

TITLE OF THE INVENTION

Apparatus for and Method of Manufacturing Electronic Components

BACKGROUND OF THE INVENTION

Field of the Invention

5 The present invention relates to an apparatus for and a method of manufacturing electronic components employed for manufacturing a plurality of electronic components by sealing semiconductor chips or the like mounted on a plurality of regions provided on a substrate respectively with resin thereby forming a sealed substrate and dividing the sealed substrate along the respective regions.

10 Description of the Background Art

 Systems generally employed for efficiently manufacturing a plurality of electronic components include a system of dividing a sealed substrate. The sealed substrate to be divided for manufacturing electronic components is now described with reference to Figs. 4A to 4C. Fig. 4A is a perspective view schematically showing the sealed
15 substrate to be divided as viewed from the side of a substrate, and Figs. 4B and 4C are plan views showing exemplary sealed substrates as viewed from the sides of sealing resin respectively. All of the accompanying drawings are schematically illustrated in a properly omitted or exaggerated manner, in order to facilitate easy understanding.

 As shown in Figs. 4A to 4C, each sealed substrate 91 has a substrate 92 formed
20 by a printed board or the like and sealing resin 93 formed on one side of substrate 92. Substrate 92 is divided into a plurality of latticed regions 96 through virtually provided boundary lines 94 and 95 in directions X and Y. Chip-like components (not shown) such as semiconductor chips are mounted on regions 96 respectively.

 Substrate 92 tends to increase in size nowadays, in order to satisfy the
25 requirements for reduction of the cost and the size of electronic components. Further, the yield of the electronic components in substrate 92, i.e., the number of regions 96 tends to increase (see Fig. 4B). In addition, a plurality of island portions 97 each including a plurality of regions 96 and an independent portion of sealing resin 93 may be

formed on sealed substrate 91, in order to satisfy requirements for prevention of warpage etc. in sealed substrate 91 (see Fig. 4C).

The system of manufacturing a plurality of electronic components from sealed substrate 91 is now described. First, chip-like components (hereinafter referred to as "chips") are mounted on plurality of regions 96 provided on substrate 92 respectively. Then, the plurality of chips mounted on substrate 92 are collectively sealed with sealing resin 93. Thus, sealed substrate 91 is completed. Then, sealed substrate 91 is cut (divided) along boundary lines 94 and 95. Thus, sealed substrate 91 is singulated into the plurality of electronic components corresponding to regions 96 respectively. The electronic components having sealing resin 93 obtained by singulating sealed substrate 91 are often referred to as packages.

In the step of cutting (dividing) sealed substrate 91, a cutter (dicer) employing a rotary blade or another cutter employing a laser beam is used. When sealed substrate 91 is singulated with such a cutter, fine dust particles partially result from substrate 92 or sealing resin 93. Such dust particles cause a problem in appearance, and may cause a contact failure when the completed electronic components are mounted on an electronic apparatus or the like. After sealed substrate 91 is cut (divided), therefore, the obtained electronic components must be sufficiently cleaned. In general, wash water or steam is sprayed onto the electronic components, in order to clean the same (refer to Japanese Patent Laying-Open No. 2004-207424 (pages 2 and 9 and Fig. 7), for example).

SUMMARY OF THE INVENTION

However, the aforementioned prior art has the following problems: According to the technique of spraying wash water onto the electronic components, it is difficult to uniformly spray the wash water onto the electronic components. When the wash water is merely sprayed onto the electronic components, an effect of removing dust particles strongly adhering to sealing resin is limited. Thus, fine dust particles may not be completely removable. According to the technique of spraying steam onto the

electronic components, a mechanism for generating the steam is required, whereby an apparatus for manufacturing the electronic components is increased in size. In addition to the requirement for the steam-generating mechanism, the maintenance time is increased due to employment of high-temperature steam. Further, the employment of high-temperature steam may result in a problem in safety.

The present invention aims at solving the following problems in relation to an apparatus for and a method of manufacturing electronic components employed for manufacturing a plurality of electronic components by dividing a sealed substrate: The first problem resides in the point that fine dust particles may not be completely removable. The second problem resides in the point that the apparatus for manufacturing electronic components is increased in size. The third problem resides in the point that the time is increased and a problem in safety may arise in maintenance.

In the following description, parenthesized numerals correspond to the reference numerals in the drawings, and are inserted in order to clarify the correspondence between the terms in the description and the elements shown in the drawings. These numerals are not intended to "interpret the terms in the description in limitation to the elements shown in the drawings".

In order to solve the aforementioned problems, provided according to the present invention is an apparatus (1) for manufacturing electronic components employed for manufacturing a plurality of electronic components by sealing chips mounted on a plurality of regions provided on a substrate (23) respectively with resin thereby forming a sealed substrate (8) and thereafter dividing the sealed substrate (8) along the respective regions, comprising a receiving portion (2) receiving the sealed substrate (8), a dividing portion (3) dividing the sealed substrate (8) into the plurality of electronic components and a cleaning portion (4) having a cleaning mechanism (13) cleaning the plurality of electronic components (15). The cleaning mechanism (13) includes a water tank (26), a water supply mechanism (28) supplying water (29) to the water tank (26) and a cleaning roller (14) provided above the water tank (26), and the cleaning roller

(14) comes into contact with the plurality of electronic components (15) by rotating in a state impregnated with stored water (27) in the water tank (26).

The aforementioned apparatus (1) may further comprise a rotating shaft (36) of the cleaning roller (14) and an air motor (45) rotationally driving the rotating shaft (36).

5 The aforementioned apparatus (1) may further comprise a draining roller (31) provided to be approachable to/separable from the cleaning roller (14) and a moving mechanism (32) advancing/retreating the draining roller (31) with respect to the cleaning roller (14), while the moving mechanism (32) may squeeze water out of the cleaning roller (14) by pressing the draining roller (31) against the cleaning roller (14).

10 The aforementioned apparatus (1) may further comprise a pair of side plates (35), bearings (42) provided on both ends of the rotating shaft (36) respectively, notches (not shown) provided on the pair of side plates (35) respectively for fittingly receiving the bearings (42) and press members (43) mounted on the pair of side plates (35) respectively for pressing the bearings (42) in the notches, while the bearings (42) may be
15 attachable and detachable from the pair of side plates (35) respectively when sides closer to ends of the notches are opened.

Preferably in the aforementioned apparatus (1), the rotating shaft (36) has a first rotating shaft (37) and a second rotating shaft (38) mounted on the first rotating shaft (37), and the first rotating shaft (37) and the second rotating shaft (38) are attachable
20 and detachable from each other.

Also provided according to the present invention is a method of manufacturing electronic components employed for manufacturing a plurality of electronic components by sealing chips mounted on a plurality of regions provided on a substrate (23) respectively with resin thereby forming a sealed substrate (8) and thereafter dividing the
25 sealed substrate (8) into the respective regions, comprising the steps of receiving the sealed substrate (8), dividing the sealed substrate (8) into the plurality of electronic components and cleaning the plurality of electronic components (15). The cleaning step includes the steps of supplying water (29) to a water tank (26), partially dipping a

cleaning roller (14) provided above the water tank (26) in stored water (27) in the water tank (26), rotating the cleaning roller (14) and bringing the cleaning roller (14) into contact with the plurality of electronic components (15) after partially dipping the cleaning roller (14) in the stored water (27).

5 In the cleaning step of the aforementioned manufacturing method, a draining roller (31) may be pressed against the cleaning roller (14) after dipping the cleaning roller (14) in the stored water (27) and before bringing the cleaning roller (14) into contact with the plurality of electronic components (15).

10 The aforementioned manufacturing method may further comprise the steps of dividedly arranging the plurality of electronic components (49) on two stages (17) after the cleaning step, inspecting the electronic components (49) arranged on the two stages (17) respectively at each stage (17), transferring an electronic component (49) determined as defective in the inspecting step from the corresponding stage (17) to a defective tray (20) and transferring an electronic component (49) determined as
15 nondefective in the inspecting step from the corresponding stage (17) to a nondefective tray (21). At least either the step of transferring the electronic component (15) determined as defective to the defective tray (20) or the step of transferring the electronic component (15) determined as nondefective to the nondefective tray (21) and the inspecting step may be carried out in parallel, while the plurality of electronic
20 components (49) may be divided or grouped into two groups to be in positional relation between first and second colors in an *ichimatsu* pattern (checkered pattern) and the two groups may be arranged on the two stages (17) respectively in the arranging step.

25 In the apparatus (1) for and the method of manufacturing electronic components according to the present invention, the cleaning roller (14) comes into contact with the plurality of electronic components (15) by rotating in the state impregnated with the stored water (27) in the water tank (26). Thus, the cleaning roller (14) impregnated with the stored water (27) uniformly comes into contact with the plurality of electronic components (15), and so rotates as to rub or brush the surfaces of the plurality of

electronic components (15). Therefore, an effect of removing fine dust particles from the surfaces of the plurality of electronic components (15) is increased.

In the apparatus (1) for manufacturing electronic components according to the present invention, the cleaning mechanism (13) includes the water tank (26), the water supply mechanism (28) supplying water to the water tank (26) and the cleaning roller (14) provided above the water tank (26). Thus, the components necessary for the apparatus (1) for manufacturing electronic components are the water tank (26), the cleaning roller (14) and the water supply mechanism (28) corresponding to the size of the sealed substrate (8). Therefore, the apparatus (1) can be downsized, and maintenance of the apparatus (1) is simplified. Further, the apparatus (1) can be easily maintained and has high safety due to the cleaning with water.

When the apparatus (1) for manufacturing electronic components according to the present invention comprises the air motor (45) rotationally driving the rotating shaft (36) of the cleaning roller (14), inconvenience caused in the rotational driving system due to the use of water is avoided.

According to an aspect of the inventive apparatus (1) for and the inventive method of manufacturing electronic components, the moving mechanism (32) squeezes water out of the cleaning roller (14) by pressing the draining roller (31) against the cleaning roller (14) after dipping the cleaning roller (14) in the stored water (27) and before bringing the cleaning roller (14) into contact with the plurality of electronic components (15). Thus, the quantity of water contained in the cleaning roller (14) when the cleaning water (14) comes into contact with the plurality of electronic components (15) is rendered substantially constant. Therefore, the effect of removing fine dust particles from the surfaces of the plurality of electronic components (15) is rendered constant and sustained.

According to another aspect of the inventive apparatus (1) for manufacturing electronic components, the bearings (42) fittingly received in the notches (not shown) provided on the pair of side plates (35) respectively are pressed by the press members

(43) in a normal state, and dismountable from the side plates (35) when the sides closer to the ends of the notches are opened. Thus, the rotating shaft (36) can be detached from the pair of side plates (35) without dismounting any member mounted on the rotating shaft (36) of the cleaning roller (14). Therefore, maintenance of the apparatus (1) is simplified.

According to still another aspect of the inventive apparatus (1) for manufacturing electronic components, the rotating shaft (36) has the first rotating shaft (37) and the second rotating shaft (38) mounted on the first rotating shaft (37), and the first rotating shaft (37) and the second rotating shaft (38) are attachable and detachable from each other. According to this structure, the rotating shaft (36) is dividable into the first rotating shaft (37) and the second rotating shaft (38). Thus, no member mounted on the rotating shaft (36) outside the cleaning roller (14) may be dismounted when the cleaning roller (14) is attached to/detached from the rotating shaft (36). Therefore, maintenance of the apparatus (1) is more simplified.

According to a further aspect of the inventive method of manufacturing electronic components, the step of dividedly arranging the plurality of electronic components (49) on the two stages (17) is provided after the step of cleaning the plurality of electronic components (15) obtained by dividing the sealed substrate (8). In this arranging step, the plurality of electronic components (49) are divided or grouped into the two groups to be in the positional relation between first and second colors in the *ichimatsu* pattern (checkered pattern), and the two groups are arranged on the two stages (17) respectively. Further, at least either the step of transferring the electronic component (15) determined as defective from one of the stages (17) to the defective tray (20) or the step of transferring the electronic component (15) determined as nondefective from one of the stages (17) to the nondefective tray (21) and the step of inspecting the electronic components (49) arranged on the other stage (17) are parallelly carried out. Thus, the steps of inspecting the cleaned plurality of electronic components (49), transferring the electronic component (49) determined as nondefective

to the nondefective tray (21) and transferring the electronic component (49) determined as defective to the defective tray (20) can be efficiently carried out.

The foregoing 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

Figs. 1A and 1B are plan views showing left- and right-side portions of an apparatus for manufacturing electronic components according to the present invention respectively;

Figs. 2A and 2B are a partially fragmented front elevational view and a right side elevational view showing a principal part of a cleaning mechanism in the apparatus shown in Figs. 1A and 1B;

Fig. 3 is an enlarged plan view showing a principal part of an inspecting portion in the apparatus shown in Figs. 1A and 1B; and

Fig. 4A is a perspective view schematically showing a sealed substrate to be singulated as viewed from the side of a substrate, and Figs. 4B and 4C are plan views showing exemplary sealed substrates as viewed from the sides of sealing resin respectively.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

A manufacturing apparatus (1) for electronic components comprises a cleaning roller (14) rotating in contact with sealing resin (24) provided on an assembly (15) of cut packages (49), a water tank (26) provided under the cleaning roller (14), stored water (27) stored in the water tank (26), a water supply pipe (28) spraying water (29) onto the water tank (26), a draining roller (31) pressed against the cleaning roller (14) impregnated with the stored water (27) and a moving mechanism (32) advancing/retreating the draining roller (31). The apparatus (1) further comprises a pair of opposite side plates (35), bearings (42) provided on both ends of a rotating shaft (36) of the cleaning roller (14) respectively, notches (not shown) provided on the pair of

side plates (35) respectively for fittingly receiving the bearings (42) and press members (43) mounted on the pair of side plates (35) respectively for pressing and fixing the bearings (42) in the notches. The bearings (42) are mountable and dismountable from the pair of side plates (35) respectively when sides closer to ends of the notches are
5 opened. The apparatus (1) further comprises coupling portions (40) provided on both sides of the rotating shaft (36) of the cleaning roller (14) respectively and outer shafts (41) provided on both sides of the rotating shaft (36) through the coupling portions (40) respectively. The outer shafts (41) are rotatably supported by the bearings (42) respectively, the rotating shaft (36) is constituted of a first rotating shaft (37) and a
10 second rotating shaft (38) mounted on the first rotating shaft (37), and the first rotating shaft (37) and the second rotating shaft (38) are attachable and detachable from each other.

[First Embodiment]

An apparatus for and a method of manufacturing electronic components
15 according to a first embodiment of the present invention are described with reference to Figs. 1A, 1B, 2A and 2B. Figs. 1A and 1B are plan views showing left- and right-side portions of the apparatus for manufacturing electronic components according to the present invention respectively. Figs. 2A and 2B are partially fragmented front elevational view and a right side elevational view showing a principal part of a cleaning
20 mechanism in the apparatus shown in Figs. 1A and 1B.

An apparatus 1 for manufacturing electronic components according to the present invention is a dividing apparatus dividing a sealed substrate into a plurality of electronic components. As shown in Fig. 1A, apparatus 1 for manufacturing electronic components has a receiving portion 2, a dividing portion 3, a cleaning portion 4, an
25 inspecting portion 5 and an unloading portion 6.

As shown in Fig. 1A, receiving portion 2 is provided with a prestage 7. Prestage 7 receives a resin-sealed substrate 8 from a resin-sealed molding apparatus of a preceding step. Sealed substrate 8 corresponds to sealed substrate 91 shown in Fig.

4A, 4B or 4C. Sealed substrate 8 is arranged on prestage 7 while directing the side corresponding to the side of sealing resin 93 shown in Fig. 4A, 4B or 4C downward. Sealed substrate 8 is aligned on prestage 7 if needed. Similarly to sealed substrate 91 shown in Fig. 4A, 4B or 4C, chips are mounted on a plurality of latticed regions of sealed substrate 8 respectively, and the plurality of chips are collectively sealed with resin.

Dividing portion 3 is provided with a cutting table 9. Cutting table 9 is movable in a direction Y in Fig. 1A, and rotatable in a direction θ . A cutting stage 10 is mounted on cutting table 9. Two spindles 11 are provided on the inner part of dividing portion 3. Two spindles 11 are independently movable in a direction X. Rotary blades 12 are provided on two spindles 11 respectively. Rotary blades 12 rotate in planes along direction Y respectively.

Cleaning portion 4 is provided with a cleaning mechanism 13. Cleaning mechanism 13 is provided with a cleaning roller 14 to be rotatable about an axis along direction Y. An assembly 15 formed by a plurality of electronic components (packages) cut out from sealed substrate 8 is arranged above cleaning mechanism 15. Assembly 15 is adsorbed and fixed by a transport mechanism (not shown) on a surface (front surface in the plane of Fig. 1A) closer to a substrate. In other words, assembly 15 is adsorbed and fixed on the surface closer to the substrate corresponding to substrate 92 shown in Fig. 4A, 4B or 4C. Assembly 15 adsorbed and fixed by the transport mechanism is moved from left to right in Fig. 1A. Following this movement, the surface (rear surface in the plane of Fig. 1A) of assembly 15 closer to the sealing resin comes into contact with rotating cleaning roller 14.

As shown in Fig. 1B, inspecting portion 5 is provided with two inspection tables 16. Inspection stages 17 are mounted on two inspection tables 16 respectively. The transport mechanism (not shown) adsorbing and fixing assembly 15 formed by the plurality of electronic components transfers the cleaned plurality of electronic components onto each inspection stage 17. In inspecting portion 5, each inspection

table 16 is independently movable in direction Y along a prescribed moving path, and independently rotatable in direction θ . Fig. 1B shows the moving path of left inspection table 16 included in two inspection tables 16 with unnumbered thick arrows shown in solid lines.

5 A camera 18 picking up still images of the electronic components is provided on the inner part of inspecting portion 5. Camera 18 is movable in direction X along arrow 19 shown in a thick solid line, and also in direction Y. Apparatus 1 for manufacturing electronic components is provided with a control portion (not shown). This control portion performs image processing on the basis of the still images of the
10 electronic components received from camera 18 and compares obtained image data with previously stored data, thereby determining whether the electronic components are nondefective or defective.

 As shown in Fig. 1B, inspecting portion 5 is provided with a defective tray 20. Electronic components determined as defective by the control portion (not shown) are
15 transferred from two inspection stages 17 respectively through transport mechanism (not shown) and stored in defective tray 20.

 Unloading portion 6 is provided with two nondefective trays 21. Electronic components determined as nondefective by the control portion (not shown) are transferred from two inspection stages 17 respectively through transport mechanism
20 (not shown) and stored in nondefective trays 21. The electronic components (nondefectives) stored in nondefective trays 21 respectively are transported to a subsequent stage (packaging step, for example).

 Referring to Fig. 1B, two systems of transport mechanisms (not shown) are provided for adsorbing, fixing and transporting the plurality of electronic components
25 from two inspection stages 17 respectively. These transport mechanisms are independently movable in directions X and Y along thick arrows shown in broken lines respectively. These transport mechanisms transfer nondefective and defective ones of the plurality of electronic components received from two inspection stages 17 and

adsorbed and fixed thereto to nondefective trays 21 and defective tray 20 respectively. The transport mechanisms (not shown) perform this transfer on the basis of results of determination on the nondefectives and the defectives received from the control portion (not shown).

5 Cleaning mechanism 13 is now described with reference to Figs. 2A and 2B. As shown in Fig. 2A, assembly 15 formed by the plurality of electronic components (packages) is adsorbed and fixed to a transport mechanism 22. Assembly 15 has a substrate 23, sealing resin 24 and clearances 25 formed by cutting. Cleaning roller 14 of sponge or the like is provided to be pressed against sealing resin 24 of assembly 15.
10 A driving mechanism rotationally drives cleaning roller 14 in a direction (counterclockwise direction) along thin arrow in Fig. 2A (described later with reference to a second embodiment).

 As shown in Figs. 2A and 2B, a water tank 26 is provided under cleaning roller 14, and stores stored water 27. Cleaning roller 14 and water tank 26 are so arranged
15 that the lower portion of cleaning roller 14 is dipped in stored water 27 along the overall width of cleaning roller 14 along direction Y in Figs. 2A and 2B. A water supply pipe 28 is provided in the vicinity of water tank 26 above stored water 27. Water supply pipe 28 is provided with a plurality of openings (not shown) capable of supplying water 29 to water tank 26 on a portion corresponding to the overall width of cleaning roller
20 14.

 Water supply pipe 28 is preferably provided on the following position: With reference to the direction for transporting assembly 15, this position is on the upstream side of cleaning roller 14 on the path for transporting assembly 15. With reference to the rotational direction of cleaning roller 14, this position is immediately in front of the
25 position for dipping rotating cleaning roller 14 in stored water 27.

 In cleaning mechanism 13 shown in Figs. 2A and 2B, water 29 is so supplied to water tank 26 that water tank 26 stores stored water 27. Rotating cleaning roller 14 is so dipped in stored water 27 that stored water 27 partially spills out of water tank 26 as

an overflow 30 while waves W are generated in stored water 27. A drain mechanism (not shown) storing and discharging overflow 30 is provided under water tank 26.

5 A draining roller 31 is provided on a side portion of cleaning roller 14, to be approachable to/separable from cleaning roller 14. Draining roller 31 is provided on a position allowing draining roller 31 to come into contact with cleaning roller 14 while cleaning roller 14 is dipped in stored water 27 and thereafter comes into contact with assembly 15. A moving mechanism 32 is an actuator, constituted of a direct-acting cylinder, for example, coupled to draining roller 31 through a proper joint. Draining roller 31 is advanced to be pressed against cleaning roller 14. Thus, stored water 27
10 contained in cleaning roller 14 is squeezed out. Then, draining roller 31 is retreated to be separated from cleaning roller 14.

On the path for transporting assembly 15 formed by the plurality of electronic components, an air spray pipe 33 is provided on the downstream side of cleaning roller 14. The injection port of air spray pipe 33 extends along direction Y in Fig. 2A, to be
15 capable of spraying air 34 onto the overall width of assembly 15.

The method of manufacturing electronic components according to the present invention is described with reference to Figs. 1A, 2A and 2B. First, dividing portion 3 shown in Fig. 1A cuts (singulates) sealed substrate 8 into the plurality of electronic components (packages) with rotary blades 12. At this time, water is supplied to the
20 portions of resin-sealed substrate 8 cut with rotary blades 12. This water can remove fine dust particles from the side of sealed substrate 8 cut with rotary blades 12, i.e., the side of substrate 23 shown in Fig. 2A.

In cleaning mechanism 13 shown in Figs. 1A, 2A and 2B, stored water 27 is previously stored in water tank 26, as shown in Figs. 2A and 2B. Thus, the lower
25 portion of cleaning roller 14 is dipped in stored water 27 along the overall width of cleaning roller 14, to be impregnated with stored water 27.

Then, cleaning roller 14 rotates in the direction (counterclockwise direction) along thin arrow in Fig. 2A. Water supply pipe 28 supplies water 29 to water tank 27.

Thus, stored water 27 partially spills out of water tank 26 as overflow 30, and waves W are generated in stored water 27.

Then, draining roller 31 is advanced by moving mechanism 32 toward cleaning roller 14 and pressed against cleaning roller 14, as shown in Fig. 2A. Thus, cleaning
5 roller 14 is partially contracted as shown by a two-dot chain line in Fig. 2A, so that stored water 27 is partially squeezed out of cleaning roller 14.

The quantity of the water squeezed out of cleaning roller 14 or the quantity of water remaining in cleaning roller 14 after draining roller 31 is pressed against the same is decided in response to the pressure for pressing draining roller 31 against cleaning
10 roller 14. Therefore, the optimum quantity of water contained in cleaning roller 14 is preferably found out by an experiment or the like, for previously setting the pressure for pressing (pushing) draining roller 31 against cleaning roller 14. Assembly 15 can be cleaned without pressing draining roller 31 against cleaning roller 14, as the case may be.

15 Then, assembly 15 formed by the plurality of electronic components is adsorbed and fixed by transport mechanism 22 as shown in Fig. 2A, and introduced into cleaning mechanism 13. Then, assembly 15 is moved rightward in Fig. 2A, to be cleaned. More specifically, cleaning roller 14 rotating in the state impregnated with stored water 27 is pressed against sealing resin 24 of assembly 15 and assembly 15 is moved. Thus,
20 cleaning roller 14 impregnated with stored water 27 rubs the surface of assembly 15, whereby fine dust particles adhering thereto can be removed. Further, cleaning roller 14 is so pressed against sealing resin 24 of assembly 15 that water squeezed out of cleaning roller 14 infiltrates into clearances 25 of assembly 15. Thus, dust particles present in clearances 25 of assembly 15 can be washed out.

25 The rotational direction of cleaning roller 14 and the direction of movement of assembly 15 are preferably opposite to each other on the portion where cleaning roller 14 and assembly 15 come into contact with each other. Thus, cleaning roller 14 comes into contact with the surface of assembly 15 at a high relative speed. Therefore, the

effect of cleaning assembly 15 is increased.

Then, air 34 is sprayed onto the overall width of assembly 15 rubbed with cleaning roller 14 impregnated with stored water 27. Thus, water adhering to assembly 15 is blown off, and the surface of assembly 15 is dried. In this step, hot air is
5 preferably used as air 34, in order to increase the drying effect.

According to this embodiment, the lower portion of cleaning roller 14 rotating in the direction along thin arrow shown in Fig. 2A is dipped in stored water 27 in water tank 26. Thus, cleaning roller 14 of sponge or the like rotates in the state impregnated with stored water 27. Cleaning roller 14 is pressed against sealing resin 24 of assembly
10 15 with a proper pressure, so that the water contained therein is extruded from cleaning roller 14.

This cleaning results in the following three effects: First, cleaning roller 14 rotating in the state impregnated with water is pressed against sealing resin 24 of transported assembly 15. Thus, cleaning roller 14 impregnated with water uniformly
15 rubs the entire surface of sealing resin 24 of assembly 15. Therefore, an excellent cleaning effect is attained also with respect to dust particles strongly adhering to the surface of sealing resin 24, and this cleaning effect is exerted on the overall surface of sealing resin 24. Second, water squeezed out of cleaning roller 14 infiltrates into clearances 25, thereby washing out dust particles present in clearances 25. Third, dust
20 particles removed from the surface of assembly 15 are reliably discharged from water tank 26 as follows: The dust particles removed from the surface of assembly 15 fall into and are stored in water tank 26 along with water squeezed out of cleaning roller 14. Then, the dust particles stored in water tank 26 are discharged from water tank 26 along with overflow 30.

25 The dust particles removed from the surface of assembly 15 may adhere to the surface of cleaning roller 14. In this case, cleaning roller 14 is so dipped in stored water 27 that the dust particles adhering to the surface thereof are separated from the surface and removed. Waves W generated when rotating cleaning roller 14 is dipped in

stored water 27 come into contact with the surface of cleaning roller 14, to increase this effect. This is because waves W wash the surface of cleaning roller 14.

Draining roller 31 is so pressed against cleaning roller 14 as to squeeze water out of cleaning roller 14. Thus, the quantity of water contained in cleaning roller 14
5 coming into contact with assembly 15 formed by the plurality of electronic components is rendered substantially constant. Therefore, the effect of removing fine dust particles from the surfaces of the plurality of electronic components is stably attained and sustained.

Apparatus 1 for manufacturing electronic components according to the first
10 embodiment can be downsized, is easy to maintain, and implements high safety. These effects are particularly remarkable as compared with a manufacturing apparatus requiring a mechanism generating steam.

Draining roller 31 is formed by a direct-acting mechanism such as a direct-acting cylinder. Thus, apparatus 1 for manufacturing electronic components can be simplified
15 in structure and downsized as compared with a case of using an oscillating mechanism such as an oscillating cylinder.

In order to supply water 29 to water tank 26 from the openings (not shown) of water supply pipe 28 in this embodiment, water 29 is preferably continuously or pulsatively sprayed onto stored water 27. Thus, sprayed water 29 is reflected or
20 swashed on the surface of stored water 27, so that reflected or swashed water R strongly hits the surface of cleaning roller 14. Further, the effect of generating waves W on the surface of stored water 27 is increased due to sprayed water 29. Thus, dust particles adhering to the surface of cleaning roller 14 are easily separated and removed from the surface. Therefore, the effect of removing dust particles adhering to the
25 surface of cleaning roller 14 is increased.

The plurality of openings of water supply pipe 28 may be so provided as to spray water 29 toward the surface of cleaning roller 14. The effect of separating and removing dust particles adhering to the surface of cleaning roller 14 is attained also by

this. In this case, water R hitting the surface of cleaning roller 14 is supplied to water tank 26. Further, water 29 can be sprayed onto both of the surface of cleaning roller 14 and stored water 27.

5 According to this embodiment, cleaning roller 14 of sponge or the like is employed. Cleaning roller 14 may simply be made of a material having excellent water absorptivity. Therefore, cleaning roller 14 may be replaced with a bristled roller-type brush or the like. In other words, the term "cleaning roller" used in this specification is not restricted to a roller but also includes a roller-type member having excellent water absorptivity.

10 In the step of cleaning assembly 15, cleaning roller 14 is worn or slightly broken. If cleaning roller 14 is continuously used, therefore, the cleaning effect cannot be sufficiently sustained, due to the wear or the breakage. Therefore, cleaning roller 14 is treated as a consumable product, and exchanged at a proper frequency.

15 Moving mechanism 32 is preferably an air-driven actuator. Thus, occurrence of inconvenience resulting from water is suppressed as compared with a case of using an electrically driven actuator. Further, the actuator may not be highly waterproof.

According to the first embodiment, sealed substrate 8 is transported from receiving portion 2 to dividing portion 3 and cleaning portion 4 along the longitudinal direction of sealed substrate, as shown in Fig. 1A. Alternatively, sealed substrate 8
20 may be transported from receiving portion 2 to dividing portion 3 and cleaning portion 4 along the short-side direction of sealed substrate. In this case, cleaning roller 14 and cleaning mechanism 13 may be so sized (in direction Y) as to correspond to the length of sealed substrate 8 in direction Y shown in Fig. 1A. Further, prestage 7 and cutting stage 10 shown in Fig. 1A may be elongated along direction Y. According to this
25 structure, the size of apparatus 1 for manufacturing electronic components in direction X shown in Fig. 1A can be reduced.

[Second Embodiment]

An apparatus for manufacturing electronic components according to a second

embodiment of the present invention is now described with reference to Fig. 2B. This embodiment aims at implementing an apparatus easy to perform maintenance. As shown in Fig. 2B, a rotating shaft 36 is provided between a pair of opposite side plates 35 in the apparatus for manufacturing electronic components according to this
5 embodiment. Rotating shaft 36 is constituted of a first rotating shaft 37 and a second rotating shaft 38. First and second rotating shafts 37 and 38 are integrated with each other by fitting or screwing in the vicinity of the center of rotating shaft 36, and rendered attachable and detachable from each other. A cleaning roller 14 is mounted on rotating shaft 36. Fixing nuts 39 are mounted on both sides of cleaning roller 14 in
10 rotating shaft 36.

Rotating shaft 36 is coupled to outer shafts 41 on coupling portions 40 in fixing nuts 39. More specifically, rotating shaft 36 and outer shafts 41 are screwed to each other on coupling portions 40. In other words, outer shafts 41 are provided on the outer sides of fixing nuts 39 respectively, while rotating shaft 36 and outer shafts 41 are
15 coupled to each other on coupling portions 40 in fixing nuts 39 respectively. Thus, rotating shaft 36 is separable from members provided on the outer sides of coupling portions 40. Rotating shaft 36 and two outer shafts 41 are components constituting a generalized rotating shaft of cleaning roller 14. Referring to Fig. 2B, first rotating shaft 37 and outer shaft 41 provided on the outer (left) side thereof as well as second rotating
20 shaft 38 and outer shaft 41 provided on the outer (right) side thereof may be integrated with each other without providing coupling portions 40. According to this structure, the generalized rotating shaft is separable into two members.

Bearings 42 are mounted on outer shafts 41 respectively. Bearings 42 are fitted into substantially U-shaped notches (not shown) provided on side plates 35 respectively.
25 Press members 43 are fixed to side plates 35 respectively on upper portions of the notches. Press members 43 are attachable and detachable from side plates 35 respectively. Press members 43 are fixed to side plates 35 respectively, thereby pressing bearings 42 with press members 43 and fixing the same to side plates 35

respectively. When press members 43 are detached from side plates 35, bearings 42 can be detached from side plates 35 respectively. A gear 44 is mounted on the outer side of side plate 35 corresponding to one of outer shafts 41.

5 For example, screws fixing press members 43 to side plates 35 may be partially dismounted for moving press members 43, so that sides closer to ends (opening sides; upper sides in Fig. 2B) of the notches are openable. According to this structure, bearings 42 can be detached from side plates 35 while opening the sides closer to the ends (opening sides) of the notches without detaching press members 43.

10 An air motor 45 and an air pipe 46 supplying air thereto are provided under a water tank 26. A gear 48 is fixed to a motor shaft 47 of air motor 45. Gears 48 and 44 fixed to motor shaft 47 and one of outer shafts 41 respectively are coupled to each other through still another gear (not shown), so that rotation of motor shaft 47 is transmitted to outer shaft 41. According to this structure, rotation of motor shaft 47 of air motor 45 is transmitted to rotating shaft 36 mounted with cleaning roller 14
15 successively through gear 48, still another gear (not shown), gear 44 and outer shaft 41. Therefore, air motor 45 rotationally drives cleaning roller 14 in the direction (counterclockwise direction) along thin arrow shown in Fig. 2A.

According to this embodiment, the following effects are attained: First, bearings 42 fitted into the notches provided on pair of side plates 35 respectively are
20 pressed and fixed by press members 43 in a normal state, and dismountable from side plates 35 when the sides closer to the ends of the notches are opened. Thus, rotating shaft 36 can be detached from pair of side plates 35 by opening the sides closer to the ends of the notches, without detaching members mounted on rotating shaft 36 of cleaning roller 14. Thus, apparatus 1 for manufacturing electronic components is easy
25 to perform.

Second, rotating shaft 36 is formed by integrating first and second rotating shafts 37 and 38 with each other. Further, first and second rotating shafts 37 and 38 are rendered attachable and detachable from each other. Thus, rotating shaft 36 can be

divided into first and second rotating shafts 37 and 38 when cleaning roller 14 is attached to/detached from rotating shaft 37, whereby members mounted on the outer side of cleaning roller 14 in rotating shaft 36 may not be detached. Thus, apparatus 1 for manufacturing electronic components is easier to maintenance.

5 Third, apparatus 1 for manufacturing electronic components comprises air motor 45 rotationally driving rotating shaft 36 of cleaning roller 14. Thus, inconvenience caused in the rotational driving system due to the use of water is avoided.

[Third Embodiment]

10 A method of manufacturing electronic components according to a third embodiment of the present invention is described with reference to Figs. 1A, 1B and 3. This embodiment aims at improving the efficiency of the step of inspecting a plurality of cleaned electronic components as well as the efficiency of the method of manufacturing electronic components. Fig. 3 is an enlarged plan view showing a principal part of inspecting portion 5 of apparatus 1 shown in Figs. 1A and 1B.

15 As shown in Fig. 3, the following operation is performed after the step of cleaning a plurality of electronic components, i.e., a plurality of packages 49 obtained by dividing a sealed substrate 8 according to this embodiment: Cleaned plurality of packages 49 are divided or grouped into two groups, which in turn are transferred onto two inspection stages 17 respectively. At this time, packages 49 are divided into the
20 two groups to be in positional relation between first and second colors in an *ichimatsu* pattern (checkered pattern).

Then, the steps of transferring defective packages 49 onto a defective tray 20 from first inspection stage 17 and inspecting packages 49 arranged on second inspection stage 17 are carried out in parallel with each other. In addition, the step of cutting
25 another sealed substrate 8 subsequently transferred to an inspecting portion 3 (see Fig. 1A) or cleaning plurality of packages 49 is carried out in parallel with these steps. In this case, the step of transferring nondefective packages 49 from first inspection stage 17 onto nondefective trays 21 (see Fig. 1B) may be carried out in place of or in addition

to the step of transferring defective packages 49 onto defective tray 20 from first inspection stage 17.

As described above, the plurality of steps are parallelly carried out in the method of manufacturing electronic components according to this embodiment. Therefore, the following plurality of steps can be efficiently carried out: These steps are the steps of cutting sealed substrate 8 into packages 49, cleaning plurality of packages 49, inspecting cleaned plurality of packages 49, transferring packages 49 determined as nondefective onto nondefective trays 21 and transferring packages 49 determined as defective onto defective tray 20. Therefore, the efficiency of the method of manufacturing electronic components can be improved.

Plurality of packages 49 are divided or separated to be in the positional relation between first and second colors in the *ichimatsu* pattern. Thus, packages 49 can be stably adsorbed and fixed from inspection stages 17 particularly in a case of manufacturing small-sized packages 49. Further, the possibility for contact between adjacent packages 49 is reduced, whereby packages 49 can be prevented from flawing.

In sealed substrate 8 shown in Fig. 1A, the chips are mounted on the plurality of latticed regions respectively, and the plurality of chips are collectively sealed with resin. The term "latticed" is not used in the strict sense of the word but indicates such a state that regions corresponding to packages 49 respectively are arranged in directions X and Y respectively. Packages 49 are generally rectangular in outline. Further, packages 49 also include packages, such as certain kinds of memory cards, for example, having curved or polygonal lines in the respective sides in plan view. According to the third embodiment, adjacent packages 49 are prevented from coming into contact with each other particularly in a case of manufacturing such packages. According to this embodiment, therefore, a remarkable effect of preventing packages from flawing is attained particularly in a case of manufacturing packages having curved or polygonal lines in the respective sides.

The term "*ichimatsu* pattern" essentially indicates a pattern formed by alternately

arranging dark-blue and white squares.

In this embodiment, the term "*ichimatsu* pattern" indicates the pattern of the checkered flag (the so-called block check).

5 In each of the aforementioned embodiments, sealed substrate 8 is cut with rotary blades 12. However, the present invention is not restricted to this but sealed substrate 8 may alternatively be cut with a band saw or a wire saw. Further alternatively, sealed substrate 8 may be cut with a high-pressure liquid, i.e., a water jet. In this case, an abrasive may or may not be used. Further alternatively, sealed substrate 8 may be fused with a laser beam.

10 As shown in Fig. 1A, apparatus 1 for manufacturing electronic components according to the present invention is formed by successively coupling receiving portion 2, dividing portion 3, cleaning portion 4, inspecting portion 5 and unloading portion 6 with each other from the left side in Fig. 1A. In other words, apparatus 1 for manufacturing electronic components is formed by coupling unified (modularized) portions in the aforementioned order. However, the present invention is not restricted to this structure but apparatus 1 for manufacturing electronic components may alternatively be formed by successively coupling receiving portion 2, dividing portion 3, cleaning portion 4, inspecting portion 5 and unloading portion 6 with each other from the right side in Fig. 1A. Further alternatively, dividing portion 3, receiving portion 2, cleaning portion 4, inspecting portion 5 and unloading portion 6 may be successively coupled with each other from the left side or the right side in Fig. 1A.

25 Although the present invention has been described and illustrated in detail, it is clearly understood that the 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 interpreted by the terms of the appended claims.

WHAT IS CLAIMED IS:

1. An apparatus for manufacturing electronic components employed for manufacturing a plurality of electronic components by sealing chips mounted on a plurality of regions provided on a substrate respectively with resin thereby forming a sealed substrate and thereafter dividing said sealed substrate along respective said regions, comprising:
 - a receiving portion receiving said sealed substrate;
 - a dividing portion dividing said sealed substrate into said plurality of electronic components; and
 - a cleaning portion having a cleaning mechanism cleaning said plurality of electronic components, wherein
 - said cleaning mechanism includes a water tank, a water supply mechanism supplying water to said water tank and a cleaning roller provided above said water tank, and
 - said cleaning roller comes into contact with said plurality of electronic components by rotating in a state impregnated with stored water in said water tank.
2. The apparatus for manufacturing electronic components according to claim 1, further comprising:
 - a rotating shaft of said cleaning roller, and
 - an air motor rotationally driving said rotating shaft.
3. The apparatus for manufacturing electronic components according to claim 1 or 2, further comprising:
 - a draining roller provided to be approachable to/separable from said cleaning roller, and
 - a moving mechanism advancing/retreating said draining roller with respect to

said cleaning roller, wherein

said moving mechanism squeezes water out of said cleaning roller by pressing said draining roller against said cleaning roller.

4. The apparatus for manufacturing electronic components according to claim 2 or 3, further comprising:

a pair of side plates,

bearings provided on both ends of said rotating shaft respectively,

5 notches provided on said pair of side plates respectively for fittingly receiving said bearings, and

press members mounted on said pair of side plates respectively for pressing said bearings in said notches, wherein

10 said bearings are mountable and dismountable from said pair of side plates respectively when sides closer to ends of said notches are opened.

5. The apparatus for manufacturing electronic components according to claim 4, wherein

said rotating shaft has a first rotating shaft and a second rotating shaft mounted on said first rotating shaft, and

5 said first rotating shaft and said second rotating shaft are attachable and detachable from each other.

6. A method of manufacturing electronic components for manufacturing a plurality of electronic components by sealing chips mounted on a plurality of regions provided on a substrate respectively with resin thereby forming a sealed substrate and thereafter dividing said sealed substrate along respective said regions, comprising the steps of:

5 receiving said sealed substrate;

dividing said sealed substrate into said plurality of electronic components; and
cleaning said plurality of electronic components, wherein
said cleaning step includes the steps of supplying water to a water tank, partially
10 dipping a cleaning roller provided above said water tank in stored water in said water
tank, rotating said cleaning roller and bringing said cleaning roller into contact with said
plurality of electronic components after partially dipping said cleaning roller in said
stored water.

7. The method of manufacturing electronic components according to claim 6,
pressing a draining roller against said cleaning roller after dipping said cleaning roller in
said stored water and before bringing said cleaning roller into contact with said plurality
of electronic components in said cleaning step.

8. The method of manufacturing electronic components according to claim 6
or 7, further comprising the steps of:

dividedly arranging said plurality of electronic components on two stages after
said cleaning step,

5 inspecting said electronic components arranged on said two stages respectively
at each stage;

transferring an electronic component determined as defective in said inspecting
step from corresponding said stage to a defective tray, and

transferring an electronic component determined as nondefective in said
10 inspecting step from corresponding said stage to a nondefective tray,
parallelly carrying out at least either said step of transferring said electronic
component determined as defective to said defective tray or said step of transferring said
electronic component determined as nondefective to said nondefective tray and said
inspecting step, and

15 grouping said plurality of electronic components into two groups to be in

positional relation between first and second colors in a checkered pattern and arranging each of said two groups on said two stages respectively in said arranging step.