

Device and method for filling elongate holders with controllable numbers of electronic components

For the purpose of transporting electronic components such as semiconductors in different production stages use is generally made of elongate, substantially tubular holders. These holders can be formed by 'tubes'. These are usually manufactured from plastic, but sometimes from aluminium. These holders are filled using a device which is provided with a guide leading to a loading position of an elongate holder, placing means for placing the components on the rail, and transport means for transporting the components from the rail and into the elongate holder.

The number of electronic components to be received in such an elongate holder depends on the size of the components. The components to be placed in the holders come from a device which supplies these components in a batch size determined by the process. Filling devices known heretofore fill the holders with a multiple of the number of components which have been supplied in a batch. This often results in incompletely filled holders, and thereby to a less effective use of the available transport capacity of the holders.

The object of the invention is to provide a device for filling the holders, wherein the number of products to be placed in a holder can be selected at random.

This object is achieved in that the transport means are adapted to transport a controllable number of components from the guide and into the elongate holder.

The invention therefore also relates to a method for filling a linear holder with a controllable number of electronic components, comprising the steps of placing the components on a guide leading to a loading position of an elongate holder, and transporting the components placed on the guide from the guide and into the elongate holder by displacing an engaging means placed in an engaging position in the direction of the guide, wherein the engaging means engages at a predetermined position between components placed on the guide.

Using such a device it is possible to place a random number of components into an

elongate holder. When the preceding processing device delivers the components in a batch size of eight components and the holder is dimensioned to contain 27 components, it is for instance possible to transport three batches of eight components each into the holder, and then - as a result of the measures according to the invention - the final three. Five of the final batch are then left over. These form the first part of the load of the subsequent holder. This holder is then filled with two whole batches of eight components, to 21 components. Of a subsequent batch only six components are then loaded into the holder. The remaining components are placed into the following holder, and so on.

In order to carry out a correct loading process, the invention therefore also relates to a method wherein the position at which the engaging means engages is determined by control means, and the control means keep track of the number of components moved into the holder in preceding movements of the carrier.

According to another preferred embodiment, the transport means comprise a carrier which is movable in the longitudinal direction of the guide and which is provided with at least one engaging means extending in the direction of the guide, and the engaging means is movable between an engaging position, in which the engaging means transports components placed on the guide in the longitudinal direction of the guide when the carrier is moved, and an inactive position, in which the engaging means is freely movable in the longitudinal direction of the guide without engaging on the components placed on the guide, and the device comprises a control element for controlling the movement of the engaging means between the engaging position and the inactive position subject to the position of the carrier along the guide.

This is a structurally attractive configuration, wherein use can be made of the construction which is usual in such a loading device and which has to undergo only a small number of structural modifications.

Essential to the invention is the measure that the engaging means is moveable relative to the components placed on the guide. The engaging means must after all be able to move between the active position, in which the components are engaged, and the inactive position in which the engaging means can move back freely to its starting position.

According to a preferred embodiment, the engaging means is therefore movable relative to the carrier, and the control element is adapted to control the movement of the engaging means relative to the carrier. The carrier herein remains at the same distance
5 from the guide and the components placed thereon, but only the engaging means moves.

According to an alternative embodiment, the engaging means is however attached fixedly to the carrier, the carrier is movable in vertical direction and the control element is adapted to control the vertical movement of the carrier. In this embodiment the
10 engaging means is simply connected directly to the carrier. The movement and driving hereof is delegated to the carrier. The choice between the two embodiments is determined by structural considerations, such as the suitability of application in already existing constructions.

15 Depending on the length of the guide and the distance which must be covered over the guide and to the holder, it can be attractive to perform the displacement in two steps. It is of course possible for this purpose to make use of two carriers, each with an engaging means, but it is simpler to make use of a carrier provided with two engaging means which are connected to the carrier in mutually offset manner in the longitudinal
20 direction of the guide.

During transport of the components over the guide there is a danger of the components moving upward and sliding over each other in the manner of roof tiles. This impairs the controllability of the process. In order to prevent this, a preferred embodiment provides
25 the measure that the device is provided with an enclosing element for enclosing on their top side elements handled by the engaging means.

This enclosing element is arranged at a height such that the components are enclosed between their guide and the enclosing element. This prevents the components tilting
30 upward and sliding over each other.

Such an enclosing element can be fixed to the carrier. It then co-displaces with the carrier, which means that the enclosing element is at its active position when this is necessary. This embodiment further requires few technical provisions.

Such an enclosing element can however also be connected to the guide. The enclosing element is here arranged fixedly so that the components are moved through a kind of 'tunnel'. The components must of course be advanced inside the tunnel formed by the enclosing element, so that a recess is preferably arranged in the upper side of the tunnel through which the engaging means can extend for the purpose of advancing the components.

The enclosing element can however also be connected to the guide for movement between an active position and an inactive position. During displacement of the components the enclosing element will be situated in the active position in order to hold the components in place.

The measures elucidated heretofore relate to a device which is adapted to load a single holder. It is possible to load more than one holder simultaneously. For this purpose however a number of loading positions for the elongate holders corresponding to the number of holders must be arranged, as well as a corresponding number of guides, each leading to a loading position, wherein at least one engaging means is arranged on the carrier for each of the guides. A number of holders can hereby be loaded simultaneously. This is particularly attractive because the production step preceding the loading generally delivers a number of components ordered in a matrix. With the present embodiment these products can easily be placed on the guide and loaded simultaneously. The foregoing embodiment provides the option of positioning the engaging means individually. It is hereby possible to place different numbers of components in the holders, also when the loading takes place simultaneously due to the reciprocating movement. The individual positioning also provides the option of compensating for the possible absence of components as a result of for instance an error in the previous process. It is however recommended that the position of the engaging means can be controlled simultaneously. The process of loading the holders can herein take place in the most efficient manner.

The invention also relates to a method wherein electronic components present on more than one guide are moved simultaneously into the holder by more than one engaging means which can be controlled together.

The engaging means can only shift the components close to and as far as the start of the holder, or into the holder. This latter will take place particularly when a number of components are already present between their extreme position and holder; they are
5 then pushed up. It is however also possible for a blow nozzle to be arranged at the end of the carrier directed toward the position of the elongate holder, in order to generate an air jet for the purpose of urging the components into the elongate holder.

According to a specific embodiment, the engaging means is adapted to displace the
10 tubular holder in its longitudinal direction. These measures provide the option of sliding the tubular holders, also known as 'tubes', from their loading position and into a processing machine for the tubes themselves, also known as a 'tube master', in which the tubes are further processed. This embodiment therefore relates to a method according to which the tubular holders are displaced in their longitudinal direction by
15 the engaging means. It is also possible to embody the enclosing element for displacement between an active position, in which the components are stored, and an inactive position in which the components are accessible to the engaging means.

The present invention will be elucidated hereinbelow on the basis of the non-limitative
20 exemplary embodiments shown in the following figures. Herein:
figure 1 shows a schematic perspective view for clarifying the principle according to the invention;
figure 2 shows a cross-sectional view in lengthwise direction of the device shown in figure 1; and
25 figure 3 shows a perspective view of an embodiment of the invention.

Figure 1 shows a metal plate 1 which is provided with two grooves 2 extending in longitudinal direction of plate 1. These grooves 2 function as guides for the purpose of guiding electronic components 3 placed in the rails. Arranged connecting to plate 1 is a
30 movable support 4 provided with recesses 5, which each provide space for an elongate, hollow holder 6, which is also referred to as a tube. These hollow holders are adapted to receive electronic components 3 and to transport the electronic components 3 received in holder 6.

A carrier in the form of a plate 7 is arranged for the purpose of carrying electronic components 3 into holders 6. This plate 7 is movable in longitudinal direction of grooves 2. The plate is provided on its underside with two protrusions 8, which function as engaging means. Engaging means 8 are attached fixedly to plate 7. Apart from being
5 movable in horizontal direction parallel to grooves 2, plate 7 can furthermore be moved in vertical direction between a lower position and an upper position. In the lower position the engaging means 8 are situated in the engaging position in which they engage products 3 for transport over the grooves and into holder 6. In the upper position the engaging means 8 are situated in their inactive position, so that they can move in
10 horizontal direction without advancing the electronic components 3. It is however also possible for carrier 7 to be movable only in horizontal direction and for engaging means 8 to be movable in vertical direction relative to carrier 7.

It sometimes occurs that components push each other upward in the manner of roof
15 tiles. This is prevented by the presence of an enclosing element 15, extending above the guide 2 embodied as grooves 2, for the purpose of enclosing components placed on the guide, which element is mounted in the present embodiment on the engaging means.

The operation of this device is as follows: Electronic components 3 which have run
20 through a production process are placed in grooves 2 of plate 1 by means of a transfer device not shown in the figure, preferably in a rectangular structure or matrix pattern. In their movement in horizontal direction toward carriers 6, engaging means 8 co-displace a predetermined number of components 3. This number of components is determined by the position in which engaging means 8 carry out their downward movement from the
25 inactive position to the engaging position. When components 3 are moved into or close to carriers 6 at the end of the stroke of plate 7, plate 7 moves upward with engaging means 8, wherein engaging means 8 are moved from their engaging position into their inactive position. The whole of 7, 8 then moves back again to the starting position, whereafter the process is repeated.

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The invention is particularly applicable in situations where the number of components 3 co-displaced with the engaging means during a stroke of plate 7 varies, for instance because the number of components 3 to be received in a carrier 6 is not a multiple of the number of components 3 placed by the transfer device in grooves 2. Reference is made

here to the example given in the introduction. What is important here is that the position at which engaging means 8 move downward to a position between components 3 determines the number of components 3 transported per stroke by engaging means 8. This position can be controlled by means of a control device not shown in the drawing, which is otherwise adapted to keep track of the number of components 3 loaded into the carriers and still present in the grooves. It is noted here that components 3 must be placed with intermediate spacing so that engaging means 8 can be placed between components 3 without damaging them.

Figure 2 shows a cross-section of a device corresponding with the device shown in figure 1, but wherein two engaging means 8A, 8B are however arranged, both of which are adapted to engage on components 3 present in a single groove 2. The transporting process is hereby divided into two steps. This does not per se affect the fact that the number of components 3 to be transported in one stroke is determined by the location at which engaging means 8A moves downward.

In the present embodiment this relates to engaging means 8A which is the furthest removed from carrier 6. The other engaging means 8B only transports further toward carrier 6 the components 3 co-displaced by the rear engaging means 8A during a previous stroke.

Finally, figure 3 shows a perspective view of an actual embodiment of the device according to the invention which is suitable for placing components 3, such as semiconductor products, in cylindrical holders. Plate 1 in which grooves 2 are arranged is clearly visible here. It will otherwise be apparent that guides of another type could be used instead of grooves 2. The choice of the type of guide 2 does after all depend on the form of the components 3 to be transported. It is thus possible for instance to apply rails or edges.

Carrier 7 here has substantially an L-shape, this shape being determined by the manner in which this carrier 7 must be incorporated in a machine. Because only the upper side of carrier 7 is shown, engaging means 8 are not visible.

On the side of carrier 7 directed toward the holder are arranged blow nozzles 10 which

are adapted to blow products 3 into the holders. They are mounted on a block 11 which is provided on its top side with connections for air feed.

5 It is also possible to provide guides 2 with any detection system for detecting the presence or appearance of the components. Such a detection system is then preferably embodied as a video camera, and this system is then connected to the control device in order to use the information supplied by the detection system for transport purposes, and to thus enable the process of loading the holders to be carried out optimally. Empty
10 positions can for instance hereby be compensated in subsequent transporting steps.

Claims

1. Device for filling with controllable numbers of electronic components an elongate holder for such components, comprising:
 - 5 - a guide leading to a loading position of an elongate holder;
 - placing means for placing the components on the guide; and
 - transport means for transporting the components from the guide and into the elongate holder,characterized in that the transport means are adapted to transport a controllable number
10 of components from the guide and into the elongate holder.
2. Device as claimed in claim 1, characterized in that the transport means comprise a carrier which is movable in the longitudinal direction of the guide and which is provided with at least one engaging means extending in the direction of the guide, and
15 that the engaging means is movable between an engaging position, in which the engaging means is adapted to transport electronic components placed on the guide in the longitudinal direction of the guide when the carrier is moved, and an inactive position, in which the engaging means is freely movable in the longitudinal direction of the guide without engaging on the components placed on the guide, and that the device comprises
20 a control element for controlling the movement of the engaging means between the engaging position and the inactive position subject to the position of the carrier along the guide.
3. Device as claimed in claim 1 or 2, characterized in that the engaging means is
25 movable relative to the carrier, and that the control element is adapted to control the movement of the engaging means relative to the carrier.
4. Device as claimed in claim 1 or 2, characterized in that the engaging means is attached fixedly to the carrier, that the carrier is movable in vertical direction and that
30 the control element is adapted to control the vertical movement of the carrier.
5. Device as claimed in claim 4, characterized in that there is arranged on the carrier a second engaging means which is placed offset in the longitudinal direction of the rail relative to the first engaging means.

6. Device as claimed in any of the claims 2-5, characterized in that the device is provided with an enclosing element for enclosing on their top side elements handled by the engaging means.

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7. Device as claimed in claim 6, characterized in that the enclosing element is fixed to the carrier.

8. Device as claimed in claim 6, characterized in that the enclosing element is
10 connected to the guide.

9. Device as claimed in any of the foregoing claims, characterized in that the device comprises more than one loading position for an elongate holder, that the device comprises a guide leading to each loading position, and that at least one engaging means
15 is arranged on the carrier for each of the guides.

10. Device as claimed in claim 9, characterized in that the position of the engaging means is simultaneously controllable.

20 11. Device as claimed in any of the foregoing claims, characterized in that a blow nozzle is arranged at the end of the carrier directed toward the position of the elongate holder in order to generate an air jet for the purpose of urging the electronic components into the elongate holder.

25 12. Device as claimed in any of the foregoing claims, characterized in that the device is dimensioned for filling tubular holders with semiconductor products.

13. Device as claimed in claim 12, characterized in that the engaging means is adapted to displace the tubular holder in its longitudinal direction.

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14. Device as claimed in any of the foregoing claims, characterized in that visual detecting means are arranged for detecting electronic components placed on the at least one guide.

15. Method for filling an elongate holder with a controllable number of electronic components, comprising the following steps of:

- placing components on a guide leading to a loading position of an elongate holder; and

5 - transporting the components placed on the guide from the guide and into the elongate holder by displacing an engaging means placed in an engaging position in the direction of the guide, characterized in that the engaging means engages at a predetermined position between components placed on the guide.

10 16. Method as claimed in claim 15, characterized in that the position at which the engaging means engages is determined by control means, and that the control means keep track of the number of electronic components moved into the holder in preceding movements of the carrier.

15 17. Method as claimed in claim 15 or 16, characterized in that electronic components present on more than one guide are moved simultaneously into the holder by more than one urging element which can be controlled together.

18. Method as claimed in any of the claims 15-17, characterized in that electronic
20 components in the form of semiconductor products are placed into tubular holders.

19. Method as claimed in claim 18, characterized in that the tubular holders are displaced in their longitudinal direction by the engaging means.