

221279

A COMPONENT ORIENTING APPARATUS

The present invention relates to an apparatus for use in orienting elongate components. More particularly, but not exclusively, the invention relates to an apparatus for use in orienting elongate components of known length width and thickness, the length of the component being greater than the width and greater than the thickness thereof. Such an apparatus may be used in the orienting of electronic component chips during a manufacturing process to facilitate various operations which are performed on the electronic component chips in later stages in the process.

The background to the invention will first be described. Fig. 8 is a perspective view showing two electronic component chips 1, to which the present invention can be applied. Each of the electronic component chips 1 may be a capacitor chip or an inductor chip, for example. Such a chip 1 has dimensions L, W and T along longitudinal, crosswise and perpendicular directions which are orthogonal to each other. Within the dimensions L, W and T, the longitudinal dimension L has the longest size. The crosswise dimension W, which is smaller than the longitudinal dimension L, may be larger than or equal

to the perpendicular dimension T . The chip 1 is provided with external terminal electrodes 2 and 3 on both of longitudinal ends thereof. However, the present invention is also applicable to an electronic component chip being in the state of the so-called partially fabricated item, which is not yet provided with such external terminal electrodes, for example.

The present invention is directed to an apparatus for aligning components such as the rectangular-parallelipipedic electronic component chips 1 shown in Fig. 8, each of which has a longitudinal dimension L longer than other dimensions W and T , in the same orientation as each other. The components to be aligned are so oriented that the same are longitudinally parallel with each other while crosswisely and perpendicularly defined surfaces thereof are along constant directions. Fig. 8 shows an adjacent pair of electronic component chips 1, within a large number of those aligned in such a state. Although longitudinally and crosswisely defined surfaces of the adjacent pair of electronic component chips 1 are opposite to each other in Fig. 8, the electronic component chips 1 may be so aligned that longitudinally and perpendicularly defined surfaces thereof are opposite to each other.

The aligned state of the electronic component chips 1 shown in Fig. 8 is required for carrying out steps shown in Figs. 9 to 11, for example.

Fig. 9 shows a component orienting apparatus 4 which is employed in the plant of the applicant company. The component orienting apparatus 4 is in the form of a plate as a whole, for example, and arranged to be horizontally directed in plane. The component orienting apparatus 4 is provided with a plurality of orienting passages 5. The sectional geometry of each orienting passage 5 is decided in consideration of the outer geometry of each electronic component chip 1, in order to receive the chip 1 along a prescribed direction and to orient the same in a prescribed direction. An electronic component chip holder, 6, which is in the form of a plate as a whole, for example, is provided under the component orienting apparatus 4. This holder 6 is not known in the art, but merely employed in the plant of the applicant company. The electronic component chip holder 6 has a plurality of receiving portions 7, which are defined by through holes, for example. Positions of the respective receiving portions 7 correspond to those of the respective orienting passages 5. Elastic members 8 of silicone rubber, for example, are formed on inner peripheral surfaces of the receiving portions 7. The elastic members 8 are adapted

to elastically hold the electronic component chips 1, as understood from the following description. The electronic component chip holder 6 is thus adapted to receive and hold the electronic component chips 1 one by one in the
5 respective receiving portions 7, to enable simultaneous handling of a large number of electronic component chips 1, which may be too small for direct handling. In more concrete terms, the electronic component chips 1 are handled for measuring various electrical properties in
10 steps of testing the same, forming the external terminal electrodes 2 and 3, performing soldering on the external terminal electrodes 2 and 3, taping or magazinizing the electronic component chips 1, mounting the electronic component chips 1, and the like.

15 Referring again to Fig. 9, a plurality of chips 1 are first placed at random on the component orienting apparatus 4, to be inserted in the receiving portions 7 of the holder 6 respectively in the aforementioned manner. At this time, a frame member 9 may be employed to prevent
20 dropping of the chips 1 from the component orienting apparatus 4. Then, horizontal vibration, for example, is applied to the component orienting apparatus 4, while supplying vacuum suction into the orienting passages 5 through the receiving portions 7 as shown by arrows 10.

Among the chips 1, only those oriented in a prescribed direction are received in the orienting passages 5 in response to the above operation, as shown in Fig. 10. After the chips 1 are filled in all of the orienting passages 5, those remaining on the component orienting apparatus 4 are removed.

Thereafter a pusher 12 having projections 11 in positions corresponding to the orienting passages 5 is moved along an arrow 13, as shown in Fig. 11. In response to this, the projections 11 press the respective chips 1, which in turn are pushed into corresponding ones of the receiving portions 7 of the holder 6. At this time, the elastic members 8 are elastically deformed for receiving the chips 1, to finally elastically hold the chips 1.

It is understood that the configuration of the orienting passages 5 in the aforementioned component orienting apparatus 4 is significant for efficiently aligning the electronic component chips 1. Thus, the configuration of such orienting passages 5 has been devised in various ways. Japanese Patent Publication Gazette No. 36630/1987 discloses an exemplary configuration of such orienting passages.

Figs. 12 to 14 illustrate an orienting passage 5a, the configuration of which is substantially similar to that disclosed in the aforementioned prior art. This

orienting passage 5a basically comprises a receiving portion 14 and an aligning portion 15. The receiving portion 14 is provided with an upwardly opening first space 17, which is defined by an inverse-conical inner peripheral surface 16. The aligning portion 15 has a cylindrical inner peripheral surface 19, which is rectangular in section, defining a second space 18 communicating with the lower end of the first space 17. The sectional geometry of the inner peripheral surface 19 is selected to reject a longitudinal dimension L of an electronic component chip 1 but crosswisely and perpendicularly orient the same in constant directions.

According to this prior art, the receiving portion 14 has the inverse-conical inner peripheral surface 16, to be capable of receiving the electronic component chip 1 regardless of the direction thereof. Thus, the electronic component chip 1 can be easily received in the first space 17 of the receiving portion 14.

However, the prior art shown in Figs. 12 to 14 has the following problems to be solved:

First, it is rather difficult to introduce the electronic component chip 1, which is easily received in the receiving portion 14, sequentially into the aligning portion 15. One of the reasons for this may be that relatively sharp edges 20 and 21 are defined between the

inner peripheral surface 16, which is circular in section,
and the inner peripheral surface 19, which is rectangular
in section. Thus, an electronic component chip 1, which
is in a position shown by broken lines in Fig. 14, is
5 undesirably engaged with the edge 20, for example, and
prevented from insertion into the space 18 of the aligning
portion 15.

In order to reduce the possibility of the
aforementioned engagement between the chip 1 and the edge
10 20 or 21, the sectional dimensions of the inner peripheral
surface 19 of the aligning portion 15 may be increased.
In this case, however, the chip 1 cannot be accurately
centered in the aligning portion 15.

Further, working steps for forming the
15 inverse-conical inner peripheral surface 16 and the
sectionally rectangular inner peripheral surface 19 are
complicated. In general, the inverse-conical inner
peripheral surface 16 is formed by drilling, while the
inner peripheral surface 19, which is rectangular in
20 section, is formed by broaching or electric spark
machining. In order to obtain the orienting passage 5a in
a desired configuration, therefore, it is necessary to
combine two types of working methods. Since such two
types of working methods must be carried out in two steps,
25 burrs are easily caused on the edges 20 and 21, which

define the boundary between the receiving portion 14 and the aligning portion 15. Such burrs further hinder introduction of the chip 1 into the aligning portion 15, while after treatment for removing the
5 flashes is extremely troublesome.

The present invention aims to overcome the abovementioned and associated problems.

According to the invention there is provided an apparatus for use in orienting elongate components of
10 known length, width and thickness, the length of the component being greater than the width and greater than the thickness thereof, the apparatus comprising a plurality of orienting passages, wherein each passage is formed by a receiving portion defined by an
15 upwardly tapering first inner surface portion and an aligning portion defined by a cylindrical second inner surface portion, the first and second inner surface portions together defining a continuous profiled contour for guiding a component in said passage, and
20 wherein the sectional geometry of each orienting passage is substantially elliptical along the length of the passage, the elliptical section having a major axis and a minor axis of lengths related respectively to the width and thickness of the component to be

oriented thereby, each passage thus being formed so that a component may only pass therethrough in one given orientation with respect to the length, width and thickness of the component as dictated by the elliptical section and continuous profiled contour of the passage.

In an embodiment of the invention, to be described in greater detail hereinafter, each of a plurality of rectangular-parallelipedic components is first received in the upwardly taperingly opening first space provided in each receiving portion. Then, the component is guided by the rounded face provided between the first inner peripheral surface defining the first space and the second inner peripheral surface of the aligning portion defining the second space, to enter the second space. The sectional geometry of the second inner peripheral surface defining the second space is so selected as to reject the longitudinal dimension of the component but crosswisely and perpendicularly orient the same in constant directions respectively, as hereinabove described. Thus, a plurality of components positioned in respective aligning portions of a plurality of such orienting passages can be aligned in the same orientation as each other along prescribed directions.

Thus, the components received in the receiving portions are smoothly introduced into the aligning portions through the rounded faces. Since the receiving portions are provided with the upwardly taperingly opening first spaces, the components can be easily received in the receiving portions, as a matter of course. Thus, a large number of components can be efficiently aligned in the orienting passages in prescribed condition.

10 The components can be easily introduced into the aligning portions through the aforementioned rounded faces. Therefore, it is not necessary to provide large clearances between the second inner peripheral surfaces of the aligning portions and the outer surfaces of the components. Thus, the aligned components can be accurately centred in the aligning portions.

It is not necessary to provide two types of inverse-conical and sectionally rectangular inner peripheral surfaces, dissimilarly to the prior art shown in Figs. 12 to 14. Orienting passages may be easily formed by a single working step such as drilling, to cause no problem of burring.

These and other objects, features, aspects and advantages of the present invention will become more apparent from the following detailed description of the present invention when taken in conjunction with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is a fragmentary enlarged plan view showing a component orienting apparatus 30 according to an embodiment of the present invention;

Fig. 2 is a sectional view taken along the line II - II in Fig. 1;

Fig. 3 is a sectional view taken along the line III - III in Fig. 1;

Fig. 4 is a front elevational view showing a drill 39 employed for forming an orienting passage 31 shown in Figs. 1 to 3;

Fig. 5 is a fragmentary enlarged plan view corresponding to Fig. 1, for illustrating another orientation passage.

Fig. 6 is a sectional view corresponding to Fig. 3, for illustrating still another embodiment of the present invention;

Fig. 7 is a sectional view showing a receiving-side member 40 and an aligning-side member 41, forming a

component orienting apparatus 30b shown in Fig. 6, which are separated from each other;

Fig. 8 is a perspective view showing exemplary condition of electronic component chips 1, which are in an aligned state to be attained by the present invention;

Figs. 9 to 11 are sectional views showing exemplary application of a component orienting apparatus 4, for illustrating the background of the present invention;

Fig. 12 is a fragmentary enlarged plan view showing a component orienting apparatus which forms the prior art of interest to the present invention;

Fig. 13 is a sectional view taken along the line XIII - XIII in Fig. 12; and

Fig. 14 is a sectional view taken along the line XIV - XIV in Fig. 12.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Figs. 1 to 3 show a principal part of a component orienting apparatus 30 according to an embodiment of the present invention. This component orienting apparatus 30 is in the form of a plate as a whole, substantially similarly to that shown in Figs. 9 to 11. Figs. 1 to 3 show a single orienting passage 31, which is one of a plurality of those parallelly provided in such a component orienting apparatus 30.

The orienting passage 31 basically comprises a receiving portion 32 and an aligning portion 33, similarly to the orienting passage 5a shown in Figs. 12 to 14. Thus, the receiving portion 32 receives a component (not shown) such as an electronic component chip, for example, which is to be aligned in the aligning portion 33 with those adjacent thereto along a prescribed direction.

The receiving portion 32 is provided with a first space 35 which is defined by an upwardly taperingly opening first inner peripheral surface 34.

On the other hand, the aligning portion 33 has a cylindrical second inner peripheral surface 37 defining a second space 36 which communicates with the lower end of the first space 35 provided in the receiving portion 32. When the component orienting apparatus 30 is applied to the rectangular-parallelipipedic electronic component chip 1 shown in Fig. 8, for example, the sectional geometry of the second inner peripheral surface 37 is so selected as to reject the longitudinal dimension L of the chip 1 but crosswisely and perpendicularly orient the same along constant directions respectively.

As clearly shown in Figs. 2 and 3, the first inner peripheral surface 34 is continuous with the second inner peripheral surface 37 through a rounded face 38. According to this embodiment, the first inner peripheral

surface 34 is also rounded with curvature which is substantially similar to that of the rounded face 38. However, this is not an essential characteristic of the present invention.

5 The component orienting apparatus 30 is used in the mode shown in Figs. 9 to 11, for example. According to the component orienting apparatus 30, the opening of the first space 35 is defined by an elongated hole as shown in Fig. 1, whereby the chip 1 is received in the first space
10 35 in a somewhat oriented state in a stage corresponding to that shown in Fig. 9. The chip 1 once received in the first space 35 is immediately introduced into the second space 36 through the rounded face 38. According to this embodiment, the chip 1 can be thus smoothly introduced
15 into the second space 36 of the aligning portion 33, whereby a clearance to be defined between the chip 1 and the second space 36 can be minimized. For example, a clearance of not more than 0.05 mm is sufficient for a chip 1 having a perpendicular dimension T of 0.55 mm.
20 Thus, accuracy for centering the chip 1 positioned in the aligning portion 33 can be improved.

 The orienting passage 31 shown in Figs. 1 to 3 can be easily worked by a drill 39 shown in Fig. 4, for example. Namely, the drill 39 is adapted to form a hole in a
25 prescribed position of a metal plate of stainless steel,

for example, for providing the component orienting apparatus 30. Thereafter either the drill 39 or the metal plate is transversely moved, thereby to finish the first and second inner peripheral surface 34 and 37 as well as the rounded face 38. The first and second inner peripheral surface 34 and 37 and the rounded face 38 can be finished in good states through such a simple drilling step, to cause no problem of flashes.

Fig. 5 is a fragmentary enlarged plan view illustrating another orientation passage. In the orienting passage 31a of a component orienting apparatus 30a shown in Fig. 5, both of a first inner peripheral surface 34a of a receiving portion 32a and a second inner peripheral surface 37a of an aligning portion 33a are rectangular in section, and hence rounded faces 38a are formed along respective sides of such rectangles. Thus, this passage is merely different in plane configuration from that shown in Figs. 1 to 3, but the sectional configuration of the orienting passage 31a shown in Fig. 5 is substantially similar to that shown in Figs. 2 and 3.

Figs. 6 and 7 illustrate still another embodiment of the present invention. Fig. 6 corresponds to Fig. 3. It may be necessary to increase the vertical dimension of each orienting passage, depending on the configuration and

dimensions of components such as electronic component chips to which the inventive component orienting apparatus is applied. The embodiment shown in Figs. 6 and 7 is particularly advantageous in such case.

5 Referring to Fig. 6, a component orienting apparatus 30b has orienting passages 31b, each of which has a relatively long vertical dimension. This component orienting apparatus 30b is formed by a receiving-side member 40 and an aligning-side member 41, which are
10 vertically stacked together. The receiving-side member 40 can be separated from the aligning-side member 41. A receiving portion 32b and an aligning portion 33b forming each orienting passage 31b are provided in the receiving-side member 40 and the aligning-side member 41
15 respectively. Also in this embodiment, the receiving portion 32b is provided with a first space 35b which is defined by an upwardly taperingly opening first inner peripheral surface 34b. Further, the aligning portion 33b has a cylindrical second inner peripheral surface 37b
20 defining a second space 36b, which communicates with the lower end of the first space 35b. The sectional geometry of the second inner peripheral surface 37b is selected in relation to the dimensions of an electronic component chip 1 to which the component orienting apparatus 30b is
25 applied, similarly to the second inner peripheral surface

37 shown in Figs. 1 to 3. The first inner peripheral surface 34b is continuous with the second inner peripheral surface 37b through a rounded face 38b.

In the state shown in Fig. 6, an electronic component chip 1a is already received in the second space 36b of the aligning portion 33b. However, another electronic component chip 1b is also received in the first space 35b of the receiving portion 32b since the orienting passage 31b is deeper than those of the aforementioned embodiments. Although such an upwardly positioned chip 1b must be removed for carrying out the step shown in Fig. 11, for example, it is rather difficult to discharge the chip 1b once deeply introduced into the receiving portion 32b. According to this embodiment, however, the receiving-side member 40 can be separated from the aligning-side member 41 as shown in Fig. 7, thereby to efficiently remove unwanted chips such as the chip 1b shown in Fig. 6. The step shown in Fig. 11, for example, may be carried out only through the aligning-side member 41 after the same is separated from the receiving-side member 40.

While the present invention has been described with reference to the embodiments shown in the drawings, various modifications are also possible within the scope of the present invention.

1
In the embodiment shown in Fig. 1, for example, the first inner peripheral surface 34 provided in the receiving portion 32 is similar in sectional configuration to the second inner peripheral surface 37 provided in the aligning portion 33. However, this is not an essential
5 characteristic of the present invention, but sectional configurations of first and second inner peripheral surfaces can be separately selected so far as the object of the present invention is attained.

10 Orienting passages of the inventive component orienting apparatus may be aligned in parallel with each other, or may be provided to form parallel rows and columns.

The present invention can be widely applied to
15 orientation of various types of rectangular-parallelipedic components, in addition to electronic component chips.

Although the present invention has been described and illustrated in detail, it is clearly understood that the
20 same is by way of illustration and example only and is not to be taken by way of limitation, the scope of the present invention being limited only by the terms of the appended claims.

CLAIMS:

1. An apparatus for use in orienting elongate components of known length, width and thickness, the length of the component being greater than the width and greater than the thickness thereof, the apparatus comprising a plurality of orienting passages, wherein each passage is formed by a receiving portion defined by an upwardly tapering first inner surface portion and an aligning portion defined by a cylindrical second inner surface portion, the first and second inner surface portions together defining a continuous profiled contour for guiding a component in said passage, and wherein the sectional geometry of each orienting passage is substantially elliptical along the length of the passage, the elliptical section having a major axis and a minor axis of lengths related respectively to the width and thickness of the component to be oriented thereby, each passage thus being formed so that a component may only pass therethrough in one given orientation with respect to the length, width and thickness of the component as dictated by the elliptical section and continuous profiled contour of the passage.



2. An apparatus as claimed in claim 1, wherein the aligning portion and the receiving portion are axially aligned in their longitudinal directions.
3. An apparatus as claimed in with claim 1 or 2, wherein said plural orienting passages are defined in a substantially planar member comprising a first plate member in which said receiving portion of each passage is formed and a second plate member in which said aligning portion of each passage is formed, the plate members being separable.
4. An apparatus as claimed in any preceding claim adapted for use with electronic component chips.
5. Apparatus substantially as herein described with reference to any of Figures 1 to 3, 6 and 7 or 9 to 11 of the accompanying drawings.
-

