

VISION INSPECTION APPARATUS

BACKGROUND OF THE INVENTION

5 1. Field of the Invention

The present invention relates to a vision inspection apparatus, and particularly, to a vision inspection apparatus capable of inspecting external appearance of an electronic component.

10 2. Background of the Invention

An electronic component may not drive or mal-drive due to inferior processes. When these mal-functioned electronic components are presented on the market, the reliability of the electronic component may be lowered.

15 Accordingly, a plurality of processes are performed so as to select good electronic component through various inspections before the electronic component is presented on the market.

A vision inspection process, one of the various inspections, is to inspect external appearance of the electronic component, such as a
20 marking state, whether leads or ball grid has been damaged, and whether any crack or any scratch has occurred.

FIG. 7 is a view showing a configuration of a strip type vision inspection apparatus in accordance with the conventional art.

The conventional strip type vision inspection apparatus comprises
25 a loading unit 500, a first vision inspection unit 510, a second vision

inspection unit 520, and an inverting unit 530 which are installed in a line.
The electronic component is transferred by a transfer tool 550.

The conventional vision inspection processes are as follows.

Firstly, the electronic component in the loading unit 500 is
5 transferred to the first vision inspection unit 510 by the transfer tool 550,
thereby undergoing a first vision inspection process by the first vision
inspection unit 510. Then, the electronic component having been
completely first-vision inspected is inverted, that is, turned upside down by
the inverting unit 530. Then, the inverted electronic component undergoes
10 a second vision inspection process by the second vision inspection unit
520, and undergoes an unloading process by the unloading unit 540.

However, the conventional strip type vision inspection apparatus
has the following problems.

The electronic components having been completely first-vision
15 inspected should be inverted by the inverting unit 530 before the electronic
component is transferred to the second vision inspection unit 520.

This may cause the first vision inspection unit 510 and the second
vision inspection unit 520 to be in a standby state while the electronic
component is inverted by the inverting unit 530 and transferred. As a
20 result, the vision inspection may not be consecutively performed, and it
may take a lot of time to perform the vision inspection.

Furthermore, a total distance that the electronic component is
transferred during the vision inspection is long. This may cause a low
throughput per hour, thereby resulting in low productivity and economic
25 characteristic.

Furthermore, transferring of the electronic component to the second vision inspection unit 520 from the inverting unit 530 is separately performed from transferring of the electronic component to the unloading unit 540 from the second vision inspection unit 520. Accordingly, while the electronic component is unloaded by the unloading unit 540, the next electronic component to be transferred to the second vision inspection unit 520 has to be in a standby state at the inverting unit 530. As a result, the vision inspection may not be consecutively performed, and it may take a lot of time to perform the vision inspection. Also, since a throughput per hour becomes significantly low, it is disadvantageous in productivity and economic aspect.

Secondly, it is impossible to transfer any electronic component unloaded by the unloading unit 540 to the loading unit 500 in a circulation manner, in order to re-inspect some electronic components which have been undergone vision inspection.

According to the conventional structure, the loading unit 500 and the unloading unit 540 are designed and installed, which cannot transfer any electronic component unloaded by the unloading unit 540 to the loading unit 500 in a circulation manner.

An additional transfer tool may be composed so as to circulate the electronic component unloaded by the unloading unit 540 to the loading unit 500. However, this may cause the vision inspection apparatus to have a very complicated structure. Also, the operation for circulating the electronic component unloaded by the unloading unit 540 to the loading unit 500 may collide with an operation for loading electronic component

having not been inspected yet to the loading unit 500.

Thirdly, the loading unit 500 and the unloading unit 540 are arranged respectively in front and right of the vision inspection apparatus. This may cause loading and unloading processes to be performed together with an operator's long moving path, and cause the operator's works to be easily disturbed. This may result in degraded efficiency. In order to enhance the efficiency, an additional manpower has to be provided, which increases labor costs.

Fourthly, since a moving path of the electronic component under the structure becomes complicated, the entire size of the vision inspection apparatus is increased. This may cause high costs in fabricating the vision inspection apparatus, and cause utilization efficiency of a clean room to be lowered.

15 SUMMARY OF THE INVENTION

Therefore, a first object of the present invention is to provide a vision inspection apparatus capable of increasing a throughput per hour by enabling consecutive operations of vision inspection.

20 A second object of the present invention is to provide a vision inspection apparatus capable of increasing a throughput per hour by preventing time waste due to inverting and unloading processes.

A third object of the present invention is to provide a vision inspection apparatus capable of re-inspecting any electronic component by transferring unloaded electronic component to a loading unit in a

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circulation manner, and capable of preventing waste of time, through simplified designs and arrangements of the loading unit and the unloading unit.

A fourth object of the present invention is to provide a vision
5 inspection apparatus capable of enhancing operation efficiency with minimized manpower, and capable of simplifying a moving path of electronic components, by reducing an operator's moving path through an enhanced arrangement structure of a loading unit and an unloading unit.

To achieve these and other advantages and in accordance with
10 the purpose of the present invention, as embodied and broadly described herein, there is provided a vision inspection apparatus, comprising: a loading unit for loading at least one electronic component to be vision-inspected; a first vision inspection unit for performing first vision inspection with respect to the electronic component loaded by the loading unit; a
15 second vision inspection unit for performing second vision inspection with respect to the electronic component; an inverting unit installed between the first and second vision inspection units, for inverting the electronic component having been completely first-vision inspected by the first vision inspection unit before the electronic component is transferred to the
20 second vision inspection unit; an unloading unit for unloading the electronic component having been completely second vision-inspected by the second vision inspection unit; and a transfer tool for simultaneously transferring electronic components respectively in the first vision inspection unit, the inverting unit, and the second vision inspection unit to
25 the next respective units.

The loading process of the electronic component by the loading unit, and the unloading process the electronic component by the unloading unit may be performed in one side of the vision inspection apparatus.

The first vision inspection unit, the inverting unit, and the second
5 vision inspection unit may be arranged in a line, and form an inspection region unit, and the loading unit and the unloading unit may be arranged in a line, and form a standby region unit. And, the inspection region unit and the standby region unit may be arranged in parallel.

The electronic component loaded by the loading unit of the
10 standby region unit may be transferred to the inspection region unit by a loading interface unit. And, the electronic component having been completely inspected at the inspection region unit may be transferred to the unloading unit of the standby region unit by an unloading interface unit.

The transfer tool may simultaneously transfer the electronic
15 components respectively loaded in the loading interface unit, the first vision inspection unit, the inverting unit, and the second vision inspection unit to the first vision inspection unit, the inverting unit, the second vision inspection unit, and the unloading interface unit.

The loading unit may include a stack unit in which electronic
20 components are stacked, and a loading transfer unit for transferring the electronic component stacked in the stack unit to the loading interface unit.

The unloading unit may include a good unit, a rejection unit, and a bin unit for sorting the electronic component based on inspection result at the inspection region unit to the good unit, the rejection unit, and the bin
25 unit; and an unloading transfer unit for transferring the electronic

component having been completely inspected at the inspection region unit, to the good unit, the rejection unit, or the bin unit from the unloading interface unit.

The first vision inspection unit may include a first component loading unit for being loaded with the electronic component transferred from the loading interface unit by the transfer tool; a first transfer unit for transferring the electronic component loaded in the first component loading unit; and a first inspection unit for performing first vision inspection with respect to the electronic component transferred by the first transfer tool.

The second vision inspection unit may include a second component loading unit for being loaded with the electronic component transferred from the inverting unit by the transfer tool; a second transfer unit for transferring the electronic component loaded in the second component loading unit; and a second inspection unit for performing second vision inspection with respect to the electronic component transferred by the second transfer tool.

The transfer tool may include a first transfer tool for transferring the electronic component loaded in the loading interface unit to the first vision inspection unit; a second transfer tool for transferring the electronic component to the inverting unit from the first vision inspection unit; a third transfer tool for transferring the electronic component to the second vision inspection unit from the inverting unit; and a fourth transfer tool for transferring the electronic component to the unloading interface unit from the second vision inspection unit.

The vision inspection apparatus may be further provided with a transfer tool guide rail for guiding the first, the second, the third, and the fourth transfer tools together so that the first, the second, the third, and the fourth transfer tools can simultaneously transfer the electronic components.

5 According to another aspect of the present invention, there is provided a vision inspection apparatus, comprising: an inspection region unit for performing vision inspection with respect to electronic components; a standby region unit for loading the electronic component to be transferred to the inspection region unit, and unloading the electronic
10 component having been completely vision-inspected at the inspection region unit; a loading interface unit for transferring the electronic component having been loaded to the standby region unit to the inspection region unit; and an unloading interface unit for transferring the electronic component having been completely vision inspected at the inspection
15 region unit to the standby region unit.

The vision inspection apparatus according to the present invention may have the following advantages.

Firstly, the electronic component having been loaded in the standby region unit may be transferred to the inspection region unit
20 through the loading interface unit. The electronic component having been completely inspected at the inspection region unit may be transferred to the standby region unit through the unloading interface unit. And, the inverting unit may be arranged between the first and the second vision inspection units. Accordingly, the electronic component may be
25 simultaneously transferred to the first vision inspection unit, the inverting

unit, the second vision inspection unit, and the unloading interface unit, from the loading interface unit, the first vision inspection unit, the inverting unit, and the second vision inspection unit, through the plurality of transfer tools. As a result, the plurality of electronic components may be
5 consecutively processed. This may allow greatly enhanced throughput per hour.

Secondly, the electronic component loaded in the standby region unit may be transferred to the inspection region unit through the loading interface unit. The electronic component having been completely
10 inspected at the inspection region unit may be transferred to the standby region unit through the unloading interface unit. And, the inverting unit may be arranged between the first and second vision inspection units. Accordingly, a moving path of the electronic component may be shortened and simplified. This may allow transferring time of electronic component to
15 be greatly reduced, thereby enhancing a throughput per hour.

Thirdly, due to the simplified path of the electronic component, the entire structure of the vision inspection apparatus may be simplified and the fabrication costs may be greatly reduced.

Fourthly, process for loading the electronic component by the
20 loading unit, and process for unloading the electronic component by the unloading unit may be performed in one side of the vision inspection apparatus. Accordingly, the unloaded electronic component may be directly transferred to the loading unit. This may allow the electronic component to be easily transferred in a circulation manner and to be easily
25 re-examined, thereby enhancing the productivity.

Fifthly, since loading and unloading processes by the loading unit and the unloading unit may be performed at one side of the vision inspection apparatus, an operator's moving path may be shortened. This may enhance the operation efficiency, and prevent unnecessary waste of manpower. Furthermore, an installation space for the vision inspection apparatus, and an operation space for the operator each provided in a clean room may become small.

Sixthly, since loading and unloading processes by the loading unit and the unloading unit may be performed at one side of the vision inspection apparatus, the loading and the unloading processes may be smoothly performed even if a plurality of the vision inspection apparatuses are arranged in parallel. Furthermore, since a distance between the vision inspection apparatuses may be minimized, utilization efficiency of the clean room may be maximized.

Seventh, the loading unit and the unloading unit may be arranged in a line to form the standby region unit. And, the first vision inspection unit, the inverting unit, and the second vision inspection unit may be arranged in a line to form the inspection region unit. And, the standby region unit and the vision inspection region unit may be arranged in parallel. This may allow the entire configuration of the vision inspection apparatus to be compact and simplified.

Eighth, since the loading interface unit and the unloading interface unit may serve as buffers when re-inspecting electronic component is necessary, the electronic component may be more easily transferred in a circulation manner.

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.

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BRIEF DESCRIPTION OF THE DRAWINGS

The accompanying drawings, which are included to provide a further understanding of the invention and are incorporated in and
10 constitute a part of this specification, illustrate embodiments of the invention and together with the description serve to explain the principles of the invention.

In the drawings:

FIG. 1 is a planar view of a vision inspection apparatus
15 according to the present invention;

FIG. 2 is a side conceptual view of a standby region unit in FIG. 1;

FIG. 3 is a side conceptual view of an inspection region unit in FIG.
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FIG. 4 is a planar conceptual view showing a transfer path of an
20 electronic component in FIG. 1;

FIG. 5 is a planar conceptual view showing one installation example of the vision inspection apparatus in FIG. 1;

FIG. 6 is a planar conceptual view showing another installation example of the vision inspection apparatus of in. 1; and

25 FIG. 7 is a planar view of a vision inspection apparatus in

accordance with the conventional art.

DETAILED DESCRIPTION OF THE INVENTION

5 Description will now be given in detail of the present invention, with reference to the accompanying drawings.

 Hereinafter, a vision inspection apparatus according to the present invention will be explained in more detail with reference to the attached drawings.

10 The vision inspection apparatus 1 according to the present invention serves to sort electronic components 2 by inspecting external appearance of the electronic component 2. Here, the electronic components 2 may be semiconductor devices, semiconductor strips, semiconductor packages, etc. of which external appearance may influence
15 on the reliability of products.

 The vision inspection apparatus 1 may include a loading unit 10 for loading at least one electronic component to be vision-inspected, a first vision inspection unit 50 for performing first vision inspection with respect to the electronic component 2, a second vision inspection unit 60 for
20 performing second vision inspection with respect to electronic component 2, an inverting unit 70 installed between the first and the second vision inspection units 50 and 60 for inverting the electronic component having been completely first-vision inspected by the first vision inspection unit 50, and an unloading unit 20 for unloading electronic component 2 having
25 been completely second-vision inspected by the second vision inspection

unit 60.

The first vision inspection unit 50, the inverting unit 70, and the second vision inspection unit 60 may be arranged in a line along a first direction to form an inspection region unit 101. The loading unit 10 and the
5 unloading unit 20 may be arranged in a line along the first direction to form a standby region unit 100. The inspection region unit 101 and the standby region unit 100 may be arranged in parallel along a second direction perpendicular to the first direction.

The electronic component 2 loaded in the loading unit 10 of the
10 standby region unit 100 may be transferred to the inspection region unit 101 by a loading interface unit 14. And, the electronic component 2 having been completely second-vision inspected by the second vision inspection unit 60 of the inspection region unit 101 may be transferred to the unloading unit 20 of the standby region unit 100 by an unloading interface
15 unit 24.

The electronic components 2 respectively loaded in the loading interface unit 14, the first vision inspection unit 50, the inverting unit 70, and the second vision inspection unit 60 may be simultaneously transferred by the transfer tool 30 to the next respective units, i.e., the first
20 vision inspection unit 50, the inverting unit 70, the second vision inspection unit 60, and the unloading interface unit 24.

The loading unit 10 may include a stack unit 12 in which electronic components 2 are stacked, and a loading transfer unit 120 for transferring the electronic component stacked in the stack unit 12 to the loading
25 interface unit 14.

The stack unit 12 may be configured to have a stack type structure in which a plurality of the electronic components 2 may be stacked. Alternatively, the stack unit 12 may be configured to have a tray type structure in which the electronic component 2 may be mounted one by one.

5 Still alternatively, the stack unit 12 may be configured to have various structures. If necessary, the stack unit 12 may be transferred by a guide rail, an elevator, or a transfer, etc.

The loading interface unit 14 may further include a loading transfer unit 14A. The loading transfer unit 14A may serve to be loaded with the

10 electronic component 2 transferred from the loading unit 10, and may be driven by a driving unit for loading. The loading transfer unit 14A may have various configurations such as a table, a tray, and a die according to a type of the electronic component 2.

The driving unit for loading may have various configurations

15 according to a driving method. Preferably, the driving unit for loading may be configured such that the loading transfer unit 14A may be reciprocally transferred along a loading guide 14B.

The first vision inspection unit 50 may perform first vision inspection with respect to one surface (e.g., top surface) of two surfaces

20 (top and bottom surfaces) of the electronic component 2. And, the second vision inspection unit 60 may perform second vision inspection with respect to the other surface (e.g., bottom surface) of the two surfaces (top and bottom surfaces) of the electronic component 2.

The inverting unit 70 may invert the electronic component 2 having

25 been completely first-vision inspected so as to sequentially perform first

and second vision inspections.

The vision inspection apparatus according to the present invention may have the following characteristics.

Firstly, the first vision inspection unit 50, the inverting unit 70, and
5 the second vision inspection unit 60 may be arranged in a line in
accordance with a process order of the electronic component 2. This may
allow electronic components 2 respectively loaded in the loading interface
unit 14, the first vision inspection unit 50, the inverting unit 70, and the
second vision inspection unit 60 to be simultaneously transferred to the
10 next respective units, i.e., the first vision inspection unit 50, the inverting
unit 70, the second vision inspection unit 60, and the unloading interface
unit 24. As a result, the electronic component 2 may undergo consecutive
vision inspections. Since electronic components 2 are consecutively
processed by a plurality of transfer tools 30, a throughput per hour may be
15 significantly increased.

Secondly, the inverting unit 70 may perform an inverting operation
while the first and the second vision inspection units 50 and 60 perform
vision inspections. This may prevent waste of time for the inverting
operation. Furthermore, since the electronic components 2 are
20 simultaneously transferred, additional time for loading or unloading
electronic component 2 may not be required.

Thirdly, since time for transfer the electronic component 2 is
greatly reduced due to a simplified and short transferring path for
electronic component 2, a throughput per hour may be increased much
25 more.

The first and second vision inspection units 50 and 60 may be configured in various manners according to a type of the electronic component 2, a vision inspection method, etc.

For instance, the first and the second vision inspection units 50
5 and 60 may include first and second component loading units 52 and 62,
and first and second inspection units 54 and 64. The first and the second
component loading units 52 and 62 may load electronic component 2 such
that one surface of two surfaces of the electronic component 2 is toward
the upper direction. The first and the second inspection units 54 and 64
10 may obtain external image of the electronic component 2 having been
loaded in the first and the second component loading units 52 and 62, and
may inspect whether the electronic component 2 is good or rejected by
analyzing the obtained external image.

The first and the second inspection units 50 and 60 may further
15 include first and second transfer units for transferring the first and the
second component loading units 52 and 62 so as to smoothly perform the
first and the second vision inspections.

The first and the second transfer units may be driven such that the
electronic component 2 having been loaded in the first and the second
20 component loading units 52 and 62 is reciprocally transferred between the
first and the second component loading units 52, 62 and the first and the
second inspection units 54, 64. For this, the first and the second transfer
units may be configured such that the first and the second component
loading units 52 and 62 are reciprocally transferred along first and second
25 inspection guide rails 51 and 61. Although not shown, the first and the

second transfer units may be configured such that the electronic component 2 having been loaded in the first and the second component loading units 52 and 62 is transferred between the first and the second component loading units 52, 62 and the first and the second inspection units 54, 64, by rotation or up-down motion of the first and the second component loading units 52 and 62. The first and second transfer units may be configured in various manners.

The first and the second vision inspection units 50 and 60 may further include inspection robots for moving the first and the second inspection units 54 and 64, such that the first and the second inspection units 54 and 64 inspect the electronic component 2 while moving in X and Y directions above the first and the second component loading units 52 and 62.

For enhanced reliability of vision inspections, the first and the second vision inspection units 50 and 60 may further include first and second cleaners 56 and 66 for cleaning external surface of the electronic component 2 while electronic component 2 is transferred to the first and the second inspection units 54 and 64 from the first and the second component loading units 52 and 62.

The first and the second cleaners 56 and 66 may have various structures including a brush for brushing external surface of the electronic component 2, an air curtain for removing particles attached to the outer surface of electronic component 2 in a blowing manner, etc.

In the present invention, the first and the second component loading units 52 and 62 may be provided so as to transfer the electronic

component 2, and the first and the second inspection units 54 and 64 may be provided so as to vision-inspect the electronic component 2. Since the electronic components 2 in the first and second vision inspection units 50 and 60 may be simultaneously loaded to the first and the second component loading units 52 and 62, vision inspection may be rapidly performed through two steps.

That is, first to fourth processes for transferring electronic component 2 may be simultaneously performed. The first transfer process may be to transfer electronic component 2 to the first component loading unit 52 from the loading interface unit 14, and the second transfer process may be to transfer electronic component 2 loaded to the first component loading unit 52 to the inverting unit 70. The third transfer process may be to transfer electronic component 2 loaded to the inverting unit 70 to the second component loading unit 62, and the fourth transfer process may be to transfer electronic component 2 loaded to the second component loading unit 62 to the unloading interface unit 24.

In process of vision-inspecting electronic component 2, transferring electronic components 2 between the units may be stopped. Rather, electronic components 2 loaded in the first and the second component loading units 52 and 62 may be transferred to the first and the second inspection units 54 and 64 to be vision-inspected by the first and the second inspection units 54 and 64. Then, the electronic component 2 may be returned to the first and the second component loading units 52 and 62.

The first component loading unit 52, the first inspection unit 54, the

second component loading unit 62, and the second inspection unit 64 may be arranged in directions different from those of the first vision inspection unit 50, the inverting unit 70, and the second vision inspection unit 60.

That is, the first component loading unit 52, the inverting unit 70,
5 and the second component loading unit 62 may be arranged in a line without having any obstacles disposed therebetween.

This may shorten a transfer distance of the electronic component 2 according to each vision inspection region unit. As a result, the entire configuration of the vision inspection apparatus including the transfer tool
10 30 may become more simplified. Furthermore, time taken to transfer the electronic component 2 between the units may be reduced.

Preferably, the first component loading unit 52, the first inspection unit 54, the second component loading unit 62, and the second inspection unit 64 may be arranged in the second direction.

15 The transfer tool 30 may have various structures such as a picker and a grip. In order to reduce the size of the vision inspection apparatus 1 and to transfer the electronic component 2 more smoothly and rapidly, the transfer tool 30 may be preferably configured to transfer the electronic component 2 while moving above each region.

20 In order to simultaneously transfer the electronic component 2, the transfer tool 30 may include a first transfer tool 32 for transferring the electronic component 2 of the loading interface unit 14 to the first component loading unit 52, a second transfer tool 34 for transferring the electronic component 2 to the inverting unit 70 from the first component
25 loading unit 52, a third transfer tool 36 for transferring the electronic

component 2 to the second component loading unit 62 from the inverting unit 70, and a fourth transfer tool 38 for transferring the electronic component 2 of the second component loading unit 62 to the unloading interface unit 24.

5 The first to the fourth transfer tools 32, 34, 36 and 38 may be driven by one transfer tool guide rail 40 so as to transfer the respective electronic components 2 in an integrated configuration with each other.

 That is, the first to the fourth transfer tools 32, 34, 36 and 38 may be driven by one transfer tool guide rail 40 and one driving unit, not by a
10 plurality of transfer tool guide rails and driving units. This may allow the vision inspection apparatus to have a simplified entire configuration.

 Hereinafter, the unloading unit 20 will be explained in more detail.

 The unloading unit 20 may be configured such that the vision-inspected electronic components 2 are unloaded in accordance with the
15 order of the vision inspections regardless of the vision inspection result.

 Alternatively, as shown, the unloading unit 20 may be configured such that electronic components 2 having been completely vision inspected are sorted according to grades based on the vision inspection result for the subsequent smooth processes.

20 More concretely, the unloading unit 20 may include a good unit 22A for unloading the electronic component 2 sorted as good product based on the vision inspection result, and a rejection unit 22B for unloading the electronic component 2 sorted as rejected product based on the vision inspection result.

25 The unloading unit 20 may further include a bin unit 22C. The bin

unit 22C may be used for sorting rejected electronic component 2 more specifically according to inferior degrees based on the vision inspection result.

The unloading unit 20 may further include an unloading transfer
5 unit 122 for transferring the electronic component 2 to the good unit 22A, the rejection unit 22B, or the bin unit 22C from the unloading interface unit 24.

Here, the loading transfer unit 120 and the unloading transfer unit 122 may be configured to move above the loading unit 10 and the
10 unloading unit 20. Alternatively, the loading transfer unit 120 and the unloading transfer unit 122 may be configured to be integrally driven by one loading and unloading guide rail 124, or to be separately driven from each other.

The vision inspection apparatus according to the present invention
15 may have the following advantages.

Firstly, since the loading unit 10 and the unloading unit 20 are arranged in one side of the vision inspection apparatus, electronic component 2 may be transferred in a circulation manner. Accordingly, when unloaded electronic component 2 needs to be re-examined, the
20 electronic component 2 having been completely vision-inspected may be circulated to the loading unit 10 without passing through an operator 6. This may shorten time to re-inspect electronic component 2, and reduce the number of works performed by the operator 6. Furthermore, since the loading interface unit 14 and the unloading interface unit 24 may serve as
25 buffers, interference between the electronic components 2 due to transfer

in a circulation manner may be effectively prevented.

Secondly, since the loading unit 10 and the unloading unit 20 may be arranged at one side of the vision inspection apparatus, the operator's space for performing the process by the loading unit 10 and the operator's
5 space for performing the process by the unloading unit 20 may have only to be reserved at one side of the vision inspection apparatus 1. This may allow one operator 6 to easily perform the processes by the loading unit 10 and the unloading unit 20, and may shorten the operator's working path. Furthermore, since the operator's space may be reduced, a space for
10 installing the vision inspection apparatus 1 inside a clean room may be reduced. This may allow the vision inspection apparatus 1 to be freely arranged in the clean room. Besides, even if a plurality of the vision inspection apparatuses are arranged in parallel, the loading and the unloading processes for the electronic component 2 may be smoothly
15 performed, and a distance between the vision inspection apparatuses may be minimized. Accordingly, utilization efficiency of the clean room may be maximized.

As shown in FIGS. 5 and 6, the vision inspection apparatuses according to the present invention may be freely arranged so as to be
20 symmetric to each other. In this case, one operator 6 may operate two or more vision inspection apparatuses 1.

The vision inspection apparatus 1 according to the present invention may perform the following vision inspection with respect to each of the electronic components 2.

25 FIG. 4 is an exemplary view showing a transfer path of the

electronic component 2 in the vision inspection apparatus 1 according to the present invention.

Referring to FIGS. 1 and 4, the electronic component 2 may be loaded to the stack unit 12 of the loading unit 10 (S1).

5 Then, the electronic component 2 loaded to the stack unit 12 of the loading unit 10 may be transferred to the loading transfer unit 14A of the loading interface unit 14 by the loading transfer unit 120 (S2-1).

 The electronic component 2 having been transferred to the loading transfer unit 14A may be transferred to the inspection region unit 101 from
10 the standby region unit 100 by the loading guide 14B (S2-2).

 Once the electronic component 2 may have been transferred to the first vision inspection unit 50 from the loading interface unit 14, the loading transfer unit 14A may be made to return to the initial position (i.e., standby region unit 100), and then load a new electronic component 2.

15 The electronic component 2 having been transferred to the inspection region unit 101 by the loading guide 14B may be transferred to the first component loading unit 52 of the first vision inspection unit 50 by the first transfer tool 32 (S3-1).

 The electronic component 2 having been transferred to the first
20 component loading unit 52 may be transferred to the first inspection unit 54 along a first inspection guide rail 51, and undergoes first vision inspection (S3-2).

 The electronic component 2 having been completely first-vision inspected by the first inspection unit 54 may be made to return to the first
25 component loading unit 52 by the first inspection guide rail 51 (S3-1).

The electronic component 2 returned to the first component loading unit 52 after having been completely first vision-inspected may be transferred to the inverting unit 70 by the second transfer tool 34, and then is inverted (S4).

5 The inverted electronic component 2 may be transferred to the second component loading unit 62 of the second vision inspection unit 60 by the third transfer tool 36 (S5-1).

The electronic component 2 having been transferred to the second component loading unit 62 may be transferred to the second inspection
10 unit 64 along a second inspection guide rail 61, and undergo second vision inspection (S5-2).

The electronic component 2 having been completely second-vision inspected by the second inspection unit 64 may be made to return to the second component loading unit 62 by the second inspection guide rail 61
15 (S5-1).

The electronic component 2 which returned to the second component loading unit 62 after having been second-vision inspected may be transferred to an unloading transfer unit 24A of the unloading interface unit 24 by the fourth transfer tool 38. (S6-1).

20 The electronic component 2 having been transferred to the unloading transfer unit 24A may be transferred to the standby region unit 100 from the inspection region unit 101 by the unloading guide 24B (S6-2).

Once the electronic component 2 has been transferred to the unloading unit 20 from the unloading interface unit 24, the unloading
25 transfer unit 24A may be made to return to the initial position (i.e., the

inspection region unit 101), and load next electronic component 2 from the second component loading unit 62 of the second vision inspection unit 60 by the fourth transfer tool 38.

5 The electronic component 2 having been transferred to the standby region unit 100 by the unloading guide 24B may be sorted based on the first and the second vision inspection results, and may be transferred by the unloading transfer unit 122 to the good unit 22A, the rejection unit 22B, or the bin unit 22C of the unloading unit 20 (S7).

When the electronic component 2 is needed to be re-examined,
10 the electronic component 2 having been transferred to the unloading unit 20 may be transferred to the loading transfer unit 14A of the loading interface unit 14 by being reloaded by the loading transfer unit 120. Here, electronic component 2 to be re-examined may be transferred to the loading unit 10 from the unloading interface unit 24, or may be directly
15 transferred to the loading transfer unit 14A of the loading interface unit 14 without passing through the loading unit 10.

Especially, the loading transfer unit 14A of the loading interface unit 14 may serve as a buffer between the loading unit 10 and the inspection region unit 101, and the unloading transfer unit 24A of the
20 unloading interface unit 24 may serve as a buffer between the inspection region unit 101 and the unloading unit 20. Accordingly, the electronic component 2 may be easily re-examined.

The vision inspection processes for the electronic component 2 may be performed through two steps, i.e., a transferring step and a vision-
25 inspecting step.

A transferring step may be performed in a direction as indicated by the arrow A of FIG. 4. That is, electronic components 2 loaded in the loading interface unit 14, the first vision inspection unit 50, the inverting unit 70, and the second vision inspection unit 60 may be simultaneously transferred, by the first to the fourth transfer tools 32, 34, 36 and 38, to the next units, i.e., the first vision inspection unit 50, the inverting unit 70, the second vision inspection unit 60, and the unloading interface unit 24 by one step, respectively. That is, four electronic components 2 may be transferred to vision-inspected at the same time.

10 In the case that the electronic components 2 are loaded to the loading interface unit 14, the first vision inspection unit 50, the inverting unit 70, and the second vision inspection unit 60, the electronic components 2 may be transferred by driving the first to the fourth transfer tools 32, 34, 36 and 38. However, in the case that the electronic components 2 are loaded to some parts of the loading interface unit 14, the first vision inspection unit 50, the inverting unit 70, and the second vision inspection unit 60 in a state that the vision inspection apparatus is initially driven, the electronic components 2 may not be substantially transferred but the transfer tool 30 may be driven.

20 A vision-inspecting step may be performed in a direction as indicated by the arrow B of FIG. 4, after the transferring step. That is, a first vision-inspection process, an inverting process, and a second vision inspection process may be performed. The electronic component 2 loaded to the loading unit 10 may be transferred to the loading transfer unit 14A of the loading interface unit 14. The electronic component 2 may be

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transferred to the inspection region unit 101 from the standby region unit 100 by the loading guide 14B. The electronic component 2 loaded to the unloading transfer unit 24A of the unloading interface unit 24 may be transferred to the standby region unit 100 from the inspection region unit 101 by the unloading guide 24B. And, the electronic component 2 may be unloaded by the unloading transfer unit 122 of the unloading unit 20.

For the first and the second vision inspection, the electronic components 2 loaded to the first and the second component loading units 52 and 62 of the first and the second vision inspection units 50 and 60 may be transferred to the first and the second inspection units 54 and 64 along the first and the second inspection guide rails 51 and 61. Then, the electronic components 2 having been completely first and second-vision inspected by the first and the second inspection units 54 and 64 may be made to return to the first and the second component loading units 52 and 62 along the first and the second inspection guide rails 51 and 61.

Here, the electronic components 2 may be merely transferred to the inverting unit 70 and the second vision inspection unit 60 without undergoing any processes, based on the first vision inspection result.

The foregoing embodiments and advantages are merely exemplary and are not to be construed as limiting the present disclosure. The present teachings can be readily applied to other types of apparatuses. This description is intended to be illustrative, and not to limit the scope of the claims. Many alternatives, modifications, and variations will be apparent to those skilled in the art. The features, structures, methods, and other characteristics of the exemplary embodiments

described herein may be combined in various ways to obtain additional and/or alternative exemplary embodiments.

As the present features may be embodied in several forms without departing from the characteristics thereof, it should also be understood
5 that the above-described embodiments are not limited by any of the details of the foregoing description, unless otherwise specified, but rather should be construed broadly within its scope as defined in the appended claims, and therefore all changes and modifications that fall within the metes and bounds of the claims, or equivalents of such metes and bounds are
10 therefore intended to be embraced by the appended claims.

What is claimed is:

1. A vision inspection apparatus, comprising:
 - a loading unit for loading at least one electronic component to be
5 vision-inspected;
 - a first vision inspection unit for performing first vision inspection
with respect to the electronic component loaded by the loading unit;
 - a second vision inspection unit for performing second vision
inspection with respect to the electronic component;
 - 10 an inverting unit installed between the first and second vision
inspection units, for inverting the electronic component having been
completely first-vision inspected by the first vision inspection unit before
the electronic component is transferred to the second vision inspection
unit;
 - 15 an unloading unit for unloading the electronic component having
been completely second vision-inspected by the second vision inspection
unit; and
 - a transfer tool for simultaneously transferring electronic
components respectively in the first vision inspection unit, the inverting unit,
20 and the second vision inspection unit to the next respective units.
2. The vision inspection apparatus of claim 1, wherein
loading process of the electronic component by the loading unit, and the
unloading process of the electronic component by the unloading unit are
25 performed in one side of the vision inspection apparatus.

3. The vision inspection apparatus of claim 1, further comprising:

a loading interface unit for transferring the electronic component
5 loaded to the loading unit to the first vision inspection unit; and

an unloading interface unit for transferring the electronic component loaded to the second vision inspection unit to the unloading unit.

10 4. The vision inspection apparatus of claim 1, wherein the first vision inspection unit, the inverting unit, and the second vision inspection unit are arranged in a line, and form an inspection region unit;

wherein the loading unit and the unloading unit are arranged in a line, and form a standby region unit;

15 wherein the inspection region unit and the standby region unit are arranged in parallel to each other.

5. The vision inspection apparatus of claim 4, further comprising:

20 a loading interface unit for transferring the electronic component having been loaded by the loading unit of the standby region unit to the inspection region unit; and

an unloading interface unit for transferring the electronic component having been completely second-vision inspected at the
25 inspection region unit to the unloading unit of the standby region unit.

6. The vision inspection apparatus of claim 3 or 5, wherein the loading unit comprises:

- a stack unit in which electronic component are stacked, and
- 5 a loading transfer tool for transferring the electronic component stacked in the stack unit to the loading interface unit.

7. The vision inspection apparatus of claim 3 or 5, wherein the unloading unit comprises:

- 10 a good unit, a rejection unit, and a bin unit for sorting the electronic component based on inspection result at the inspection region unit to the good unit, the rejection unit, and the bin unit; and
- an unloading transfer unit for transferring the electronic component having been completely inspected at the inspection region unit, to the
- 15 good unit, the rejection unit, and the bin unit from the unloading interface unit.

8. The vision inspection apparatus of claim 3 or 5, wherein the first vision inspection unit comprises:

- 20 a first component loading unit for being loaded with the electronic component transferred from the loading interface unit by the transfer tool;
- a first transfer unit for transferring the electronic component loaded in the first component loading unit; and
- a first inspection unit for performing first vision inspection with
- 25 respect to the electronic component transferred by the first transfer unit.

9. The vision inspection apparatus of claim 1, wherein the second vision inspection unit comprises:

a second component loading unit for being loaded with the electronic component transferred from the inverting unit by the transfer tool;

a second transfer unit for transferring the electronic component loaded in the second component loading unit; and

a second inspection unit for performing second vision inspection with respect to the electronic component transferred by the second transfer unit.

10. A vision inspection apparatus, comprising:

an inspection region unit for performing vision inspection with respect to at least one electronic component;

a standby region unit for loading the electronic component to be transferred to the inspection region unit, and unloading the electronic component having been completely vision inspected at the inspection region unit;

a loading interface unit for transferring the electronic component having been loaded to the standby region unit to the inspection region unit; and

an unloading interface unit for transferring the electronic component having been completely vision inspected at the inspection region unit to the standby region unit.

11. The vision inspection apparatus of claim 10, wherein the inspection region unit comprises:

a first vision inspection unit for performing first vision inspection
5 with respect to the electronic component transferred by the loading interface unit;

an inverting unit for inverting the electronic component having been completely first-vision inspected and transferred thereto; and

a second vision inspection unit for performing second vision
10 inspection with respect to the transferred electronic component after being inverted,

wherein the standby region unit comprises:

a loading unit for loading an electronic component to be vision-inspected; and

15 an unloading unit for sorting and unloading the electronic component transferred from the unloading interface unit based on the vision inspection result,

wherein the inspection region unit and the standby region unit are arranged in parallel.