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Inventor(s)	Miura; Kazuma et al.

Drying device and drying method

Abstract

A drying device includes multiple partitioned spaces, and a jetting device configured to jet air to a component holder in each of the multiple spaces.

Inventors: **Miura; Kazuma (Nagoya, JP), Shimosaka; Kenji (Obu, JP), Suzuki; Daisuke (Chiryu, JP)**

Applicant: **FUJI CORPORATION** (Chiryu, JP)

Family ID: **1000008767718**

Assignee: **FUJI CORPORATION (Chiryu, JP)**

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Primary Examiner: Laux; David J

Attorney, Agent or Firm: Oblon, McClelland, Maier & Neustadt, L.L.P.

Background/Summary

TECHNICAL FIELD

(1) The present disclosure relates to a drying device and a drying method for drying a component holder.

BACKGROUND ART

(2) The following Patent Literature discloses a technique for drying a component holder by jetting air.

PATENT LITERATURE

(3) Patent Literature 1: JP-A-2014-168745

BRIEF SUMMARY

Technical Problem

(4) An object of the present specification is to appropriately dry a component holder by jetting air.

Solution to Problem

(5) In order to achieve the object, according to the present specification, there is provided a drying device including multiple partitioned spaces; and a jetting device configured to jet air to a

component holder in each of the multiple spaces.
(6) According to the present specification, there is provided a drying device including multiple partitioned spaces; a jetting device configured to jet air to each of the multiple spaces; and a control device configured to control an operation of the jetting device, in which the control device controls an operation of the jetting device such that air is jetted to a cleaned component holder to dry the component holder in a first space that is one space among the multiple spaces, and then air is jetted to the component holder dried in the first space to dry the component holder in a second space that is a space different from the first space among the multiple spaces.
(7) According to the present specification, there is provided a drying method of drying a cleaned component holder by using a drying device including multiple partitioned spaces and a jetting device configured to jet air to each of the multiple spaces, the drying method including a first drying step of jetting air to the cleaned component holder to dry the component holder in a first space that is one space among the multiple spaces; and a second drying step of jetting air to the component holder dried in the first space to dry the component holder in a second space that is a space different from the first space among the multiple spaces.
Advantageous Effects
(8) According to the present disclosure, air can be jetted to a component holder in any space among multiple spaces, and thus various component holders can be suitably dried.

Description

BRIEF DESCRIPTION OF DRAWINGS
(1) FIG. **1** is a perspective view illustrating an electronic component mounting device.
(2) FIG. **2** is a perspective view illustrating a suction nozzle.
(3) FIG. **3** is a perspective view illustrating an external appearance of a nozzle management device.
(4) FIG. **4** is a perspective view illustrating an internal structure of the nozzle management device.
(5) FIG. **5** is a sectional view illustrating a nozzle drying device.
(6) FIG. **6** is a perspective view illustrating the nozzle drying device.
(7) FIG. **7** is a sectional view illustrating the nozzle drying device.
(8) FIG. **8** is a block diagram illustrating a control device provided in the nozzle management device.
(9) FIG. **9** is a sectional view illustrating a discard box.
(10) FIG. **10** is a sectional view illustrating the discard box.
(11) FIG. **11** is a sectional view illustrating the discard box.
(12) FIG. **12** is a sectional view illustrating the discard box.
(13) FIG. **13** is a sectional view illustrating the discard box.
DESCRIPTION OF EMBODIMENTS
(14) Hereinafter, preferred embodiments of the present disclosure will be described in detail with reference to the drawings.
(15) FIG. **1** illustrates electronic component mounting device **10**. First, a configuration of electronic component mounting device **10** will be described. Electronic component mounting device **10** includes single system base **12** and two electronic component mounters (hereinafter, sometimes abbreviated to “mounters”) **14** adjacent above system base **12**. A direction in which mounters **14** are arranged will be referred to as an X-axis direction, and a horizontal direction perpendicular to the X-axis direction will be referred to as a Y-axis direction.
(16) Each mounter **14** mainly includes mounter main body **20**, conveyance device **22**, mounting head moving device (hereinafter, sometimes abbreviated to a moving device) **24**, mounting head **26**, supply device **28**, and nozzle station **30**. Mounter main body **20** includes frame **32** and beam **34** that is suspended on frame **32**.

(17) Conveyance device **22** includes two conveyor devices **40** and **42**. Two conveyor devices **40** and **42** are disposed parallel to each other and in such a manner as to extend in the X-axis direction on frame **32**. Each of two conveyor devices **40** and **42** conveys a circuit board supported at each of conveyor devices **40** and **42** in the X-axis direction with an electromagnetic motor (not illustrated). The circuit board is held by a board holding device (not illustrated) at a predetermined position.
(18) Moving device **24** is an XY-robot type moving device. Moving device **24** includes an electromagnetic motor (not illustrated) for sliding slider **50** in the X-axis direction, and an electromagnetic motor (not illustrated) for sliding slider **50** in the Y-axis direction. Mounting head **26** is attached to slider **50**, and mounting head **26** is moved to any position on frame **32** due to an operation of two electromagnetic motors.
(19) Mounting head **26** mounts an electronic component on a circuit board. Suction nozzle **60** is provided at a lower end face of mounting head **26**. As illustrated in FIG. **2**, suction nozzle **60** is configured by body cylinder **64**, flange portion **66**, suction pipe **68**, and locking pin **70**. Body cylinder **64** has a cylindrical shape, and flange portion **66** is fixed to protrude from an outer circumferential surface of body cylinder **64**. Suction pipe **68** has a thin pipe shape, and is held by body cylinder **64** so as to be movable in an axial direction in a state of extending downward from a lower end part of body cylinder **64**. Locking pin **70** is provided at an upper end part of body cylinder **64** so as to extend in a radial direction of body cylinder **64**. Suction nozzle **60** is detachably attached to mounting head **26** by one touch by using locking pin **70**. Locking pin **70** is not illustrated in FIGS. **5**, **7**, and **9** to **13** that will be described later. A spring (not illustrated) is built into mounting head **26**, and the spring applies elastic force to suction pipe **68** of suction nozzle **60** attached to mounting head **26**. Consequently, suction pipe **68** is biased in a direction extending downward from the lower end part of body cylinder **64** by the elastic force of the spring built into mounting head **26**. 2D code **74** is attached to an upper surface of flange portion **66**. 2D code **74** indicates an identification (ID) or the like of suction nozzle **60** as individual information. Instead of 2D code **74**, a barcode or an RF tag may be attached to the upper surface of flange portion **66**. However, in a case where the RF tag is attached to the upper surface of flange portion **66**, a reader for acquiring individual information from the RF tag is attached to transfer head (refer to FIG. **4**) **120** of nozzle management device (refer to FIG. **3**) **80** that will be described later.
(20) Suction nozzle **60** communicates with positive and negative pressure supply devices (not illustrated) via a negative pressure air passage and a positive pressure air passage. Suction nozzle **60** picks up and holds an electronic component by using a negative pressure, and separates the held electronic component by using a positive pressure. Mounting head **26** has a nozzle lifting/lowering device (not illustrated) that lifts and lowers suction nozzle **60**. The nozzle lifting/lowering device changes a position of the electronic component held by mounting head **26** in the up-down direction.
(21) Supply device **28** is a feeder-type supply device, and includes multiple tape feeders **72** as illustrated in FIG. **1**. Tape feeder **72** accommodates taped components that are wound therearound. The taped component is obtained by taping an electronic component. Tape feeder **72** causes a feeding device (not illustrated) to feed the taped component. Consequently, feeder-type supply device **28** supplies an electronic component at a supply position by feeding a taped component.
(22) Nozzle station **30** includes nozzle tray **76**. Nozzle tray **76** accommodates multiple suction nozzles **60**. In nozzle station **30**, suction nozzle **60** attached to mounting head **26** and suction nozzle **60** accommodated in nozzle tray **76** are exchanged as required. Nozzle tray **76** is detachable from nozzle station **30**, and thus collection of suction nozzle **60** accommodated in nozzle tray **76**, provision of suction nozzle **60** to nozzle tray **76**, and the like can be performed outside mounter **14**.
(23) Next, mounting work using mounter **14** will be described. In mounter **14**, with the configuration described above, mounting work can be executed on a circuit board held by conveyance device **22** by using mounting head **26**. Specifically, a circuit board is conveyed to a work position according to a command from a control device (not illustrated) of mounter **14**, and is held by the board holding device at that position. Tape feeder **72** feeds a taped component

according to a command from the control device, and supplies an electronic component at a supply position. Mounting head **26** is moved above the supply position of the electronic component, and picks up and holds the electronic component by using suction nozzle **60**. Subsequently, mounting head **26** is moved above the circuit board, and mounts the electronic component held thereby on the circuit board.

(24) In mounter **14**, as described above, an electronic component supplied by tape feeder **72** is picked up and held by suction nozzle **60**, and thus the electronic component is mounted on the circuit board. Thus, in a case where a failure has occurred in suction nozzle **60**, since there is concern that the mounting work may not be appropriately performed, it is necessary to appropriately manage suction nozzle **60**. Therefore, suction nozzle **60** is managed by a nozzle management device described below.

(25) Next, a configuration of the nozzle management device will be described. As illustrated in FIG. **3**, nozzle management device **80** has a generally rectangular parallelepiped shape, and is provided with door **82** through which nozzle tray **76** is stored in nozzle management device **80** or nozzle tray **76** is extracted from nozzle management device **80** on a front surface thereof. Touch panel **86** or the like that displays various pieces of information and is used to perform each operation is disposed above door **82**.

(26) As illustrated in FIG. **4**, nozzle management device **80** includes management device main body **90**, pallet accommodation device **92**, nozzle transfer device **94**, nozzle inspection device **96**, nozzle cleaning device **98**, and nozzle drying device **100**. FIG. **4** is a perspective view illustrating a state in which an outer shell member of nozzle management device **80** is detached, and illustrates an internal structure of nozzle management device **80**. Control device **200** is connected to nozzle management device **80**. Details of control device **200** will be described later.

(27) Management device main body **90** includes frame **102** and beam **104** suspended on frame **102**. Frame **102** has a hollow structure, pallet accommodation device **92** is disposed in frame **102**, and an upper end part of pallet accommodation device **92** is exposed on an upper surface of frame **102**.

(28) Pallet accommodation device **92** includes multiple pallet placement shelves **106** and support arm **108**. Pallet placement shelf **106** is a shelf on which nozzle pallet **110** is placed, and multiple pallet placement shelves **106** are disposed to be arranged in the up-down direction inside frame **102**. Nozzle pallet **110** accommodates multiple suction nozzles **60**. Support arm **108** is moved in the up-down direction ahead of multiple pallet placement shelves **106** and approaches and separates from pallet placement shelves **106** due to an operation of an arm moving device (not illustrated). Consequently, storage of nozzle pallet **110** into pallet placement shelf **106** and extraction of nozzle pallet **110** from pallet placement shelf **106** are performed by support arm **108**. Nozzle pallet **110** extracted from pallet placement shelf **106** is moved above frame **102** due to upward movement of support arm **108**.

(29) Nozzle transfer device **94** is a device that transfers suction nozzle **60** between nozzle tray **76** and nozzle pallet **110**, and is disposed in beam **104**. Nozzle transfer device **94** includes transfer head **120** and head moving device **122**. Camera **126** in a state of facing downward, holding chuck **128** that holds suction nozzle **60**, and air supply device **130** are attached to a lower end face of transfer head **120**.

(30) As illustrated in FIG. **5**, holding chuck **128** has two holding pawls **132**, and by causing two holding pawls **132** to approach each other, suction nozzle **60** is held in body cylinder **64**, and by causing two holding pawls **132** to separate from each other, held suction nozzle **60** is released. Air flow path **136** is formed in the main body portion **134** of the holding chuck **128**. A lower end part of air flow path **136** is open between two holding pawls **132**, and an upper end part thereof is connected to air supply device **130**. Thus, in a state in which holding chuck **128** holds suction nozzle **60**, air is supplied to air flow path **136** by air supply device **130**, and thus air is jetted from the lower end part of air flow path **136** toward the inside of suction nozzle **60**. Consequently, air is jetted into the inside of suction nozzle **60**, and thus air is jetted from the tip portion of suction pipe

68. Holding chuck **128** has rotation device **138** (refer to FIG. **8**) that rotates on its own axis. Consequently, suction nozzle **60** held by holding chuck **128** rotates.

(31) As illustrated in FIG. **4**, head moving device **122** is an XYZ type moving device that moves transfer head **120** in the front-rear direction, the left-right direction, and the up-down direction on frame **102**. Fixing stage **131** for setting nozzle tray **76** is provided on an upper surface of the front side of frame **102**, and suction nozzle **60** is transferred between nozzle tray **76** set on fixing stage **131** and nozzle pallet **110** supported by support arm **108** of pallet accommodation device **92**.

(32) Nozzle inspection device **96** includes camera **140**, load cell **142**, and joint **146**. Camera **140** is disposed on the upper surface of frame **102** so as to face upward, and the tip portion of suction nozzle **60** is inspected by using camera **140**. Specifically, suction nozzle **60** that is an inspection target is held by holding chuck **128**, and suction nozzle **60** held by holding chuck **128** is imaged by camera **140** from below. Consequently, imaging data of the tip portion of suction nozzle **60** is obtained, and a state of the tip portion of suction nozzle **60** is inspected based on the imaging data.

(33) Load cell **142** is disposed near camera **140**, and expansion and contraction states of the tip portion of suction nozzle **60** are inspected by using load cell **142**. Specifically, suction nozzle **60** that is an inspection target is held by holding chuck **128**, and the tip portion of suction nozzle **60** held by holding chuck **128** comes into contact with load cell **142**. As described above, the tip portion of suction nozzle **60** is allowed to expand and contract, and thus the expansion and contraction states of the tip portion of suction nozzle **60** are inspected based on a load measured by load cell **142**.

(34) Joint **146** is disposed on a lower surface of air supply device **130**, and air is supplied thereto from air supply device **130**. An air flow rate of suction nozzle **60** is inspected by using the air supplied from air supply device **130** to joint **146**. Specifically, joint **146** is moved above suction nozzle **60** placed on cleaning pallet **158** that will be described later due to an operation of head moving device **122**. Joint **146** is connected to suction nozzle **60** that is an inspection target, and thus air is supplied from air supply device **130**. In this case, an air pressure is measured, and an air flow rate of suction nozzle **60** is inspected based on the air pressure.

(35) Multiple discard boxes **148** are disposed on the upper surface of frame **102**, and suction nozzle **60** determined as being a defective nozzle through the inspection is discarded into discard box **148**. Suction nozzle **60** determined as being a normal nozzle through the above inspection is returned to nozzle tray **76** or nozzle pallet **110**.

(36) Nozzle cleaning device **98** is a device that cleans and dries suction nozzle **60**, and is disposed near pallet accommodation device **92**. Nozzle cleaning device **98** includes cleaning/drying mechanism **150** and cleaning pallet moving mechanism **152**. Cleaning/drying mechanism **150** is a mechanism that cleans and dries suction nozzle **60** in the inside thereof. Cleaning pallet moving mechanism **152** is a mechanism that moves cleaning pallet **158** between an exposed position where cleaning pallet **158** is exposed (a position where cleaning pallet **158** is illustrated in FIG. **4**) and the inside of cleaning/drying mechanism **150**.

(37) Nozzle drying device **100** is a device that dries suction nozzle **60**, and is disposed near cleaning pallet **158** located at the exposed position. As illustrated in FIG. **6**, nozzle drying device **100** includes housing **160** and air blow device **162**. Housing **160** is generally block-shaped, and three bottomed holes **164**, **166**, and **168** are formed in housing **160**. Each of bottomed holes **164**, **166**, and **168** has a cylindrical shape that is open on the upper surface of housing **160** and is recessed downward. Interiors of three bottomed holes **164**, **166**, and **168** serve as three drying chambers **170**, **172**, and **174** for drying suction nozzle **60**. Inner diameters of three drying chambers **170**, **172**, and **174** are different from each other, the inner diameter of drying chamber **170** is the largest, the inner diameter of drying chamber **174** is the smallest, and the inner diameter of drying chamber **172** is about intermediate between the inner diameter of drying chamber **170** and the inner diameter of drying chamber **174**. When distinguishing three drying chambers **170**, **172**, and **174**, drying chamber **170** will be referred to as first drying chamber **170**, drying chamber **172** will be

referred to as second drying chamber **172**, and drying chamber **174** will be referred to as third drying chamber **174**.

(38) As illustrated in FIG. **5** which is a sectional view taken along the line AA in FIG. **6**, housing **160** is provided with two through-holes **176** and **178** that extend in the radial direction of bottomed hole **164**, and two through-holes **176** and **178** are open in the outer wall surface of housing **160** and the inner wall surface of first drying chamber **170**. Through-hole **176** penetrates through the sidewall of housing **160** obliquely upward from the outer wall surface of housing **160** toward the inner wall surface of first drying chamber **170**. On the other hand, through-hole **178** penetrates through the sidewall of housing **160** so as to extend in a generally horizontal direction above through-hole **176**. Valve **180** is connected to the opening of through-hole **176** to the outer wall surface of housing **160**, and valve **182** is also connected to the opening of through-hole **178** to the outer wall surface of housing **160**. Valve **180** is connected to air blow device **162** via pipe **184**, and valve **182** is connected to air blow device **162** via pipe **186**. Consequently, air blow device **162** is operated and valves **180** and **182** are opened, and thus air is jetted from through-holes **176** and **178** toward the inside of first drying chamber **170**. Valves **180** and **182** are normally closed valves.

(39) As illustrated in FIG. **6**, housing **160** is provided with through-hole **188** extending downward from the bottom surface of bottomed hole **166**, that is, the bottom surface of second drying chamber **172**, bent at a right angle toward the outer wall surface of housing **160**, and open to the outer wall surface of housing **160**. Valve **190** is connected to the opening of through-hole **188** to the outer wall surface of housing **160**, and valve **190** is connected to air blow device **162** via pipe **192**. Consequently, air blow device **162** is operated and valve **190** is opened, and thus air is jetted from through-hole **188** toward the inside of second drying chamber **172**. Valve **190** is a normally closed valve.

(40) Housing **160** is provided with through-hole **194** extending downward from the bottom surface of bottomed hole **168**, that is, bottom surface of third drying chamber **174**, bent at a right angle toward the outer wall surface of housing **160**, and open to the outer wall surface of housing **160**. Valve **196** is connected to the opening of through-hole **194** to the outer wall surface of housing **160**, and valve **196** is connected to air blow device **162** via pipe **198**. Consequently, air blow device **162** is operated and valve **196** is opened, and thus air is jetted from through-hole **194** toward the inside of third drying chamber **174**. Valve **196** is a normally closed valve.

(41) As illustrated in FIG. **8**, control device **200** includes controller **202** and multiple drive circuits **206**. Multiple drive circuits **206** are connected to pallet accommodation device **92**, air supply device **130**, rotation device **138**, nozzle inspection device **96**, nozzle cleaning device **98**, air blow device **162**, and valves **180**, **182**, **190**, and **196**. Controller **202** includes CPU, ROM, RAM, and the like, and is mainly a computer, and is connected to multiple drive circuits **206**. Consequently, operations of pallet accommodation device **92**, nozzle transfer device **94**, and the like are controlled by controller **202**.

(42) In nozzle management device **80**, cleaning or the like of suction nozzle **60** is performed in order to appropriately manage suction nozzle **60** with the above configuration. Specifically, an operator places nozzle tray **76** in which suction nozzle **60** that is a cleaning target is accommodated on fixing stage **131** of nozzle management device **80**. In nozzle management device **80**, when nozzle tray **76** is placed on fixing stage **131**, camera **126** is moved above placed nozzle tray **76** due to an operation of head moving device **122**, and images suction nozzle **60** accommodated in nozzle tray **76**. In this case, controller **202** acquires an ID of suction nozzle **60** accommodated in nozzle tray **76** based on imaging data acquired through the imaging. controller **202** manages suction nozzle **60** in nozzle management device **80** by using the acquired ID of suction nozzle **60**. Control device **200** stores a size or the like of suction nozzle **60** for each ID of suction nozzle **60** and can thus also acquire the size or the like of suction nozzle **60** based on the ID of suction nozzle **60**.

(43) When the ID of suction nozzle **60** is acquired through the imaging of suction nozzle **60** accommodated in nozzle tray **76**, suction nozzle **60** accommodated in nozzle tray **76** is transferred

to cleaning pallet **158** of nozzle cleaning device **98** by nozzle transfer device **94**. In this case, cleaning pallet **158** is moved to the exposed position due to an operation of cleaning pallet moving mechanism **152**. When the transfer of suction nozzle **60** to cleaning pallet **158** is completed, cleaning pallet **158** is moved to the inside of cleaning/drying mechanism **150** due to an operation of cleaning pallet moving mechanism **152**, to perform cleaning and drying of suction nozzle **60**. When the cleaning and drying of suction nozzle **60** by cleaning/drying mechanism **150** is completed, cleaning pallet **158** is moved from the inside of cleaning/drying mechanism **150** to the exposed position due to an operation of cleaning pallet moving mechanism **152**. In this case, holding chuck **128** is moved above cleaning pallet **158** moved to the exposed position due to an operation of head moving device **122**. Air is jetted from holding chuck **128** toward suction nozzle **60** placed on cleaning pallet **158** due to an operation of air supply device **130**. Consequently, moisture is blown off from the upper surface of suction nozzle **60** placed on cleaning pallet **158**, particularly, the upper surface of flange portion **66**, or the like.

(44) Suction nozzle **60** is dried to some extent through drying in cleaning/drying mechanism **150** and jetting of air from holding chuck **128**. However, since the drying in cleaning/drying mechanism **150** and the jetting of air from holding chuck **128** are performed in a state in which suction nozzle **60** is placed on cleaning pallet **158**, there is concern that moisture may remain in suction nozzle **60**. In particular, in suction nozzle **60**, as described above, body cylinder **64** and suction pipe **68** are allowed to be moved relative to each other, so that since water enters between body cylinder **64** and suction pipe **68**, there is a case where water entering between body cylinder **64** and suction pipe **68** remains. There is concern that suction nozzle **60** in which moisture remains between body cylinder **64** and suction pipe **68** as described above may be determined as being a defective nozzle in inspection using load cell **142**. Specifically, the inspection using load cell **142** is, as described above, inspection of expansion and contraction states of the tip portion of suction nozzle **60**, and in suction nozzle **60** in which moisture remains between body cylinder **64** and suction pipe **68**, the sliding resistance between body cylinder **64** and suction pipe **68** is increased due to the moisture, and thus a load measured by load cell **142** is increased. Thus, it is determined that an expansion or contraction state of the tip portion of suction nozzle **60** is not appropriate, and thus there is concern that suction nozzle **60** may be determined as being a defective nozzle.

(45) In view of this, in nozzle management device **80**, when the drying in cleaning/drying mechanism **150** and the jetting of air from holding chuck **128** are completed, suction nozzle **60** is dried by using nozzle drying device **100**. Specifically, when the drying in cleaning/drying mechanism **150** and the jetting of air from holding chuck **128** are completed, suction nozzle **60** placed on cleaning pallet **158** is held by holding chuck **128**. Next, holding chuck **128** is moved above first drying chamber **170** of housing **160** of nozzle drying device **100** due to an operation of head moving device **122**, and is then lowered. Consequently, suction nozzle **60** held by holding chuck **128** is inserted into the inside of first drying chamber **170** of housing **160**, as illustrated in FIG. **5**. Holding chuck **128** is lowered to a position where the lower surface side of flange portion **66** of suction nozzle **60** and the side surface of suction pipe **68** are located in the lateral direction of through-hole **178**.

(46) Thereafter, in the inside of first drying chamber **170**, suction nozzle **60** held by holding chuck **128** rotates due to an operation of rotation device **138**. In this case, air is jetted from holding chuck **128** due to an operation of air supply device **130**, so that the air jetted from above suction nozzle **60** held by holding chuck **128** is blown to the inside of suction nozzle **60**. As described above, by blowing air into suction nozzle **60**, suction pipe **68** is moved relative to body cylinder **64** downward and extends downward. Consequently, the sliding surface of suction pipe **68** with respect to body cylinder **64** is exposed below flange portion **66**. When holding chuck **128** rotates, air blow device **162** is operated and valves **180** and **182** are opened, and thus air is jetted from through-holes **176** and **178** toward suction nozzle **60** that is rotating. In this case, the air jetted from through-hole **178** is blown to the sliding surface of suction pipe **68** exposed from body cylinder **64** of suction nozzle

60, and the air jetted from through-hole **176** is also blown to the tip of suction pipe **68** of suction nozzle **60**. That is, the air jetted from through-holes **176** and **178** is blown to the entire lower part of flange portion **66** over the entire circumference of suction nozzle **60**. Consequently, it is possible to suitably remove moisture remaining between body cylinder **64** and suction pipe **68**. Nozzle drying device **100** can also remove adhering matter other than moisture, specifically, for example, oil, dust, an electronic component or a part thereof, a solder, and an adhesive.

(47) As described above, in nozzle drying device **100**, suction nozzle **60** can be suitably dried by jetting air to suction nozzle **60** held by holding chuck **128**. However, in nozzle drying device **100**, since many types of suction nozzles having different sizes are managed, there is concern that a suction nozzle having a large size cannot be suitably dried according to the above method. Specifically, in nozzle drying device **100**, suction nozzle **210** (refer to FIG. **9**) having a nozzle diameter larger than the nozzle diameter of suction nozzle **60** is also managed. Suction nozzle **210** after being cleaned by nozzle cleaning device **98** is held by holding chuck **128** and is inserted into first drying chamber **170** as illustrated in FIG. **9**. Since the inner diameter of first drying chamber **170** is larger than the outer diameter of flange portion **212** of suction nozzle **210**, entire suction nozzle **210** can be inserted into first drying chamber **170**. In this case, holding chuck **128** is lowered to a position where the lower surface side of flange portion **212** of suction nozzle **210** and the side face of suction pipe **214** are located in the lateral direction of through-hole **178**, and thus suction nozzle **210** is inserted into first drying chamber **170**.

(48) Suction nozzle **210** held by holding chuck **128** rotates in the same manner as suction nozzle **60**, air is jetted from through-holes **176** and **178**, and air is also jetted from holding chuck **128**. Consequently, the sliding surface of suction pipe **214** with respect to body cylinder **216** is exposed below flange portion **212**, and the air jetted from through-hole **178** is blown to the lower surface side of flange portion **212** of suction nozzle **210** and the sliding surface of suction pipe **214** exposed from body cylinder **216**. However, since suction nozzle **210** is larger than suction nozzle **60**, the air jetted from through-hole **176** is also blown to the sliding surface of suction pipe **214** of suction nozzle **210**. That is, in first drying chamber **170**, when the air is blown to suction nozzle **210** held by holding chuck **128**, the air is blown to the lower surface side of flange portion **212** of suction nozzle **210** and the side surface of suction pipe **214**, but the air is not blown to the tip of suction pipe **214**. Thus, there is concern that the entire suction nozzle **210** cannot be suitably dried through the blowing of the air in first drying chamber **170**.

(49) Therefore, when the drying in first drying chamber **170** is finished, suction nozzle **210** held by holding chuck **128** is inserted into second drying chamber **172** of nozzle drying device **100**, as illustrated in FIG. **7**. However, since the outer diameter of flange portion **212** of suction nozzle **210** is larger than the inner diameter of second drying chamber **172**, only suction pipe **214** of suction nozzle **210** is inserted into second drying chamber **172**. In this case, suction pipe **214** of suction nozzle **210** is inserted into second drying chamber **172** such that the opening of second drying chamber **172** to the upper surface of housing **160** is covered with flange portion **212** of suction nozzle **210**. However, the opening of second drying chamber **172** to the upper surface of housing **160** is covered with flange portion **212** such that a slight gap is formed between the upper surface of housing **160** and the lower surface of flange portion **212** of suction nozzle **210**.

(50) As described above, when suction pipe **214** of suction nozzle **210** held by holding chuck **128** is inserted into second drying chamber **172**, air is jetted from holding chuck **128** due to an operation of air supply device **130**, and thus the air jetted from above suction nozzle **210** held by holding chuck **128** is blown to the inside of suction nozzle **210**. As described above, by blowing air into suction nozzle **210**, suction pipe **214** is moved relative to body cylinder **216** downward and extends downward. Consequently, the sliding surface of suction pipe **214** with respect to body cylinder **216** is exposed below flange portion **212**.

(51) Next, after the operation of air supply device **130** is stopped and the jetting of air from holding chuck **128** is stopped, air blow device **162** is operated and valve **190** is opened. Consequently, as

illustrated in FIG. **10**, air is jetted from through-hole **188** toward the tip of suction pipe **214** of suction nozzle **210**. In this case, moisture adhering to the tip of suction pipe **214** is blown off by the air jetted toward the tip of suction pipe **214** of suction nozzle **210**. By the air jetted from through-hole **188**, suction pipe **214** is moved upward relative to body cylinder **216**, so that suction pipe **214** extends upward, and thus the sliding surface of suction pipe **214** with respect to body cylinder **216** is exposed above body cylinder **216**.

(52) As described above, when the sliding surface of suction pipe **214** with respect to body cylinder **216** is exposed above body cylinder tube **216**, the air is jetted again from holding chuck **128** due to an operation of air supply device **130** after the operation of air blow device **162** is stopped, valve **190** is closed, and the jetting of air from through-hole **188** is stopped. In this case, air is blown from holding chuck **128** to the sliding surface of suction pipe **214** exposed above body cylinder **216**. Consequently, moisture adhering to the sliding surface of suction pipe **214** exposed above body cylinder **216** is blown off. As illustrated in FIG. **7**, suction pipe **214** extends downward again due to the jetting of air from holding chuck **128**.

(53) As described above, when suction pipe **214** extends downward due to the jetting of air from holding chuck **128**, air blow device **162** is operated again and valve **190** is opened after the operation of air supply device **130** is stopped and the jetting of air from holding chuck **128** is stopped. Consequently, air is jetted from through-hole **188**, and thus suction pipe **214** extends upward again as illustrated in FIG. **10**. That is, in second drying chamber **172**, the jetting of air from holding chuck **128** and the jetting of air from through-hole **188** are alternately performed, and thus the air is jetted to suction pipe **214** in a state in which suction pipe **214** is repeatedly slid up and down with respect to body cylinder **216**. Consequently, it is possible to suitably remove moisture remaining between body cylinder **216** and suction pipe **214** of suction nozzle **210**.

(54) That is, in suction nozzle **210** having the nozzle diameter larger than the nozzle diameter of suction nozzle **60**, air is blown to a position other than the tip of suction pipe **214** below flange portion **212** in first drying chamber **170**. After the blowing of air to suction nozzle **210** in first drying chamber **170** is completed, air is blown to the tip of suction pipe **214** in second drying chamber **172**, and the air is blown to suction pipe **214** in a state in which suction pipe **214** is slid with respect to body cylinder **216**. Consequently, entire suction nozzle **210** can be suitably dried. In second drying chamber **172**, the air jetted from holding chuck **128** and through-hole **188** leaks from the gap between the upper surface of housing **160** and the lower surface of flange portion **212** of suction nozzle **210**. Consequently, an increase in the air pressure in second drying chamber **172** is suppressed.

(55) In nozzle drying device **100**, suction nozzle **230** (refer to FIG. **11**) having the nozzle diameter larger than the nozzle diameter of suction nozzle **60** but smaller than the nozzle diameter of suction nozzle **210** is also managed. Suction nozzle **230** after being also cleaned by nozzle cleaning device **98** is held by holding chuck **128**, and is inserted into first drying chamber **170** as illustrated in FIG. **11**. Since the inner diameter of first drying chamber **170** is larger than the outer diameter of flange portion **232** of suction nozzle **230**, entire suction nozzle **230** can be inserted into first drying chamber **170**. In this case, holding chuck **128** is lowered to a position where the lower surface side of flange portion **232** of suction nozzle **230** and the side face of suction pipe **234** are located in the lateral direction of through-hole **178**, and thus suction nozzle **230** is inserted into first drying chamber **170**.

(56) Suction nozzle **230** held by holding chuck **128** also rotates in the same manner as suction nozzle **60**, air is jetted from through-holes **176** and **178**, and air is also jetted from holding chuck **128**. Consequently, the sliding surface of suction pipe **234** with respect to body cylinder **236** is exposed below flange portion **232**, and thus the air jetted from through-hole **178** is blown to the lower surface side of flange portion **232** of suction nozzle **60** and the sliding surface of suction pipe **234** exposed from body cylinder **236**. However, since suction nozzle **230** is also larger than suction nozzle **60**, the air jetted from through-hole **176** is blown to the sliding surface of suction pipe **234**,

and is not blown to the tip of suction pipe **234**. Thus, entire suction nozzle **230** cannot be suitably dried by blowing the air in first drying chamber **170**.

(57) Therefore, when the drying in first drying chamber **170** is finished, suction nozzle **230** held by holding chuck **128** is inserted into third drying chamber **174** of nozzle drying device **100**, as illustrated in FIG. **12**. However, since the outer diameter of flange portion **232** of suction nozzle **230** is larger than the inner diameter of third drying chamber **174**, only suction pipe **234** of suction nozzle **230** is inserted into third drying chamber **174**. In this case, suction pipe **234** of suction nozzle **230** is inserted into third drying chamber **174** such that the opening of third drying chamber **174** to the upper surface of housing **160** is covered with flange portion **232** of suction nozzle **230**. However, the opening of third drying chamber **174** to the upper surface of housing **160** is covered with flange portion **232** such that a slight gap is formed between the upper surface of housing **160** and the lower surface of flange portion **232** of suction nozzle **230**.

(58) As described above, when suction pipe **234** of suction nozzle **230** held by holding chuck **128** is inserted into third drying chamber **174**, the jetting of air from holding chuck **128** and the jetting of air from through-hole **194** are alternately performed in the same manner as in second drying chamber **172**. That is, first, air is jetted from holding chuck **128** due to an operation of air supply device **130**, and thus the air jetted from above suction nozzle **230** held by holding chuck **128** is blown to the inside of suction nozzle **230**. Consequently, as illustrated in FIG. **12**, suction pipe **234** is moved downward relative to body cylinder **236** and extends downward, and thus the sliding surface of suction pipe **234** with respect to body cylinder **236** is exposed below flange portion **232**.

(59) Next, after the operation of air supply device **130** is stopped and the jetting of air from holding chuck **128** is stopped, air blow device **162** is operated and valve **196** is opened. Consequently, as illustrated in FIG. **13**, air is jetted from through-hole **194** toward the tip of suction pipe **234** of suction nozzle **230**. In this case, moisture adhering to the tip of suction pipe **234** is blown off by the air jetted toward the tip of suction pipe **234** of suction nozzle **230**. Suction pipe **234** is moved upward relative to body cylinder **236** by the air jetted from through-hole **194** such that suction pipe **234** extends upward, and thus the sliding surface of suction pipe **234** with respect to body cylinder **236** is exposed above body cylinder **236**.

(60) The jetting of air from holding chuck **128** and the jetting of air from through-hole **194** are alternately performed, and thus the air is jetted to suction pipe **234** in a state in which suction pipe **234** is repeatedly slid up and down with respect to body cylinder **236**. Consequently, it is possible to suitably remove moisture remaining between body cylinder **236** and suction pipe **234** of suction nozzle **230**.

(61) That is, in suction nozzle **230** having the nozzle diameter larger than the nozzle diameter of suction nozzle **60** and smaller than the nozzle diameter of suction nozzle **210**, air is blown to a position other than the tip of suction pipe **234** below flange portion **232** in first drying chamber **170**. After the blowing of air to suction nozzle **230** in first drying chamber **170** is completed, air is blown to the tip of suction pipe **234** in third drying chamber **174**, and the air is blown to suction pipe **234** in a state in which suction pipe **234** is slid with respect to body cylinder **236**. Consequently, entire suction nozzle **230** can be suitably dried. In third drying chamber **174**, the air jetted from holding chuck **128** and through-hole **194** leaks from the gap between the upper surface of housing **160** and the lower surface of flange portion **232** of suction nozzle **230**. Consequently, an increase in the air pressure in third drying chamber **174** is suppressed.

(62) As described above, in nozzle management device **80**, suction nozzle **60** having a relatively small size is dried through blowing of air in first drying chamber **170**. Suction nozzle **210** having a relatively large size is dried through blowing of air in first drying chamber **170**, and then dried through blowing of air in second drying chamber **172**. Suction nozzle **230** having a size intermediate between suction nozzle **60** and suction nozzle **210** is dried through blowing of air in first drying chamber **170**, and then dried through blowing of air in third drying chamber **174**. That is, in nozzle management device **80**, the suction nozzle is dried in one or more of three drying

chambers **170**, **172**, and **174** according to a size thereof. Consequently, it is possible to appropriately dry the suction nozzles having various sizes.

(63) A size of a suction nozzle that is a drying target is determined based on an ID of the suction nozzle acquired previously. That is, when the suction nozzle is stored in nozzle management device **80**, controller **202** acquires the ID of the suction nozzle based on imaging data obtained by camera **126**, as described above. Control device **200** stores data in which the ID of the suction nozzle and the size of the suction nozzle are correlated with each other. Thus, controller **202** specifies the size of the suction nozzle that is a drying target based on the ID of the suction nozzle that is a drying target by referring to the data. Controller **202** dries the suction nozzle according to the above-described method based on the specified size of the suction nozzle.

(64) The suction nozzle dried according to a method corresponding to the size of the suction nozzle is subjected to inspection in nozzle inspection device **96**, and the suction nozzle of which an inspection result is favorable is accommodated in nozzle tray **76** placed on fixing stage **131** or nozzle pallet **110** of pallet accommodation device **92**. The suction nozzle of which the inspection result is not favorable is discarded into discard box **148** disposed next to fixing stage **131**.

(65) Suction nozzle **60** is an example of a component holder and a suction nozzle. Flange portion **66** is an example of a flange portion. Suction pipe **68** is an example of a nozzle. Nozzle drying device **100** is an example of a drying device. Air blow device **162** is an example of a jetting device. First drying chamber **170** is an example of a first space. Second drying chamber **172** is an example of a second space. Third drying chamber **174** is an example of a second space. Through-holes **176** and **178** are an example of a first jetting port. Through-holes **188** and **194** are an example of a second jetting port. Control device **200** is an example of a control device. Suction nozzle **210** is an example of a component holder and a suction nozzle. Flange portion **212** is an example of a flange portion. Suction pipe **214** is an example of a nozzle. Suction nozzle **230** is an example of a component holder and a suction nozzle. Flange portion **232** is an example of a flange portion. Suction pipe **234** is an example of a nozzle.

(66) Thus, the above-described present embodiment achieves the following effects.

(67) In nozzle drying device **100**, multiple drying chambers **170**, **172**, and **174** are provided, and air is jetted to a suction nozzle held by holding chuck **128** in each of multiple drying chambers **170**, **172**, and **174**. Consequently, air can be blown to the suction nozzle in any of multiple drying chambers **170**, **172**, and **174**, and thus various suction nozzles can be suitably dried.

(68) In nozzle drying device **100**, suction nozzle **210** held by holding chuck **128** is dried in first drying chamber **170** and is then dried in second drying chamber **172**, and suction nozzle **230** held by holding chuck **128** is dried in first drying chamber **170** and is then dried in third drying chamber **174**. Consequently, air can be blown in second drying chamber **172** or third drying chamber **174** to the tips of suction pipes **214** and **234** of suction nozzles **210** and **230** to which air cannot be blown in first drying chamber **170**, and thus entire suction nozzles **210** and **230** can be appropriately dried.

(69) In nozzle drying device **100**, jetting of air from holding chuck **128** and jetting of air from through-holes **188** and **194** are alternately performed in second drying chamber **172** or third drying chamber **174**, and thus air is jetted to suction pipes **214** and **234** while sliding suction pipes **214** and **234** of suction nozzles **210** and **230**. That is, in second drying chamber **172** or third drying chamber **174**, jetting of air from above and jetting of air from below suction nozzles **210** and **230** are alternately performed, and thus air is jetted to suction pipes **214** and **234** while expanding and contracting suction pipes **214** and **234** of suction nozzles **210** and **230**. Consequently, it is possible to suitably remove moisture remaining between body cylinders **216** and **236** and suction pipes **214** and **234** of suction nozzles **210** and **230**.

(70) In nozzle drying device **100**, the inner diameter of first drying chamber **170** is made larger than the outer diameters of flange portions **212** and **232** of suction nozzles **210** and **230**. Therefore, entire suction nozzles **210** and **230** are inserted into first drying chamber **170**, and air is blown to a portion other than the tips of suction pipes **214** and **234** of suction nozzles **210** and **230**. On the

other hand, the inner diameter of second drying chamber **172** is made smaller than the outer diameter of flange portion **212** of suction nozzle **210**, and the inner diameter of third drying chamber **174** is made smaller than the outer diameter of flange portion **232** of suction nozzle **230**. Thus, suction pipes **214** and **234** of suction nozzles **210** and **230** are inserted into second drying chamber **172** or third drying chamber **174**, and air is blown to the tips of suction pipes **214** and **234**. Consequently, entire suction nozzles **210** and **230** can be appropriately dried.

(71) In nozzle drying device **100**, three drying chambers **170**, **172**, and **174** are provided, and the inner diameters of three drying chambers **170**, **172**, and **174** are different from each other. Consequently, air can be blown to suction nozzles having various sizes in any of three drying chambers **170**, **172**, and **174**, and thus the suction nozzles having various sizes can be appropriately dried.

(72) The present disclosure is not limited to the above embodiment, and can be implemented in various forms where various modifications and improvements are made based on the knowledge of those skilled in the art. Specifically, for example, although the above embodiment discloses the suction nozzle drying method, the present disclosure may be applied to various component holders as long as the component holders can hold components. For example, the present disclosure may be applied to a gripper that grips a component with multiple pawls, that is, a so-called chuck.

(73) In the above embodiment, the suction nozzle is dried in drying chambers **170**, **172**, and **174** partitioned by the inner wall surfaces of bottomed holes **164**, **166**, and **168**, but the suction nozzle may be dried in spaces partitioned by at least one surface.

(74) In the above embodiment, suction nozzles **210** and **230** are dried in first drying chamber **170**, and are then dried in second drying chamber **172** or third drying chamber **174**, but may be dried in first drying chamber **170** after being dried in second drying chamber **172** or third drying chamber **174**.

(75) In the above embodiment, suction nozzles **210** and **230** are dried in two of three drying chambers **170**, **172**, and **174**, but may be dried in one drying chamber. In such a case, it is necessary to provide a drying chamber capable of blowing air to entire suction nozzles **210** and **230**. Specifically, for example, a drying chamber in which a through-hole similar to through-hole **188** of second drying chamber **172** is formed is provided in first drying chamber **170**, and thus air can be blown to entire suction nozzles **210** and **230** in one of the drying chambers.

(76) In the above embodiment, for example, the opening of second drying chamber **172** to the upper surface of housing **160** is covered with flange portion **212** such that a slight gap is formed between the upper surface of housing **160** and the lower surface of flange portion **212** of suction nozzle **210**, and thus an increase in the air pressure in second drying chamber **172** is suppressed. On the other hand, by forming a leak hole in second drying chamber **172** or through-hole **188**, an increase in the air pressure in second drying chamber **172** may be suppressed. In such a case, the opening of second drying chamber **172** to the upper surface of housing **160** may be covered with flange portion **212** such that the upper surface of housing **160** and the lower surface of flange portion **212** of suction nozzle **210** are in close contact with each other. By disposing a silencer in the leak hole, it is possible to suppress wind noise. A similar method can be naturally employed in third drying chamber **174**.

REFERENCE SIGNS LIST

(77) **60**: Suction nozzle (component holder), **66**: Flange portion, **68**: Suction pipe (nozzle), **100**: Nozzle drying device (drying device), **162**: Air blow device (jetting device), **170**: First drying chamber (first space), **172**: Second drying chamber (second space), **174**: Third drying chamber (second space), **176**: Through-hole (first jetting port), **178**: Through-hole (first jetting port), **188**: Through-hole (second jetting port), **194**: Through-hole (second jetting port), **200**: Control device, **210**: Suction nozzle (component holder), **212**: Flange portion, **214**: Suction pipe (nozzle), **230**: Suction nozzle (component holder), **232**: Flange portion, **234**: Suction pipe (nozzle)

Claims

1. A drying method of drying a component holder by using a drying device including multiple spaces and a jetting device configured to jet air to each of the multiple spaces, the drying method comprising: a first moving step of controlling a transfer head to move the component holder into a first space of the multiple spaces; a first drying step of jetting air to the component holder to partially dry the component holder in the first space; a second moving step of controlling the transfer head to move the component holder into a second space of the multiple spaces, an inner diameter of the first space being larger than an inner diameter of the second space; and a second drying step of jetting the air to the component holder, previously partially dried in the first space, to further dry the component holder in the second space.
2. A drying device comprising: a transfer head that moves a component holder, the component holder configured to hold components; multiple spaces including a first space and a second space, an inner diameter of the first space being larger than an inner diameter of the second space; a jetting device configured to jet air to each of the multiple spaces; and control circuity configured to control the transfer head to move the component holder into the first space, control the jetting device such that air is jetted to the component holder to partially dry the component holder in the first space, control the transfer head to move the component holder into the second space, and control the jetting device such that the air is jetted to the component holder, previously partially dried in the first space, to further dry the component holder in the second space.
3. The drying device according to claim 2, wherein the first space is provided with a first jetting port that is a jetting port for jetting air toward a predetermined portion of the component holder, and the second space is provided with a second jetting port that is a jetting port for jetting air toward a portion different from the predetermined portion of the component holder.
4. The drying device according to claim 2, wherein the component holder is a suction nozzle having an expandable and contractible nozzle, and the suction nozzle is dried while expanding and contracting the nozzle by alternately performing jetting of air from above the suction nozzle and jetting of air from below the suction nozzle in at least one of the first space and the second space.
5. The drying device according to claim 2, wherein the component holder has a flange portion, each of the multiple spaces is a space that is partitioned by a sidewall and is open above, the inner diameter of the first space is larger than an outer diameter of the flange portion, and the inner diameter of the second space is smaller than the outer diameter of the flange portion.
6. The drying device according to claim 2, wherein the multiple spaces are three or more spaces, each of the three or more spaces is a space that is partitioned by a sidewall and is open above, and inner diameters of openings of the three or more spaces are different from each other.