate 12 in a perspective illustration. The adapter plate 12 is formed as adapter sheet plate 14, the height H of which corresponds at least essentially to the height of the respective side wall 3, 4, and the depth T of which corresponds at least essentially to the depth of the side walls 3, 4. At its upper end 15, the adapter plate 12 has two assembly hooks 16 arranged next to one another as fastening means for fastening to the respective side wall 3, 4. The assembly hooks 16 are formed to engage behind the upper edge 17 of the side wall 3, so that the adapter plate 12 can be attached to the side wall 3, as shown in Figure 1B.

The adapter plate 12 further has several carrying rails 18, which are aligned parallel to one another. The carrying rails 18 thereby extend in the depth extension of the adapter plate 12 and have a distance from one another, which is larger than the distance of adjacent guide rails 11 of the side walls 3, 4 in the direction of the height H. The distances between the adjacent carrying rails 18 are in particular selected in such a way that a carrying compartment 19 for receiving a substrate stack with a predetermined maximum number of individual substrates is provided by each carrying rail 18.

Figure 3 shows two second adapter plates 12, 13 in a perspective top view. Due to the identical formation of the adapter plates 12, 13, the carrying rails 18 lie at the same height in the case of assembly on the substrate magazine 2 as intended, so that two carrying rails 18 located opposite one another in each case form a receptacle 20 for the respective substrate stack.

According to the present exemplary embodiment, the carrying rails 18 do not extend continuously over the respective adapter sheet, but are formed so as to be interrupted in their longitudinal extension. The carrying rails 18 are in each case in particular formed by means of several sheet metal tongues 21, which are sheet metal tongues 21, which are cropped, in particular cut-free, and bent-out from the adapter sheet.

The assembly hooks 16 are preferably also formed as bent-over sheet sections of the respective adapter plate 12, so that the adapter plate 12 as a whole is formed in one piece, whereby the number of individual parts is minimized and production costs and assembly effort are reduced.

5 The respective adapter plate 12, 13 can be assembled on to the respective side wall 3 or 4 by means of the respective assembly hook 16, as shown in Figure 1B, so that the carrying rails 18 of the opposite adapter plates 12, 13 are located opposite one another at the same height, and form the respective carrying compartment 19 or the respective receptacle 20, respectively, for a substrate stack. The number of the carrying rails 18 is significantly lower than the number of the guide rails 11, so that, as already mentioned above, the distance in height of adjacent carrying rails 18 is
10 increased and is advantageously suitable for receiving a printed circuit board stack or substrate stack, respectively.

Due to the fact that the side wall 3 is supported in a shiftable manner, the clear width between the adapter plates 12, 13 can also be set. It is thus possible by means of the same substrate magazine 2, to receive individual substrates in the compartments 10 and to securely store them laterally on
15 the edge region thereof by means of the guide rails 11 as well as substrate stacks of the same substrates, which can then be arranged on the carrying rails 18. For this purpose, the side wall 4 is removed only slightly from the side wall 3, so that the clear width between the carrying walls 12, 13 corresponds to the previous clear width between the side walls 3, 4.

Retaining means 22 are optionally assigned to the carrying rails 18, as shown in an exemplary
20 manner by means of Figure 1B for one of the carrying rails 18, which, in the relaxed state, lie in the shifting path of a substrate stack along the carrying rail 18. The retaining means 22 are formed, for example, as elastically displaceable latching lugs, which can be pushed out of the movement path by means of a substrate stack under elastic deformation, when a sufficiently high pushing force is applied. The retaining means 22 protect the respective substrate stack in the substrate
25 magazine 2 against an unintentional shifting or displacing. At least one, preferably several retaining means of this type, which make it possible that several substrates are held in a compartment 10 so as to lie next to one another, are in particular in each case also assigned to the guide rails 10, so that pushing one on top of the other or pushing against one another is prevented in response to a movement of the substrate magazine 2.

30 In particular at their second end 23 facing away from the assembly hook 16, the adapter plates 12, 13 moreover optionally have one or several elastically deformable latching elements 24 in the form

of latching hooks, which can be introduced into a latching opening of the respective side wall 3, 4 under elastic deformation in such a way that, in the assembled state, they engage behind the respective side wall 3, 4 in a positive manner. The adapter plates 12, 13 can thus be fastened to the side walls 3, 4 in a particularly secure manner.

- 5 The magazine system 1 preferably has a plurality of pairs of adapter plates 12, 13, wherein the pairs of adapter plates differ from one another, for example in the number and the distance of the carrying rails 18 from one another. An adaptation of the substrate magazine 2 in different substrate stack heights is thus made possible.

CLAIMS

1. A magazine system (1) for production lines for planar substrates, in particular wafers, solar cells or printed circuit boards, comprising at least one substrate magazine (2), which has two side walls (3,4), which are arranged opposite one another and which are vertically aligned, as well as a plurality of compartments (10), which are formed between the side walls (3,4) and into which one or several substrates can in each case be inserted, wherein each compartment has two guide rails (11), which are arranged on the side parts (3,4) at a distance from and parallel to one another, **characterized in** that the magazine system (1) has at least one adapter plate (12,13) for each of the side walls (3,4), wherein the respective adapter plate (12,13) has fastening means for releasable fastening to one of the side walls (3,4), and wherein on a respective side, the adapter plates (12,13) in each case have one or several carrying rails (18), which in the fastened state on the side walls (3,4), together in each case form a support (20) for a substrate stack.
2. The magazine system according to claim 1, **characterized in** that each adapter plate (12,13) has at least one assembly hook (16) for suspension on the respective side wall (3,4).
3. The magazine system according to any one of the preceding claims, **characterized in** that each adapter plate (12,13) has at least one elastically displaceable latching element (24) for the positive locking to the respective side wall (3,4).
4. The magazine system according to any one of the preceding claims, **characterized in** that each adapter plate (12,13) has the at least one assembly hook (16) at a first end (15), and the at least one latching element (24) at the second end (23) facing away from the first end (15).
5. The magazine system according to any one of the preceding claims, **characterized in** that several carrying rails (18) are arranged parallel to one another on each adapter plate (12,13), wherein adjacent carrying rails (18) have a distance from one another, which is larger than a distance of the adjacent guide rails (11) from one another.
6. The magazine system according to any one of the preceding claims, **characterized in** that the adapter plates (12,13) arranged on the substrate magazine (2) form at least two carrying compartments (19), which lie one on top of the other, of the substrate stacks.

7. The magazine system according to any one of the preceding claims, **characterized in** that the respective adapter plate (12,13) is formed as adapter sheet, and the respective carrying rail (18) is formed as at least a cropped and bent-out sheet metal tongue (21) in the adapter sheet.
8. The magazine system according to any one of the preceding claims, **characterized in** that the
5 respective carrying rail (18) can be or is releasably fastened to the respective adapter plate (12,13).
9. The magazine system according to any one of the preceding claims, **characterized in** that at least one elastically displaceable, in particular deformable retaining means (22) for a substrate stack is assigned to the respective carrying rail (18).
10. The magazine system according to any one of the preceding claims, **characterized in** that at
10 least one side wall (4) of the substrate magazine is supported in a shiftable manner in such a way that a clear width between the side walls (3,4) can be changed.
11. The magazine system according to any one of the preceding claims, **characterized in** that each side wall (3,4) has at least one opening or receptacle for at least one assembly hook (16).
12. The magazine system according to any one of the preceding claims, **characterized in** that
15 each side wall (3,4) has at least one counter latching element for cooperating with the latching element (24) of an adapter plate (12,13).
13. The magazine system according to any one of the preceding claims, **characterized in** that the at least one latching element (24) of the adapter plate (12,13) is formed in one piece with the adapter plate (12,13).
- 20 14. The magazine system according to any one of the preceding claims, **characterized in** that the at least one assembly hook (16) is formed in one piece with the adapter plate (12,13).