

Singulating and loading device for elongate holders for electronic components

The invention relates to a device for singulating elongate holders for electronic components. Little is known in the field of singulating such elongate holders; up to the present time the singulation has been carried out substantially by hand. With the increasing cost of human labour, even in the Far East, a need arises for a device for singulating holders for electronic components.

The present invention provides such a device for this purpose, comprising a collecting container for containing the elongate holders for electronic components in a substantially parallel extending situation, a first raising member extending at an angle to the vertical in upward direction from the collecting container and provided with engaging elements at the same mutual distance in its longitudinal direction, wherein the engaging elements are adapted to releasably engage the elongate holders for electronic components at least at two positions lying on either side of the centre of gravity, a second raising member extending at an angle to the vertical in upward direction from the collecting container and provided with engaging elements at the same mutual distance in its longitudinal direction, wherein the engaging elements are adapted to releasably engage the elongate holders for electronic components at least at two positions lying on either side of the centre of gravity, wherein the engaging elements are each adapted to engage an elongate holder for electronic components for the purpose of transferring the engaged elongate holder for electronic components to the engaging elements of the other raising member as the other raising member passes, and wherein the raising members are movable mutually reciprocally with a limited stroke with a component in their longitudinal direction and in their transverse direction, as well as drive means for driving at least one of the two raising members in their movement.

The singulation of the elongate holders for electronic components finds application particularly, though not solely, in tubes used to transport small electronic components, such as semi-manufactures in the semiconductor industry. The use of such elongate holders or tubes is generally accepted in this industry. These tubes must be filled with semi-manufactures to be able to fulfil their function as transport means. For this purpose they must be singulated and positioned at a defined location. The above described

measures provide for the singulation so that the tubes can be placed at the defined position and can be respectively filled and emptied.

The tubes or other elongate holders for electronic components are herein placed
5 substantially parallel to each other in a collecting container. The collecting container is preferably formed such that the tubes can only be arranged parallel to each other, for instance by opting for a width of the collecting container which is considerably smaller than the length of the tubes. The tubes are then picked up one by one by an engaging element and subsequently moved obliquely upward by the mutually reciprocal
10 movement of the raising members. The inclining position is chosen here in order to prevent the tubes falling out of the engaging elements. As the raising members pass each other the tubes are transferred from the one raising member to the other.

The operation of the system requires only a relative movement of the raising members.
15 It is then structurally attractive to have only one of the raising members move and to hold the other stationary. An attractive embodiment provides for this purpose the measure that the first raising member is mounted fixedly, that the second raising member is movable with a component in its longitudinal direction and in its transverse direction, and that the drive means are adapted to drive only the second raising member.
20 To enable transfer of the tubes or other elongate holders for electronic components the stroke of the movement in the direction of the raising members must equal a whole number of times the pitch of the grooves.

As stated above, the relative movement must comprise a component in the longitudinal
25 direction of the raising member and in the transverse direction thereof. It can be attractive for construction of the drive to separate these movements. The present invention provides for this purpose the measure that the first raising member is movable in its longitudinal direction and that the second raising member is movable in its transverse direction.

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It is otherwise also structurally attractive for the driving when the drive means are adapted to drive the raising members in mutual movement in circular manner.

The required effect of the two raising members also makes it possible to make use of a substantially rectangular movement. The construction of the drive means cannot here be as simple as in the foregoing embodiment. However, as a result of the fact that the transfer of the elongate holder for electronic components from the one raising member to the other takes place in a straight movement transversely of the direction of movement of the raising members, the transfer of the elongate holder for electronic components from the one raising member to the other will take place more easily.

In order to be able to properly support and engage the elongate holders for electronic components, the engaging elements comprise a first protrusion which extends at a right angle from the raising member and which is adapted to support the elongate holders for electronic components. This measure not only has a favourable effect on pick-up of the elongate holders for electronic components from the collecting container, but also on the transfer of the elongate holders for electronic components from the one raising member to the other.

The engaging elements preferably comprise a second protrusion extending at a right angle from the raising member, wherein an indentation is created between the first and the second protrusion for at least partially receiving the elongate holders for electronic components and wherein the distance between the first and the second protrusion is greater than the smallest dimension of the cross-section of the elongate holders for electronic components. Engaging of the elongate holders for electronic components by the raising members is facilitated by this measure.

The envelope of the cross-section of the elongate holders for electronic components is usually a rectangle. In many cases this is moreover a rectangle which is not necessarily a square. A rectangle can be picked up by the engaging means in two different positions. It is important however that the elongate holder for electronic components is delivered in a single defined position. It is then attractive to already provide at an early stage for engaging of the elongate holders for electronic components in the correct position. The distance between the first and the second protrusion is therefore preferably smaller than the largest dimension in cross-section of the elongate holders for electronic components. This measure has the consequence that the elongate holders for electronic components with a rectangular cross-section can be engaged in only two of the four

ways that are possible in principle; with the other two methods of engagement the elongate holder for electronic components would not fit into the space between the adjacent protrusions.

- 5 So as to make a distinction between the two possible remaining positions, a detection member is preferably present for detecting the position of the elongate holders for electronic components in the engaging elements. It is noted here that there are profiles of elongate holders for electronic components with a high degree of symmetry, so that there is no difference between the two positions. Other elongate holder for electronic
- 10 components, such as the tubes with a so-called A-profile, which are much used for transport of semiconductors, do not have such a symmetry, so that there is difference between the two positions. In such a situation it is attractive to be able to detect this difference and undertake appropriate action.
- 15 When it is determined in a device according to the invention that an elongate holder for electronic components has been engaged in undesirable manner by raising members, it is important that this does not continue further into the processing cycle, or that the position thereof is corrected. An attractive embodiment provides for this purpose the measure that the device comprises an ejector member for ejecting elongate holders for
- 20 electronic components where the detection member has detected that it has not been picked up in the correct position in the engaging elements.

The foregoing claims relate to the singulating process. After singulation the tubes must be taken to a predetermined position so as to be loaded. A preferred embodiment

25 provides for this purpose the measure that the device comprises a pick-up member for picking up the elongate holders for electronic components from an engaging element and for placing the engaged elongate holder for electronic components in a loading position.

- 30 This loading position is preferably defined by a loading block comprising a number of grooves which each form a loading position, wherein the grooves are ordered for the purpose of positioning the elongate holders for electronic components parallel to each other. A loading block not only has the advantage of a defined position, but also of a

number of mutually adjacent positions which can function as buffer, so that possible disruptions can be readily compensated.

5 The presence of more than one loading position makes it possible to pick up and place more than one elongate holder for electronic components at a time. In order to make use of this option, the pick-up member is adapted to simultaneously pick up more than one elongate holder for electronic components and to place in a groove each of the picked-up elongate holders for electronic components.

10 For discharge of the elongate holders for electronic components, or tubes, it is attractive when the loading block comprises a number of loading surfaces, on each of which is placed a number of grooves. The filled elongate holders, or tubes, can then be tilted and discharged in groups.

15 An attractive dimensioning is found to result when the loading block comprises six loading surfaces which are ordered in a regular hexagon, and the loading block is rotatable and drivable about a shaft extending through the centre of the hexagon.

20 The loading block can comprise a number of discs, each extending transversely of the rotation axis, wherein the grooves are arranged in each of the discs. The weight of the loading block is hereby reduced to a minimum value.

For filling of the elongate holders for electronic components, or tubes, it is essential that they be fixed. The filling process does after all take place at a great speed, while the
25 elongate holders for electronic components are light. In order to fix the elongate holders for electronic components use is therefore preferably made of grooves which are adapted to clamp fixedly the elongate holders for electronic components.

Although the foregoing relates to a filling device, it is likewise possible for the device to
30 comprise a processing member for processing the holders for electronic components in a manner other than for filling. This processing member can then be formed by another processing member, wherein it is important that the holder for electronic components is placed singulated in a defined position.

The elongate holders for electronic components, usually for transporting the semiconductor products, can, partly depending on the products used, have different cross-sections. A number of parts of the device according to the invention, such as the parts of the raising device which come into contact with the elongate holders for electronic components, the engaging part of the gripper device and the parts of the positioning block coming into contact with the elongate holders for electronic components, then preferably take an easily exchangeable form.

The present invention will be elucidated hereinbelow with reference to the accompanying drawings, in which:

- figure 1 shows a cross-sectional view of a first preferred embodiment of the invention;
- figure 2 is a cross-sectional view of a combination of raising members for use in the embodiment shown in figure 1;
- figure 3 is a schematic perspective view of the combination of raising members shown in figure 2;
- figure 4 shows a schematic perspective view of a second embodiment of the invention; and
- figure 5 shows a schematic perspective view of a third embodiment of the invention.

Figure 1 shows a cross-sectional view of a device for filling profiled tubes with semiconductor products, which device makes use of the present invention. In this view the longitudinal direction of the tubes extends transversely of the cross-sectional plane. To enable filling of a tube, it must be situated at a predefined location. In order to carry the tube to this location, it must be singulated. The device shown in figure 1 therefore comprises a singulating function and a positioning function.

The device comprises a frame 1, only parts of which are shown. Arranged in frame 1 is a collecting container 2 into which the tubes for singulating can be placed. The length of collecting container 2 in the direction transversely of the plane of section is herein slightly greater than the length of the tubes for singulating. The width of collecting container 2 is chosen so as to contain a sufficient supply of tubes. Two raising members 3a, 3b, only one of which, i.e. 3a, is shown, extend obliquely upward from holder 1. The

two raising members 3a, 3b are placed substantially parallel to each other. In figure 3 the raising members are shown schematically in detail. The first raising member 3a comprises a plate 6 in which horizontally extending grooves 4 are arranged. Protrusions 5 are situated between the grooves. All grooves 4 and protrusions 5 have the same size.

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Raising member 3a is mounted fixedly in the present embodiment. The second raising member 3b comprises two elements 3b' and 3b''. These elements both have the same profile and have the same profile as the first raising member 3a. It ensues herefrom that both elements of the second raising member 3b', 3b'' are likewise provided with protrusions 5 and grooves 4, this with the same pitch as is the case with the first raising member 3a. The form and dimensions of grooves 4 and protrusions 5 depend on the form and dimensions of the cross-section of tubes 7. The dimensions of grooves are herein chosen such that tubes 7 fit in only one way into grooves 4. It is of course not essential to apply this condition; this is not required in the case of symmetrical cross-sections. With a limited degree of symmetry it is possible for the tubes 7 to fit into grooves 4 in two ways. When the device must be suitable for different types of profile, it is attractive to make replaceable those parts of the raising members to which the protrusions are fixed and in which the grooves are arranged. Such raising members are shown in figure 2 in the form of a cross-section and in figure 3 in the form of a perspective view.

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Figures 4 and 5 show cross-sections of raising members with grooves of alternative forms for elongate holders for electronic components having a different form.

A relative movement of raising members 3a, 3b takes place in order to perform the singulating process and to move tubes 7 upward. There are various possibilities herefor; it is possible, as already elucidated above, to mount the first raising member 3a fixedly and to have the second raising member 3b perform a movement. This movement must have a component in upward direction in order to move tubes 7 upward, but must also have a component in transverse direction to be able to transfer tubes 7 or other holders for electronic components from the first raising member 3a to the second raising member 3b and, when tube 7 or the elongate holder for electronic components has been moved upward, to move the holder back to the first raising member 3a. It is possible for this purpose to drive the second member 3b such that it performs a substantially

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rectangular movement. It is likewise possible to have the second member 3b perform a circular or elliptical movement.

It is of course also possible to have both raising members 3a, 3b perform a movement.

- 5 There is the option here of having both raising members 3a, 3b perform a compound movement in both directions as in the foregoing embodiment wherein one of the two raising members 3a, 3b is stationary. In order to obtain the relative movement required for operation, these compound movements must however be in opposite phase. As in the foregoing embodiment, this movement can be circular, compound or rectangular. A
10 rectangular movement is otherwise recommended to allow the transfer of the tubes from the one raising member to the other to take place as effectively as possible.

- Finally, it is possible to separate the movements in both directions; the first raising member 3a herein performs a movement in a first direction and the second raising
15 member 3b a movement in the second direction. This results in the advantage that each of the raising members 3a, 3b has to be driven in only one direction, which is structurally simple.

- Another aspect relates to the position of engagement of the holders for electronic
20 components to be singulated; in the present exemplary embodiment the tubes 7 or the other holders for electronic components to be singulated are engaged alternately in their centre and on their sides. It is recommended here that the engagement takes place on either side of the centre of gravity of tubes 7 so as to prevent the tubes falling out of raising members 3a, 3b. While at the first raising member 3a the tubes are engaged by a
25 single element, this is however over a certain length extending on either side of the centre of gravity of tubes 7. At the second raising member 3b the tubes are indeed engaged at two positions, albeit over a limited length. Both positions lie on either side of the centre of gravity of the engaged tube 7. Other configurations of raising members 3a, 3b are of course possible, for instance by assembling each of the raising members
30 3a, 3b from two parts which are placed in pairs on either side of the centre of gravity of the tubes.

The driving of raising members 3a, 3b is not shown in the drawings; this will be self-evident to a skilled person; for a circular movement use can be made of rotating driving,

such as an electric motor; for a linear movement use can be made of a linear drive means such as a pneumatic cylinder or a crank-connecting rod mechanism to convert a rotating movement to a linear movement.

- 5 In order to pick up tubes 7 or other elongate holders from the uppermost position of one of the raising members, use is made of an engaging element 10. This engaging element 10 comprises a carriage 11 which is movable along a rail 12 mounted on frame 1 in the direction parallel to the direction of raising members 3a, 3b. Arranged on carriage 11 is a gripper 13 which is adapted to engage tubes 7, this of course to the extent these latter are situated outside the raising member. Gripper 13 is adapted to engage tubes 7 firmly such that they are released by the raising members. Through the movement of carriage 11 along rail 12 the tubes 7 are then moved to a position above loading block 20. Gripper 13 can herein be adapted to simultaneously engage and transport more than one tube 7. Gripper 13 is preferably adapted to simultaneously engage the same number of tubes 7 that can be placed on the relevant surface of loading block 20.

- Loading block 20 is mounted rotatably on a shaft 21 bearing mounted in frame 1. Loading block 20 comprises three discs 22a, 22b and 22c, which are each mounted fixedly on shaft 21. In the present exemplary embodiment the discs 22 each take the form of a regular hexagon. An equal number of grooves 24 are arranged in each of the six sides 23 of discs 22. The grooves 24 of the different sides 23 lie mutually in line so that tubes 7 can extend through each of the grooves 24 lying mutually in line. Grooves 24 can herein be formed such that tubes 7 are clamped in grooves 24. This is not however essential; it is likewise possible to fix the tubes in other manner at a defined position on loading block 20, for instance by means of clamps. It is however recommended to use clamps because these clamps are often handled.

- In the present embodiment the loading block 20 is adapted such that a surface 23 of the block is loaded while tubes 7 of the following surface 23 are being filled. This filling can otherwise take place simultaneously with tubes 7 placed on the relevant surface 23, but can also take place sequentially. Between placing of tubes 7 and loading thereof the block 20 must be rotated through an angle of 60°. Shaft 21 of block 20 is coupled for this purpose to a controllable electric motor.

The device according to the invention is coupled to a loading device for loading the tubes with semiconductor products. The loading device does not form part of the present invention, so need not be described, although the semiconductor products are preferably moved into the tubes by means of compressed air. Other products can also be transported in the tubes. It is for that matter also possible that no tubes need be filled, but that elongate holders for electronic components are subjected to other processes.

Making use of the embodiment with the filled tubes 7, the filled tubes are discharged by further rotation of the loading block. The loading block is rotated in steps of 60° so that the tubes 7 placed on the uppermost horizontal surface of loading block 20 drop out of loading block 20 after a rotation of 60° has been performed twice. They then come to lie in a collecting bin 30. It is important here that the clamping of tubes 7 in grooves 24 of loading block 20 is such that tubes 7 drop out of grooves 24 due to the force of gravity. If however clamps are used, these must be released to allow removal of tubes 7 from grooves 24.

Use is made of an electronic control means, such as a PLC or PC for the purpose of performing and controlling the diverse operations of the components of the device according to the invention.

Claims

1. Device for singulating elongate holders for electronic components, comprising:
- a collecting container for containing the elongate holders for electronic
- 5 components in a substantially parallel extending situation;
- a first raising member extending at an angle to the vertical in upward direction from the collecting container and provided with engaging elements at the same mutual distance in its longitudinal direction, wherein the engaging elements are adapted to releasably engage the holders for electronic components at least at two positions lying
- 10 on either side of their centre of gravity;
- a second raising member extending at an angle to the vertical in upward direction from the collecting container and provided with engaging elements at the same mutual distance in its longitudinal direction, wherein the engaging elements are adapted to releasably engage the holders for electronic components at least at two positions
- 15 lying on either side of their centre of gravity;
- wherein the engaging elements are each adapted to engage a holder for electronic components and to transfer the engaged holder for electronic components to the engaging elements of the other raising member as the other raising member passes;
 - wherein the raising members are movable mutually reciprocally with a limited
- 20 stroke with a components in their longitudinal direction and in their transverse direction; and
- drive means for driving at least one of the two raising members in their movement.
- 25 2. Device as claimed in claim 1, characterized in that the first raising member is mounted fixedly, that the second raising member is movable with a component in its longitudinal direction and in its transverse direction, and that the drive means are adapted to drive only the second raising member.
- 30 3. Device as claimed in claim 1, characterized in that the first raising member is movable in its longitudinal direction and that the second raising member is movable in its transverse direction.

4. Device as claimed in claim 1, 2 or 3, characterized in that the drive means are adapted to drive the raising members in mutual movement in circular manner.
5. Device as claimed in claim 1, 2 or 3, characterized in that the drive means are adapted to drive the raising members in a substantially mutually rectangular movement.
6. Device as claimed in any of the foregoing claims, characterized in that the engaging elements comprise a first protrusion which extends at a right angle from the raising member and which is adapted to support the holders for electronic components.
7. Device as claimed in any of the foregoing claims, characterized in that the engaging elements comprise a second protrusion extending at a right angle from the raising member, wherein an indentation is created between the first and the second protrusion for at least partially receiving the holders for electronic components, and wherein the distance between the first and the second protrusion is greater than the smallest dimension of the cross-section of the holders for electronic components.
8. Device as claimed in any of the foregoing claims, characterized in that the distance between the first and the second protrusion is smaller than the largest dimension in cross-section of the holders for electronic components.
9. Device as claimed in any of the foregoing claims, characterized by a detection member for detecting the position of the holders for electronic components in the engaging elements.
10. Device as claimed in claim 9, characterized in that the device comprises an ejector member for ejecting holders for electronic components where the detection member has detected that it has not been picked up in the correct position in the engaging elements.
11. Device as claimed in any of the foregoing claims, characterized in that the device comprises a pick-up member for picking up the holders for electronic components from an engaging element and for placing the engaged holder for electronic components in a loading position.

12. Device as claimed in claim 11, characterized in that the device comprises a loading block comprising a number of grooves which each form a loading position, wherein the grooves are ordered for the purpose of positioning the holders for electronic components parallel to each other.
13. Device as claimed in claim 12, characterized in that the pick-up member is adapted to simultaneously pick up more than one holder for electronic components and to place in a groove each of the picked-up holders for electronic components.
14. Device as claimed in claim 12 or 13, characterized in that the loading block comprises a number of loading surfaces, on each of which is placed a number of grooves.
15. Device as claimed in claim 14, characterized in that the loading block comprises six surfaces which are ordered in a regular hexagon, and that the loading block is rotatable and drivable about a shaft extending through the centre of the hexagon.
16. Device as claimed in claim 15, characterized in that the loading block comprises a number of discs, each extending transversely of the rotation axis, and that the grooves are arranged in each of the discs.
17. Device as claimed in any of the claims 12-16, characterized in that the grooves are adapted to clamp fixedly the holders for electronic components.
18. Device as claimed in any of the claims 12-17, characterized in that the device comprises a processing member for processing the holders for electronic components.
19. Device as claimed in claim 18, characterized in that the processing member comprises a filling member.

20. Device as claimed in any of the foregoing claims, characterized in that the parts coming into contact with the holders for electronic components for singulating take an exchangeable form.